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DISEASES, DIAGNOSIS, AND TREATMENT

# *Intensive Methods of Applying Heat*

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## INTENSIVE METHODS OF APPLYING HEAT FOR RELIEF OF PAIN AND OTHER THERAPEUTIC EFFECTS<sup>1</sup>

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The use of heat as a means of relieving pain is one of the oldest therapeutic measures. Even suffering animals seem to be guided by instinct to resort to this simple physical agent when suffering pain. A dog suffering from earache puts his warm paw against his ear. A baby with earache places its hand to its ear. A person suffering with abdominal pain involuntarily bends his body forward and draws his thighs upward. Primitive people of all countries, from the Arctic to the South Sea Islands, treat rheumatism by hot vapor or steam baths administered in various ingenious ways. The Finlander shuts himself in a small room and creates steam by pouring water on hot stones. The Maoris of New Zealand heat stones in a pit and cover them with palm leaves on which the patient lies down, and a mat is covered over all.

Just how heat relieves pain is perhaps not fully understood. It probably acts in several ways, sometimes by diverting blood from congested parts through the production of a collateral hyperemia, and sometimes, perhaps, by accelerating blood movement and so relieving a vascular stasis. But almost magical effects in relieving pain are often produced by hot applications under conditions in which neither of these explanations seems adequate to account for the results obtained. In some way not clearly explicable heat lessens nerve sensibility and abolishes pain. It has been suggested that this thermic effect is the result of inhibition acting through the temperature nerves of the skin. Whatever may be the explanation, we know that heat, properly applied, kills pain. This remarkable quality seems to be one of the specific properties of heat, which it always possesses, no matter what its origin. Heat waves of all lengths produce pain relieving effects, but the luminous heat waves and the shorter infrared rays found in the upper region of the infrared section of the spectrum appear to be the most effective, doubtless because of their greater penetrating power.

It is not my intention to devote space in this article to the description of apparatus, but I think it worth while to call attention to the fact that special apparatus for the application of infrared rays is not needed, for the reason that these rays are always present in abundant quantity. Long infrared rays are available in any quantity desired through such

<sup>1</sup> Read at the Joint Spring Meeting of the American Electrotherapeutic Association and the American College of Physical Therapy, Washington, D. C., May, 1927.

commonly employed means of making heat applications as the fomentation, the hot poultice, hot water bag, hot sand bags, heated stones or bricks, etc., and the shorter and more penetrating infrared and luminous heat rays are always present in the radiation from arc and incandescent lamps of every sort. Even the glowing coals of an open fireplace are a most efficient source of heat rays of the very highest therapeutic value.

The one point which it is the purpose of this paper to impress is the fact that for efficient and definite effects a certain and rather high degree of intensity is required.

The specific effect of heat upon nerve sensibility is shown in its effect upon the tactile sense. Beginning with 113°F., tactile sensibility is steadily diminished as the temperature rises until at 130°F. it disappears entirely, the application at this point becoming painful.

Every person who has had any considerable experience in the use of heat for relief of pain has learned by observation that for decided effects the applications must be very hot, as hot as the patient is able to bear. Applications of lower temperature may give some relief and afford the patient considerable comfort, but to conquer the pain the application must be hot enough to produce on first contact with the skin a slightly painful sensation. In applying a fomentation a well trained attendant makes the fomentation cloth so hot that it is necessary to lift it from the skin for a few seconds almost immediately after the application is made, or to pass the hand underneath next the skin, so as to admit air and permit slight cooling of the surface by evaporation. After the compress has cooled a little, so that the heat becomes easily tolerable, it is usually left in place for four or five minutes and then renewed two or three times. The chief benefit which a patient derives from such an application is due to the intense heat effect experienced for the first half minute or minute at the beginning of each application. Thus the total duration of the effective part of the application may not be more than two or three minutes, although the time occupied by the whole treatment may have been fifteen minutes or more. Attendants should be instructed in the application of the fomentation to make the changes rapidly, at least once a minute, continuing for fifteen or twenty minutes. As the skin becomes more tolerant to heat, the temperature of the compress should be gradually increased, until the maximum temperature which the skin will tolerate is reached. I have often seen very severe and obstinate pains relieved when this intensive method was employed, even when hot compresses applied in the usual way had proved entirely ineffective.

There are various other effective methods of applying water intensively. One of the most useful of these is the intensive hot hand bath. A suitable vessel, which may be an ordinary lavatory, is filled

with water having a temperature of not less than 120°F. At this temperature the hands cannot be held in the water for any great length of time, but they may be rapidly dipped in a number of times. At first it may not be possible to hold the hands in the water for more than one or two seconds before withdrawing. After allowing the surface to cool in the air while rubbing the hands for two or three seconds, dip in the water again, and so continue alternately dipping and cooling until the desired effect is obtained. Twenty-five or thirty dips will usually suffice to relieve the misery of painful rheumatic finger joints. Tenderness of the joints will also be lessened. A good plan is to have the patient count at the rate of two counts to the second. Beginning when the hands are placed in the water, count 1, 2, 3, 4, 5. The water should be so hot that it will be impossible to keep the hands longer immersed. After lifting from the water, count five, then dip again, and so continue. As the hands become a little more accustomed to the heat the number of counts with the hands in the water may be increased to ten or even more, but the time out of the water need not be increased.

Patients suffering from rheumatic finger joints may with great profit employ the intensive hand bath three or four times a day. Care should be taken to avoid chilling the hands by exposure to cold air after a hot bath. If the hands become cold they should, as soon as possible, be given a hot bath, after which vaseline or cold cream should be applied and the fingers should be protected by warm gloves or other efficient means.

The intensive hot foot bath is equally valuable for rheumatic feet. The temperature of the foot bath at the beginning should be about 105°F. The temperature should be rapidly raised to about 110°F., and after a minute or two, more hot water should be added, so as to raise the temperature to 115°F. The feet should be repeatedly placed in the water and lifted out with counting, as already above described for the intensive hand bath.

The intensive hot foot bath is an excellent means of relieving pelvic pain as well as pains in the feet. The use of the hot foot bath for relief of dysmenorrhea is a common practice of the laity in many parts of the country. Applied by the intensive method, the efficiency of the foot bath will be found greatly increased. For nearly forty years I have made use of the hot foot bath as a means of relieving pain after abdominal operations involving the pelvic viscera, and with such good effects that in hundreds of cases of this class I found it unnecessary to employ anodynes of any sort, either immediately after the operation or at any time during the postoperative care of the patient. Patients suffer so much less from constipation, loss of appetite, nervousness, intestinal gas, and other miseries common to surgical cases of this sort that I feel fully justified in urging more frequent use of the hot foot bath

and other means of applying heat in the postoperative care of surgical cases, instead of the hypodermic injections of morphia and other anodyne medication now commonly employed. The late Dr. Lawson Tait, of Birmingham, England, with whom I spent a few months very profitably as a student assistant nearly forty years ago, never gave his patients any sort of pain relieving medicine. He said to me one day "I never give drugs of any sort to relieve pain unless I am sure the patient is going to die." Dr. Tait attributed his unusual success in abdominal operations (he had a record of 116 successive abdominal operations without a death) very largely to the fact that he withheld anodynes and encouraged intestinal activity both before and after operating. His patients often suffered greatly and sometimes made quite a bedlam of his wards with their screams and groans, and it was this experience which suggested to me the use of the hot foot bath and other hot applications in this class of cases. The comfort afforded the patient proved to be so valuable a factor in connection with other allied measures that I was able to improve even Dr. Tait's record, quite unusual for that time, which was prior to the introduction of rubber gloves, by extending the list of successive laparotomy recoveries to 165.

Another intensive method of applying heat, which I have found most useful in a very distressing class of patients, is the hot lave bath. This bath is adapted to the relief of superficial sensory disturbances, especially the intolerable itching of urticaria and the burning and itching of eczema and other irritable skin disorders. The method consists in laving the affected parts with very hot water. Care must be taken not to pour the water upon the skin in a continuous stream, as the temperature which must be employed is so great that, if poured upon the skin, a severe burn will be produced. The temperature of the water should be 120° to 130°F. Even hotter water may be employed, if great care is exercised. The best method of making the application is to extend the affected part, say a hand or an arm, over the edge of a bath tub partly filled with water of the proper temperature. With a basin the water is dipped and projected in such a way that it spreads out in a thin layer and descends upon the affected surface by the force of gravity. When applied in this way the water, no matter what its temperature, retains its heat for so short a time that the skin is not burned, although a very intense sense of heat is produced. When deftly managed, this method of applying heat is wonderfully effective in relieving most intolerable itching and burning, no matter how severe or what the cause. Applications may be made to the back by allowing the patient to sit over the edge of the tub. Parts which cannot be reached in this way may be treated by means of napkins dipped in hot water and applied to the skin by brief touchings, care being taken not to maintain the contact long enough to produce blistering. The effect

of a thermic application of this sort is so certain and prompt as to seem almost magical, and the relief afforded usually continues for several hours. With proper care to protect the skin after applications of this sort with suitable emollients, the applications usually prove to be not only palliative, but curative.

In general the most convenient and efficient means of applying heat therapeutically, either general or local, is the incandescent lamp, in which the source of radiant energy is an incandescent filament. Heat rays from such a source have a remarkable penetrating power. It was the discovery of this fact in 1891 that led me to the construction of the photophore for local use and the electric light bath cabinet for general applications of heat. This discovery was quite accidental. In turning on a sidelight one evening my hand while close to the lamp came between my eye and the filament, and I noticed a red glow through the fingers, which suggested to me at once that the incandescent light was a new and superior means of applying heat to the body because of its penetrating power. I at once constructed various forms of thermophores, consisting of one or more incandescent lamps mounted with a metallic reflector, and shortly after had constructed various types of cabinets in which thirty to fifty incandescent lights were employed. In one type of cabinet the source of heat was four arc lights, one in each corner.

I soon discovered that the overheating of the surface was something of an obstacle in the way of the highest degree of efficiency, for the reason that it prevented the use of a sufficient volume of heat to influence strongly the deeper tissues. I endeavored to overcome this difficulty in various ways. One plan was the combination of a shower bath with the electric light bath. Such a combination permitted the use of a much larger volume of heat than can be employed in the ordinary cabinet. In the use of the thermophore for local applications of heat it was found easily possible to greatly increase the intensity of the application by keeping the surface moist by passing over it a cloth or a sponge saturated with cool or tepid water at frequent intervals. The evaporation thus promoted kept the superficial layers of the skin cool without obstructing the more penetrating heat rays. I soon discovered that the same effects could be produced by directing upon the heated surface a current of air, and have employed this method ever since.

The intensity of a hot application may be greatly increased by combining with it some means of simultaneously cooling the skin surface. This method requires the use of some suitable source of heat radiation. Either an arc light, the incandescent lamp, or a heating element may be used. A small electric fan will supply the air current. With a current of air falling upon the heated surface the intensity of the light applica-

tion may be doubled. This means that the tissues beneath the skin surface are receiving twice as large quantities of radiant energy as they could receive without the protective cooling of the skin surface. By this means quantities of heat may be applied which would be absolutely intolerant to the skin and would produce structural injury if long continued, and this without the slightest injury to the skin tissues or the slightest interference with the passage of the penetrating heat rays to the deeper structures.

From the facts already stated it must be evident that cooling of the skin surface during an application of radiant heat is a matter of great practical importance. This is clearly shown by clinical experience. Cases in which no relief is obtained by ordinary hot applications readily yield to the massive doses of radiant energy which become permissible by this method. By moistening the surface from time to time, so as to maintain evaporation in connection with the air current, the surface may be so efficiently cooled that the doses may be still further increased to three or four times the amount tolerable without the surface cooling. This method is especially applicable to cases of deep seated neuralgia, such as chronic sciatica and in cases of deep seated visceral pain.

#### INTERMITTENT HOT APPLICATIONS

When revulsive effects are indicated the object desired may be readily attained by a slight modification of the method just described. By the use of a swinging electric fan the air current, instead of being continuous, will be interrupted at regular intervals. The light should be placed at such a distance from the skin that during the interruption of the air current the temperature will rise to the point of greatest tolerance. When the swing of the fan again causes the current to play upon the heated surface, cooling will occur, to be followed by a quick rise as soon as the swing of the fan carries it out of range. The periods of heating and cooling may be doubled by placing the fan at right angles with the light and in such a position that when the side facing the patient is swung to the extreme limit the air current will still be felt. When this is done the patient receives the current while the fan is both going and coming, or for the time required for one complete swing.

Another method of producing intermittent heating effects is by turning the current on and off at such intervals as may be desired. The switch controlling the current may be placed in the hands of the patient, who will regulate the duration of the application by counting. The heat should be so great that it can be tolerated only for a time not greater than that required for counting ten at a moderately rapid rate, say two counts to the second. Perhaps at first the point of tolerance may be reached at the end of five counts. When the switch is turned off the patient counts ten while the skin is cooling, then turns the cur-



rent on and repeats the counting. Instead of turning the current off and on by hand a mechanical or automatic interrupter may be employed. All of these different methods I have employed, but find on the whole nothing better than the combination of the ordinary thermophore, such as the Battle Creek junior deep therapy lamp, combined with the ordinary simple electric fan.

The suggestions offered in this brief paper may seem to be so simple that they are hardly worth considering, but I am sure that any practical clinician, who will make a trial of the intensive methods described as means of relieving pain, will find them so efficient that he will soon be making use of morphia and other anodyne drugs very much less frequently than was previously thought necessary. And I think most of my medical colleagues will agree that anything which tends directly or indirectly to lessen the use of these powerful narcotic drugs, to which patients so quickly become habituated and enslaved, is worthy of serious consideration and a fair test in practical experience.

#### DISCUSSION

DR. WILLIAM BENHAM SNOW (New York City): This is one of the most instructive papers of the session, for no one knows better than Dr. Kellogg the subject treated. In 1909 I published a work on "Radiant Light and Heat and Convective Heat." My object in making use of the term "*convective heat*" was that, a few years previous to this time, a paper had been published in which attention had been called to the fact that applications of heat by hot water bags, poultices, and things of that sort only produced a hyperemia in the skin and that the dilated vessels carried away all of the heat so that the underlying tissues received none whatever. A cat was anesthetized, the skin punctured, and a thermometer inserted. Heat was then applied to the skin at temperatures just short of burning and while the application was made there was no change in the temperature beneath the skin. In other words the hyperemia induced in the skin was adequate to carry away all the heat. This makes the use of hot applications seem impractical if you want heat effects in the deeper tissues. Convective heat was the heat carried away by the vessels in the hyperemic skin, so preventing the deep effect of heat in the underlying tissues. A year later Dr. Kellogg published a small work entitled "Light Therapeutics."

The paper we heard this morning conveys the same idea, showing that radiant light and heat in its effects is so efficient in overcoming the condition of pain in the deeper structures. Dr. Kellogg did not emphasize that in the paper as I might have, but that is what really occurs. As he observed, the penetration of heat in his finger caused him to sense that radiations went in. If we put a small diagnostic lamp in our mouth the radiations come out through the skin. If the luminous rays penetrate, the infrared do more so, and we get a penetration of from twenty to thirty millimetres, producing heat. So the effect of heat is produced in that way.

The methods Dr. Kellogg described of using more intense applications of heat are interesting, because it shows that by interrupted application we are enabled to use a temperature that could not be employed with constant exposure. Another method is to pass the hand back and forth over the surface

when intense heat is applied. With the patient under a canopy light have the patient frequently rub the hands over the surface and greater heat can be borne.

The time of application is a very important matter when using radiant light and heat over a region where pus is present or a germ process is to be aborted. It should be kept up for at least an hour without interruption. In otitis media or other infections make the applications always for an hour without interruption, at skin toleration, that the fixed cells may become well heated as they only can by long application. With these cells heated the hyperemia will persist until they are gradually cooled by the blood at  $98\frac{2}{3}^{\circ}\text{F}$ . You so get a very much prolonged effect of hyperemia from the long application. In severe infections it should be repeated at least after one hour intervals in order to get as much as possible the phagocytic effect on the infection. This is a very important point and one cannot be too emphatic in urging long applications of radiant light and heat.

Regarding the effects on pain, heat relaxes the tissues and lessens the pressure. If you have an old case of neuritis, the relief lasts only for an hour or two unless the application is constant, because you do not get rid of the local lesion—induration. The hyperemia produced by radiant light and heat or diathermy does not remove established stasis or organized hyperplasia. With a sprained ankle heat gives slight relief but does not remove the stasis; nor of a synovitis in a knee joint. There we must intervene with something that will remove the swelling. There we can use our static current. There is nothing else in the world that will get rid of the stasis like the static current. Light is limited in the relief it will afford cases of trauma. The relative effects of radiant light and heat and static as therapeutic measures are not to be compared for the relief of pain due to trauma.

DR. ELTON S. CORSON (Bridgeton, N. J.): About twenty years ago I became enthusiastic and in conjunction with my wife we applied the baking and hot water treatment for several years until we both wore ourselves out. Then there came on the scene the diathermy machine, which obviated all of those methods as requiring a less amount of effort and attention. I threw all that apparatus out in the back yard and am still sticking to Dr. Snow's static current, and to diathermy, light, and sinusoidal in getting results I obtained twenty years ago through strenuous effort and great inconvenience to the patient.

DR. A. BERN HIRSH (New York City): It is time some one had refreshed our memories with the value of moist heat. It is one that has its distinct place in our armamentarium and that you do not want to forget. When we hear gentlemen speak of its being supplanted by other (mechanical or electrical) means, we lose sight of the fact that there are certain classes of cases, surgical if you will, that demand other treatment than solely diathermy or radiant light and heat to obtain good effects. To initiate electrical treatment, for example, I refer to the whirlpool bath. We have here some of the men who were in charge at extensive physiotherapy clinics in the war hospitals, and they will confirm what I have to say, I am sure, that thousands of the cases that came there to be treated, back from the war zone with injuries of all kinds (and these parallel to the industrial injuries of today), would never have gotten anywhere if we had not been able to precede electrical applications by the whirlpool bath. Winternitz of Vienna first placed treatment by water on a scientific basis, and the late Professor Baruch of Columbia University was the father of that movement on this side. Just before he died he gave a course of lectures at the

Polyclinic Hospital in New York City to a group of us. There, when shown certain electrical methods of treatment, he acknowledged that these would take the place of much of what had been accomplished previously by hot water and cold water applications; but there still was a place, he insisted, for hydrotherapy, especially in certain painful conditions, that could not be taken by any other means at our command. I offer for your consideration the advisability of obtaining his last work, "The Epitome of Hydrotherapy," that came out about six or eight years ago. You will find it to have its value many a time in daily practice.

DR. JOHN HUNTER (Toronto, Ontario): Recently a physiologist told us that every nerve filament in the human body is insulated from origin to insertion excepting the nerves that respond to pain. These are insulated up to the molecule. For a short distance there is a raw surface. Pain is produced by pressure on this raw surface. The moment we can relieve the pressure and the stasis we relieve the pain.

DR. W. T. LINDSAY (Madison, Wis.): I have been a peculiar combination of physical therapist and surgeon for a number of years back, and want to second the words of the essayist in suggesting the use of the hot foot bath in postoperative abdominal conditions involving the pelvis and abdomen particularly. I agree with what Dr. Snow and the gentleman back here have said, that in congestive conditions of the abdomen diathermy, even if it is postoperative, should take precedence over the hot foot bath. My conception is that, following major abdominal operations, the conditions of shock have interfered with the even distribution of blood. Two methods I have used for a long time have been the immediate injection into the bowel of at least a quart of ordinary tap water, sometimes with a little mineral oil added, and when the anesthetic is worn off and patients are in a condition of pain and distress, the hot foot bath gives a great deal of relief. If I have operated in the presence of acute infection, the immediate use of diathermy through the abdomen is the method par excellence. Too much emphasis cannot be laid on the use of heat measures on the abdomen in those cases that are due to shock. By a hot foot bath you draw into the abdomen a large quantity of blood that would be in a condition of stasis from the shock. I inject a quart of water as soon as I can, in half an hour inject another quart, so that at the end of an hour following the operation two quarts have been added to the lymphatic tissue of that patient's pelvic abdomen; and if there is pain give a hot foot bath, unless there is an inflammatory infection present, when I use diathermy.

DR. J. C. ELSOM (Madison, Wis.): I should like to emphasize the good words of Dr. Hirsh when he recommended the use of the whirlpool bath. In the physical therapy departments of the army we made very extensive use of this method of application of heat, and we had large numbers of amputations and an immense amount of scar tissue. Scar tissue is extremely susceptible to applications of heat, and we must be careful not to produce blistering. When you have your hand in a tub of warm water, if you keep your hand stationary the heat is not so perceptible, but if you wiggle your hand around the heat seemingly increases. That is the theory of the whirlpool bath. There are air bubbles which produce some massage effects. You can get your effect with a lower temperature than with a limb in stationary water. I also want to emphasize the effect on scar tissue, which is always so important, and concerning which we must be so careful.

DR. ELLIOTT TARBELL (Battle Creek, Mich.) (Closing for Dr. John H. Kellogg): I am sorry Dr. Kellogg is not here to discuss this for you. Dr. Snow spoke of using the hands for relieving heat. The idea of using the fan was suggested. The long time of application Dr. Snow spoke of is what we prefer, but this suggests to you a method by which you can make the thing automatic. If you had an arm in which you wanted to apply heat with an arc lamp or an incandescent bulb and you had a small electric fan swinging around, you would greatly increase your effect. It should be at a distance from your source of heat, where a person could tolerate it without moving, about fifteen inches away. By using a fan in this way you can reduce it to about ten. You can use a little electric fan and greatly increase the heat. The same thing is true with the alpine light, the zoalite, or the infrared appliance. Dr. Corson spoke of using diathermy. I certainly agree that diathermy in the treatment is a very valuable aid. I think the whirlpool bath works out fine. That is particularly applicable for use for a limb. Our postoperative patients, most of them, get diathermy routinely. We can cut down the time of convalescence, but instead of using hypnotics we use hot foot baths and things of that kind. Dr. Lindsay spoke of injections of tap water. I think that is a very good suggestion. For many years it has been the custom in our surgical ward to give an enema after every abdominal operation. Warm water is usually employed but the temperature is varied to suit conditions.

Dr. Kellogg did not try to be comprehensive. He just tried to bring out one little idea that might be of value to you, utilizing the apparatus you have, and might help to make it more efficient.

INCOMPETENCY OF THE  
ILEOCECAL VALVE VS.  
LANE'S KINK AS THE  
CAUSE OF ILEAC STASIS

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INCOMPETENCY OF THE ILEOCECAL VALVE  
VS. LANE'S KINK AS THE CAUSE  
OF ILEAC STASIS.

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THE significance of the ileocecal valve is clearly shown by an observation of Magnus-Levy in an able article in Von Noorden's compendious work on metabolism. After calling attention to the fact that urobilin, a product of the putrefaction of bile, must be classed with indol, skatol, phenol, cresol, and other poisonous products of intestinal putrefaction, he adds:

"The classic research of Jaffé and Nencki has shown that these bodies are not present in the small intestine, confirmed by A. Schmidt and others. They originate, therefore, in the large intestine, in which the microorganisms have the necessary time to produce abnormal decompositions. This fact has become of importance for the recognition of many intestinal troubles."

In health, according to Weintrand in Von Noorden's Metabolism, urobilin is not found in the small intestine; it first appears in the cecum and ascending colon. (Nencki and Sieber, Macfadyen, A. Schmidt, Schlorlemmer.) Since the conditions

in the colon are unfavorable to absorption, urobilin seems thus to do little harm so long as it is confined to the first part of the large intestine where it is produced. *But when the ileocecal valve, which forms a sharp line of demarcation (A. Schmidt), is incompetent, the urobilin is forced back into the small intestine, and is there quickly absorbed along with other poisons.*

It appears, then, that the ileocecal valve is the chief barrier against the flooding of the body with the multitudinous toxins which are generated in the colon. So long as the putrefaction products are confined to the colon they do comparatively little harm because of the slow rate of absorption; but when they are carried by reflux into the small intestines they are rapidly absorbed, and the result is an attack of headache, so-called "biliousness," a skin eruption, loss of appetite, depression, or some other indication of a toxemic state.

The condition most favorable to the development of intestinal toxemia is ileac stasis, as originally pointed out by Arbuthnot Lane, to whom also the world is profoundly indebted for demonstrating the fact that a very great number of grave chronic ailments are due to the toxemia resulting from ileac stasis, although he erred in his attempt to find the cause of the stasis in certain harmless attachments of the terminal ileum of embryonic origin, commonly known as "Lane's kink."

The association between incompetency of the ileocecal valve and ileac stasis was first definitely established by the thoroughgoing roentgenologic studies of the alimentary canal by the writer's colleague, Dr. J. T. Case. That the relation was one of cause and effect was proven by the writer by operation for repair of the valve and immediate cure of the

stasis by so doing. The restoration of the competency of the valve is shown at the operation, and later by the barium enema. The relief of the ileac stasis is easily demonstrated by post-operative x-ray examination after a barium meal.

It cannot be claimed that incompetency of the ileocecal valve is the one and only cause of ileac stasis. Stasis may be due to obstructive lesions of various sorts; but aside from cases in which the obstruction is complete or nearly so, incompetency of the valve is a far more potent cause of stasis than simple narrowing of the lumen of the small gut. The propulsive efficiency of the small bowel is very great. Food normally enters the intestine in small quantities and the absorptive activity of this part of the alimentary canal is so great that of the 6,000 or 7,000 c. c. of material which enter the bowel every twenty-four hours only a few hundred are left to be sent on into the colon as unusable residue and this small amount is easily passed along by the powerful propulsive peristaltic waves and "rushes" which normally occur in the ileum even though the lumen of the gut may be very considerably narrowed. Every abdominal surgeon of large experience has encountered cases in which constricting lesions of the small intestine were found but in which no evidence of ileac stasis or other disorder in the bowel function has been observed. Adhesions of the small intestine to the abdominal parietes as well as to the intestine itself and other viscera are very common after abdominal operations but very rarely produce stasis.

This fact casts serious doubts upon the importance of the so-called Lane's kink as a cause of stasis. Besides, Case has demonstrated in scores of cases by x-ray examination very marked adhesions of the



terminal ileum which produced no ileac stasis. In many of these cases the writer has verified the x-ray findings at the operating table when operating for removal of a diseased appendix or dealing with some other lesion requiring abdominal section. While the medical profession and the whole world, for that matter, are under great obligations to Sir Arbuthnot Lane for demonstrating the great importance of ileac stasis as a proximal cause of many of the gravest maladies, it must be admitted that only a comparatively small number of practical surgeons have ever been convinced of the importance of Lane's kink (adhesions of the terminal ileum) as a cause of stasis. And it may be justly added that the disappointing results which have been experienced by most of those who have resorted to short-circuiting and other procedures suggested by Mr. Lane for the relief of stasis have led to a decided and growing skepticism respecting the soundness of his theories relating to the genesis and the significance of adhesions of the terminal ileum, even among those who most admire the wonderful genius and admirable personality of one of the most able and progressive of British surgeons.

Consideration of the ileocecal valve in relation to ileac stasis reveals a very different picture. Here is a brief summary of the facts which have been elucidated by the observations of Bauhin, Kraus, Hertz, Ad. Schmidt, Elliott, Keith, Cannon, Case, the writer, and others:

1. All vertebrate animals, even fishes and reptiles, are provided with an efficient ileocecal valve. The presence of this check valve between the mid-gut and the hind-gut is as universal as the pyloric sphincter between the fore-gut and the mid-gut. The only possible inference to be drawn from this

fact is that the ileocecal valve must have an important function to perform, the nature of which though formerly obscure, is now made clear by the researches of Cannon and Elliott in animals and Case, Schwartz and others in x-ray studies of the human alimentary canal.

2. A check valve at the junction of the small intestine and the colon is essential for definite and permanent advance of bowel material because of the back pressure due to the normal tonicity of the large gut and the accumulation of material in the colon which normally empties intermittently and not continuously. The check valve is in constant use in engineering practice under similar conditions in steam engines, heating systems, etc. The ileocecal valve is a most admirable illustration of vital mechanics.

3. In addition to the back pressure resulting from the accumulation of gas, liquids, and semi-solids in the colon, additional pressure reacting against the ileocolic junction is induced whenever the bowels move as a result of the contraction of the diaphragm, the abdominal muscles and of the colon itself.

4. Another factor tending to produce reflux from the colon to the small intestine and necessitating intervention of a check valve at the ileocolic junction is found in the periodical contractions of the cecum and ascending colon.

5. A still more powerful factor tending to produce a back flow from the colon into the small intestine and creating an absolute necessity for the function performed by the ileocecal valve is found in the retroperistaltic action of the right half of the colon.

This reversed action of the colon is a powerful

movement which starts about the middle of the transverse colon, and forces the intestinal contents back toward the cecum for the purpose of causing delay sufficient to permit the absorption of a considerable portion of the water content of the material sent into the large gut from the small intestine. The action is most vigorous after meals. It was discovered by Cannon in animals, and demonstrated in human beings by Case.

6. The ileocolic valve when normal is a perfect and highly efficient mechanical device. It even works in the dead subject and in the intestine when removed from the body if care is taken to avoid injury to the parts.

7. When the ileocecal valve is incompetent, even slight pressure upon the distended cecum is sufficient to cause reflux of gas and liquid into the ileum.

8. In the living body ileac stasis is practically always associated with incompetency of the ileocolic valve. The incompetency is nearly always demonstrable by the x-ray, but sometimes the x-ray fails to show the incompetency even when the condition is very marked. There is little evidence that spasm of the gut at the ileocolic junction is a very frequent cause of ileac stasis.

9. In most cases of incompetency of the ileocecal valve associated with ileac stasis as proven by x-ray examinations by Dr. Case and verified by both the writer and Dr. Case at the operating table in connection with various abdominal operations, Lane's kink was absent; that is, no adhesions of the terminal ileum were found in most cases, and in the very small number of cases in which Lane's kink was present the stasis was no greater than in those cases in which adhesions of the terminal ileum were absent.

10. In some scores of cases in which Case was able to show by the x-ray the presence of Lane's kink without incompetency of the valve, ileac stasis was present in only two or three cases.

11. Dr. Case, who has observed ileac stasis in several hundred cases, estimates that he finds the stasis due to obstructive adhesions of the terminal ileum in not more than three or four per cent. of all cases of stasis in the small intestine. His observations demonstrate most clearly that the usual cause for ileac stasis is incompetency of the ileocecal valve.

12. It is well known to abdominal surgeons that ileac stasis is rarely if ever cured by the breaking up of adhesions about the terminal ileum. It was this fact which led Sir Arbuthnot Lane to devise the operation of short-circuiting.

13. When incompetency of the ileocecal valve is associated with ileac stasis, the stasis is cured by repair of the valve and without breaking up the adhesions of the terminal ileum when these are present.

14. The relief of symptoms sometimes obtained by the operation of short-circuiting is rarely ever more than temporary. The ileac stasis ultimately returns through the dilatation of the intestine which is inevitable when the newly made ileocolic junction is not protected by a check valve as under normal conditions. The small intestine may be for a short time able to keep itself empty because relieved of the back pressure from the anti-peristaltic action of the transverse colon. But the absence of a barrier against reflux at the ileocolic junction permits the backing up of fecal matters from the pelvic colon after the blind-ended colon has first been filled, and the small intestine is gradually dilated until several

feet of it may become nearly as large as the colon. Case has demonstrated that incompetency of the ileocolic junction and reflux exist in practically all cases of short circuiting performed by Lane's method, which makes no effort to provide the protection of a valve.

15. The writer has demonstrated that the recurrence of ileac stasis after the operation of short-circuiting may be prevented by making an artificial ileocecal valve. I have also succeeded in constructing an efficient valve in cases in which a short-circuiting operation had been previously done by other surgeons without affording relief. This shows that repair of the valve is the curative measure, and not the short circuiting. Of course, there are cases in which the colon must be sacrificed.

16. In cases of chronic ileac stasis the walls of the gut are thin and atrophic, evidently the result of degeneration from over work and chronic infection. The lumen of the gut is normal. In stasis due to obstruction, the intestinal wall is inevitably thickened and hypertrophied, while the lumen of the gut is notably increased, showing the effects of forcible distention. This is never seen in intestinal stasis of the ordinary type.

17. The periodic contractions of the cecum alternating with strong retroperistaltic waves starting in the transverse colon, must inevitably cause reflux of the colon contents into the small gut unless movement in this direction is checked by the ileocolic valve. And this action is not occasional but constant for hours after every meal, so that in a person whose ileocolic valve is incompetent, the ileum is seldom if ever empty. Normally the small gut clears itself of a meal within eight or nine hours, thus insuring the gut a period of rest at least during a part of

each twenty-four-hour period. When the valve becomes incompetent, the bowel is never empty and hence never at rest. The continued presence of gas and fluid contents keeps the gut perpetually at work. The result is exhaustion and degeneration. Another potent cause of degeneration is to be found in the chronic infection which inevitably develops as the result of reflux of putrefying materials from the colon. In the rare cases in which Lane's kink is really the cause of stasis the bowel is found hypertrophied and dilated as in cases in which the lumen of the gut is narrowed to the point of obstruction by ulceration or other causes.

As regards the genesis of obstructive adhesions of the terminal ileum, the writer is fully convinced that they are the natural consequence of incompetency of the ileocecal valve. The constant presence of infectious material from the colon not only causes the terminal ileum to sag down in the pelvis but sets up an enteritis which in time develops into perienteritis and thus causes the gut to adhere to whatever surface it may happen to rest in contact with. The same process is seen in the appendix. Cecal stasis keeps the appendix distended with fecal matter thus causing infection with chronic inflammation and adhesions. The appendix is generally found diseased when the valve is incompetent.

This view is supported not alone by theoretical considerations but by several interesting observations at the operating table in cases in which marked incompetency of the ileocolic valve existed with very pronounced adhesions of the terminal ileum. The disposition of the adhesions was such that *they must have been formed after the valve had become incompetent*. This opinion, shared by my colleagues, Drs. Harris and Case, who assisted at

the operations, was based upon the fact that the extensive adhesions involved surfaces which are normally invaginated and lie within the colon and hence must have been pulled out before the adhesions occurred. In fact, the relation of the adhesions to the ileocolic junction was such as to strongly suggest that a very apt and partially successful effort had been made to repair the damaged valve, a most striking illustration of the resources of that marvelous workman, the *vis medicatrix naturæ*.

The ordinary, non-obstructing attachments of the terminal ileum, generally known as Lane's kink, have been clearly shown to be embryonic structures, and without pathological significance.

That incompetency of the ileocecal valve is a true structural lesion and not a mere functional disorder as has been suggested by some internists, will not be questioned by anyone who has taken the trouble to make a careful study of the ileocolic junction either in the anatomical laboratory or at the operating table. Inspection alone is sufficient in most cases to determine whether or not the valve is incompetent. When the valve is competent the ileum is narrowed at its junction with the colon, and its constricted terminus is hidden between folds of the colon. A deep sulcus bridged over by a thin layer of peritoneum is seen on each side of the ileocecal fold.

When the valve is incompetent, the picture is strikingly different. Instead of converging at its junction with the colon, the ileum is widely distended so that the terminus is funnel shaped, diverging toward the colon. The sulcus on either side of Treves's fold is obliterated and the line of junction between colon and ileum which is normally found at the free edges of the two lips of the valve

projecting into the lumen of the colon is found upon the surface of the bowel, where it may be easily traced above and below the fold of Treves.

The diameter of the normal ileocolic junction is 2 centimeters. I found the average diameter in 82 cases in which the valve was proved to be incompetent to be  $5\frac{1}{2}$  centimeters.

A large amount of gas in the ileum and colon is an almost certain sign of incompetency of the valve. It is easy to test the condition of the valve by making pressure on the gas filled cecum while at the same time compressing the ascending colon.

In operating for repair of incompetency of the ileocecal valve it must be remembered that while the lesion is a direct cause of many serious morbid conditions which grow out of intestinal toxemia, the result of stasis and ascending infection of the small intestine, the lesion itself is a result of some other existing morbid condition. The most common cause is some obstruction existing between the ileocecal valve and the rectum. In many cases the cause will be found in obstructive adhesions of the pelvic or ileac colon. The obstruction is more likely to occur in the middle of the pelvic loop or at the pelvi-rectal junction, but may exist at the ileo-pelvic junction. Obstruction may also arise from a neoplasm. In a certain number of cases no structural changes are found. In such cases the cause of obstruction is shown by the x-ray to be a spastic condition of the distal portion of the colon, frequently associated with colitis.

Incompetency of the valve may be due to other causes than over-distention of the cecum. Max Hertz called attention to the fact that the valve may become incompetent as a result of tubercular or syphilitic ulceration. The writer has noticed



The interesting facts to which Keith has recently called attention concerning the nodes by which the normal rhythmic function of the intestinal musculature is organized and controlled have little if any bearing upon the subjects discussed in this paper for the reason that the function of the ileocecal valve proper is purely mechanical and hence not influenced by the nervous mechanism which controls the musculature of the small intestine including the *ileocolic sphincter*, which lies above the ileocolic valve and is wholly independent of it in structure and function.

## DISINFECTION.

As air contamination is often the result of causes which cannot be remedied by ventilation alone, disinfection becomes necessary as an auxiliary, though no amount of disinfection can take the place of an abundant supply of fresh air. Substances liable to produce contamination by undergoing putrefactive decomposition should be removed to so great a distance from human habitations as to obviate all possibility of danger. In case this cannot be readily done, and often when it can be done, in order to prevent contamination during transit, the dangerous substance should be rendered innocuous by the use of disinfectants. Disinfectants are of two classes: those which simply destroy the offensive odors of putrescent substances, or *deodorants*, and those which not only destroy the odors, but the substances themselves, or check or prevent putrescent changes. The most of these are known as *antiseptics*. We will call attention to some of the best and most easily used disinfectants, and the conditions to which they are especially adapted.

**Dry Earth.**—This is one of the best of all deodorants for solid and semi-solid matters. It is a most excellent agent for deodorizing excreta. It operates by absorbing fluids and foul gases. It must be very dry, and the finer the better. Sand is not good. Earth, if wet, is worthless. Dry powdered clay is best. Coal ashes act mainly on the same principle, and are good. Dust from the road is a very good material. It should be gathered and preserved in boxes under cover, in readiness for use in wet weather. Dry earth must be used very freely to be effective.

The popular idea that dry earth, pulverized charcoal, and other substances possess the property of absorbing diseased matter from the air, is an error. These substances are valuable chiefly as absorbents liquids; the more finely divided, the more effective they are.

**Chloride of Lime** is excellent to destroy putrid substances, foul gases, and disease germs. Its efficiency is due to the chlorine gas which escapes from it when moistened.

Into a gallon of water, put a pound of fresh chloride of lime. (Be sure it is fresh. It is about worthless when old.) Stir well. Filter, or turn off after settling. Use freely.

7072

Disinfectants, etc., which have been obtained in this office, are prepared

by the direction of the Surgeon General, U. S. Army, and are distributed

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This is an excellent preparation for cleansing clothing that has been soiled by the discharges of patients. For this purpose, use one quart of the solution described to half a pailful of water. It is also very useful for cleansing the hands of nurses who may be employed in cases of loathsome or infectious disease. After preparation, the solution must be used at once or kept tightly stoppered.

**Chlorine Gas.**—This is one of the most effective of disinfectants. It may be prepared in several ways. The following are simple and practical methods:—

1. With one and a half pounds of fresh chloride of lime mix one pound of powdered alum. This is excellent to use in a sick-room where foul odors are present, as the chlorine is given off gradually.

2. Mix equal parts of chloride of lime and muriatic or sulphuric acid. Mix in an earthen vessel with water equal to the acid by measure.

3. Mix together in an earthen vessel equal parts of salt and black oxide of manganese, and pour on two parts by weight of sulphuric acid.

About a pound and a half of chloride of lime, or of the mixture of salt and oxide of manganese, with the proper amount of acid, will be required for each one hundred cubic feet of air to be disinfected. In using chlorine to disinfect rooms which have been occupied by fever patients, all colored fabrics, picture-frames, and other articles likely to be injured, should be removed, and the room tightly closed for twenty-four hours, after which it should be aired for two or three days. In disinfection after scarlet fever and diphtheria, everything used about the patient should be left in the room.

As the irritating fumes of this gas may be inhaled by accident, it will be useful to know that they may be antidoted by the inhalation of ammonia, or better, by breathing the vapor of alcohol.

**Sulphurous Acid.**—This well-known bleaching agent is also a very good disinfectant. It is even preferable to chlorine gas for disinfecting rooms and clothing, if used thoroughly. It may be used for disinfection in the same manner as for bleaching purposes. After removing from the room everything that may be discolored by a bleaching agent, as all kinds of colored cotton fabrics, and getting all in readiness to close the room quickly and tightly, place in an old iron kettle some live coals, upon which throw the sulphur or powdered brimstone, setting the kettle on bricks, or in a tub with a little water.

Another convenient method is to place in the middle of the room, on a piece of sheet-iron or boards, a few shovelfuls of wet sand. Place in the sand several bricks near together, and on the bricks two or three hot stove-covers, bottom upward. Put the sulphur on these, and there will be no danger of fire. A hot iron kettle answers equally well. Use six ounces of sulphur to each one hundred cubic feet of air to be disinfected. Close the room tightly for twenty-four hours, then ventilate for two days, and scrub and repaper the walls.

**Ozone.**—This is nature's great disinfectant. It is produced by various natural agents, such as electrical discharges, the gums of certain forest trees, the perfumes of flowers, and a great number of other means which are in constant activity, keeping good the supply which is exhausted by the destruction of the noxious vapors, germs, and various other agents destructive to human life which teem the air. The value of this wonderful agent as a disinfectant is but just coming to be appreciated in some small degree. It is to be hoped that ere long some means will be devised by which it can be cheaply manufactured in great quantities, when it may be made the means of doing an incalculable amount of good; as, for instance, in destroying the poisonous emanations from swamps, marshes, and other sources of atmospheric poisons.

**Peroxide of Hydrogen.**—This chemical preparation is somewhat analogous to ozone in its properties. It differs from ozone, however, in the fact that it is very soluble in water, so that concentrated solutions may be easily made by proper chemical means. Peroxide of hydrogen possesses the remarkable property of setting free active oxygen when brought into contact with organic substances whereby these substances are consumed. It will not attack to any extent the living tissues of animals, unless in very concentrated form, but will destroy germs of all sorts, together with the organic matter which supports the life of germs. When applied to a discharging sore or introduced into an abscess, a great quantity of foam appears, indicating that the peroxide is actively doing its work. Dilute with three to ten parts of water.

**Carbolic Acid.**—This is a reliable disinfectant if employed in a sufficient quantity, but it is rarely used in such a manner as to be effective, too weak solutions being used. A five per cent solution, or one part of carbolic acid to nineteen parts of water, is necessary for the destruction of dangerous germs.

446

**Corrosive Sublimate.**—The most efficient of all known germicides, which are available for ordinary use, is corrosive sublimate, a chemical agent often employed by housewives in the destruction of certain kinds of vermin. Most germs are killed by the application of a solution of one part corrosive sublimate in four thousand parts of water. Even weaker solutions are effective for the destruction of certain kinds of germs. A strong solution, however, is needed for the certain destruction of some dangerous germs which are very tenacious of life. A 1-2000 solution of corrosive sublimate is made by the addition of one-half dram of corrosive sublimate to a gallon of water. Solutions of this powerful poison should never be kept on hand, owing to the danger of fatal accident, especially in homes where children and ignorant persons are likely to come in contact with it. It is better to have a number of half-dram powders put up at a drug-store ready for use when needed. If a solution must be kept ready for use during the care of a case of typhoid fever, it should be tinged with some coloring matter, as cochineal, which will serve as a warning against its use, and the jug or bottle containing it should be labeled "Poison," and should be kept carefully out of the reach of persons likely to be harmed. The nature of this chemical agent is such that it cannot be kept in metal vessels. If placed in tin vessels, the tin coating is quickly destroyed, hence such solutions must be kept in glass or earthen-ware vessels.

Instead of preparing solutions from the sublimate obtained in the form of a drug store, it is better to use the corrosive sublimate tablets which are now everywhere available. These should be used according to the accompanying directions.

**Dry Heat.**—A temperature of 300° is destructive to nearly all germs. Unfortunately, however, this temperature, when maintained for a sufficient length of time to render certain the destruction of all germs, is likely to seriously damage the texture of many fabrics, hence this mode of disinfection is not in very great favor. It may be employed, however, for the disinfection of many objects which cannot be safely exposed to the action of chemical agents or water. Objects requiring disinfection by this mode may be placed in an oven, care being taken to place in the oven with the article to be disinfected, a bit of dried bread or a piece of white paper, by watching which the degree of heat and liability to injury may be determined.

**Boiling.**—This is one of the most convenient of all modes of disinfection, since it is always ready to hand, and can be employed at little

or no expense. Most disease-producing germs are killed by boiling for thirty minutes to one hour. Many germs are killed by boiling for fifteen to twenty minutes, but boiling for thirty

minutes to an hour is the safer plan. It should be remembered that boiling water is not a disinfectant. Heat in connection with moisture is the disinfecting agent, consequently it is necessary that a boiling temperature, which is ordinarily something less than  $212^{\circ}$ , should be maintained for the time mentioned to insure thorough disinfection.

It is also important to remember that there are certain very deadly germs which are not destroyed by the boiling temperature. These are multiplied by means of spores which require for their destruction heating in the presence of moisture at a temperature of  $240^{\circ}$  for half an hour.

The principal germs of this class with which human beings are likely to come in contact are the bacillus botulinus which causes tetanus, sometimes found in canned spinach, beans and ripe olives and other vegetables, as well as canned meats of various sorts which have been imperfectly "processed."

Welch's bacillus, a very poisonous organism usually found present in putrefying materials and in the excreta of carnivorous animals, also requires the same high temperature and prolonged heating for its destruction. This germ is the cause of gas gangrene which caused the death of many soldiers during the World War.

Another germ which gives rise to tetanus, a disease derived from infected wool, hair, and bristles, is propagated by spores and requires long heating at a high temperature, which is also true of the germ which produces tetanus, or lockjaw, a germ which is found in horse manure and which saturated soils are likely to be contaminated.

6  
448

**Cleansing Sick-Rooms.** — A room which has been long occupied by a person suffering from chronic disease, or by a fever patient, or a case of smallpox or other contagious disease, ought to be very thoroughly cleansed before being occupied by others. The means by which this may be most efficiently done are these: —

1. Take out the windows, and give the greatest possible freedom to ventilation.

2. Remove the old paper from the walls, and burn it. Wash the bare walls with a solution of copperas, and then apply whitewash to the ceiling. Cleanse the woodwork with a solution of chloride of lime, one pound to the gallon.

3. Remove the carpet from the floor, the bedding from the bed, and every other fabric from the room, and thoroughly disinfect them before replacing.

**Sulphur Fumigation.** — Ordinary scrubbing, whitewashing, and ventilation are useful and necessary, but are not sufficient. Disinfection is required. One of the most convenient and effective means of disinfection is fumigation by the burning of common sulphur. The following is the best method of doing this: —

Into a tub or a large dish-pan pour water to the depth of an inch. Place in the vessel two bricks laid flatwise and near together. Set upon the bricks an old iron kettle. Put into the kettle a proper quantity of flour of sulphur mixed with an equal quantity of pounded charcoal. The quantity required is four pounds for each one thousand cubic feet of air. Mix with the sulphur and charcoal a few pieces of newspaper. Before the sulphur is lighted, all clothing and other articles in the room should be so disposed as to allow the fumes of the sulphur to come in contact with them to the fullest extent. The efficiency of the fumigation is also very greatly increased by saturating the walls, and everything the room contains, with steam. The room must be kept closed for twenty-four hours, at the end of which time it should be opened and left to air for another twenty-four hours, when it may be considered thoroughly disinfected.

**Formalin Disinfection.** — Formalin candles may now be obtained at all drug-stores. These may be burned in place of sulphur in the

room which requires disinfection. This is a much more convenient method than sulphur fumigation. Directions and precautions are the same as for sulphur fumigation.

Formalin or formaldehyde tablets and candles are now procurable

at drug stores, together with proper directions for their use.

It is one of the most efficient and practical of all available disinfectants.

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**To Disinfect Clothing.** — Clothing which has been exposed to contamination by contagion, if of little value, should be destroyed. If more valuable, it may be disinfected in any one of several ways: —

1. Heat in an oven as hot as possible without scorching, for an hour or two. A temperature of 250° will do no harm.

2. If the clothing is uncolored, or colored with mineral dyes, soak a few minutes in a solution of fresh chloride of lime of the strength of one pound of the chloride to a pailful of water. Afterward boil.

3. Boil for one hour in a saturated solution of common salt. The addition of salt will raise temperature a few degrees above boiling point and insure thorough destruction of germs and germ spores.

4. Expose for several hours, in a close box, to the fumes of burning sulphur. Air thoroughly afterward, and wash.

5. Still a better, and perhaps best of all methods is fumigation with formalin. The articles may be placed in a small room, or closet, or in a box especially prepared for the purpose, and exposed to the fumes of formalin by burning a formalin candle within the enclosure. Such candles can be obtained at any drug-store, and are accompanied by full directions for their use.

**Combating Germs in the Sick Room.** — The part played by germs in the causation of many diseases, is now so well understood that evidence bearing upon this important fact is unnecessary.

It is generally supposed that when a person has once been infected by a disease, he is infected as much as possible, and it is of no use to take further precautions against infection or contagion; but the frequent occurrence of relapses in persons who have almost recovered from a contagious malady, as diphtheria or typhoid fever, points clearly to the conclusion that a patient may be re-infected in some way. Common sense suggests that a patient suffering from scarlet fever or diphtheria, must be infecting himself continually by breathing contaminated air. It has been observed for many years, and by the most eminent physicians, especially military physicians, that persons suffering from contagious diseases recover much more surely and rapidly when treated in an open shed or tent, even when suffering many disadvantages, than in the best-constructed and most perfectly appointed hospitals. The reason for this is obvious. The air of an open tent or shed is changed so frequently that there is no accumulation of



the poisons which are thrown off from the lungs and the skin of the patient, and hence the air is practically free from contamination.

Recognizing this fact, physicians and nurses have undertaken to purify the air of sick-rooms by various means. Good ventilation has been proved to be of the greatest value as a means of dispersing the germs; but no value whatever attaches to the use of disinfectants in the room with a patient, such as chloride of lime scattered about, carbolic acid evaporating in a basin of warm water, the burning of disinfectant pastiles, etc. It is possible, however, to do much in the direction of destroying germs in the sick-room, and thus supplying the patient with air of greater purity, and hence with a better opportunity for recovery. Two rooms should be devoted to the patient. They should be near together, and should both be accessible from the hall or a communicating room, so that each can be used independently of the other. These rooms should be used on alternate days. On leaving the sick-room which has been occupied last, in the morning air thoroughly by opening windows as wide as possible. The next morning, transfer the patient to the disinfected room, and proceed to disinfect the other room in the same manner. This method is the only one which is of any value while a room is in use. The accumulation of disease germs often results in the reinfection of the patient, and of course greatly increases the danger of the attendants.

It should be remembered that most germs in a sick-room are to be found upon the walls, ceiling, and floor. One of the most efficient methods of removing them is by rubbing the walls with moist bread. This method was introduced by Prof. Virchow, of Berlin. Bichloride of mercury, chloride of lime, and other antiseptics may be used to good advantage.

**How to Destroy Typhoid Germs.**—Typhoid fever is usually communicated through the discharges of typhoid-fever patients. The germs of the disease find their way to wells, water courses, and other sources of water supply, and thus other persons become infected. This means of spreading the disease would be wholly checked if the discharges of every typhoid-fever patient were properly and thoroughly disinfected. A saturated solution of copperas or sulphate of zinc will probably destroy the germs of typhoid, but there are other more positive means of disinfection. The following are among the most valuable:—

**A solution of two drams of corrosive sublimate to the gallon of water, will destroy all known germs. ~~The objection to this disinfectant is that~~**

it is so poisonous that any one is likely to be killed by accidentally swallowing even a very small portion of the solution.

**Disinfection of Spittoons and Cuspidors.**—The disinfection of spittoons is a matter of importance to which sanitarians have recently called attention. When the contents of a spittoon are allowed to dry and become powdered to dust, there is great danger of contamination of the air and communication of various maladies through this means. This is especially the case with consumption, now generally recognized as a contagious disease. It is probably more contagious than leprosy, although the fact is as yet little understood by the public. All persons suffering from any disease requiring expectoration, should be compelled by law to avoid expectoration elsewhere than in a spittoon or upon some object which may be disinfected or destroyed. Spitting upon the floors, in the streets, and upon public walks is a crime against society, and should be prohibited by law. The plan which we recommend in cases of consumption and other contagious diseases, is that the patient should expectorate upon cloths or little paper spittoons which can be burned; but if a spittoon or cuspidor is employed, it may be disinfected by pouring into it a quantity of boiling water equal to five or six times the volume of the contents of the spittoon. Spittoons should be thoroughly disinfected with boiling water daily.

**Disinfection of the Hands.**—For disinfection of the hands, which often becomes necessary through contact with persons suffering from loathsome or infectious disease, or dead bodies, or other source of probable contamination, the following is a simple and effective method: First scrub the hands thoroughly with hot water, laundry soap, and a nail brush, being careful to give special attention to the spaces under the ends of the nails, which are a common hiding-place for many dangerous germs, and the cause of the occasional serious consequences which arise from a scratch with the finger-nail. After thorough scrubbing of the hands for five minutes, bathe them for two minutes in strongest alcohol. Without drying the hands, bathe them for another



HARVEY DEMONSTRATING THE CIRCULATION OF THE BLOOD TO CHARLES I, IN 1616.

# Gorillas—Real and Mythical

BY

CARL E. AKELEY

*file Gorilla*

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AN OLD SILVER-BACKED MALE

This gorilla, the first to be collected by Mr. Akeley, is mounted for the group that will find place in the Roosevelt African Hall. He is advancing on all fours—the normal walking position—with his feet flat on the ground and his hands doubled under so that only the knuckles touch the trail. The posture and mild facial expression of this gorilla, the first specimen ever mounted by a man who had actually seen a live gorilla in the wild are in marked contrast to the erect body and the ferocious aspect of the traditional gorilla of story, of taxidermy, and of sculpture.

## Gorillas—Real and Mythical

By CARL E. AKILEY

IT is ordained that the projected Roosevelt African hall of the American Museum shall follow the ideals and customs of modern museum exhibition. Into it shall go nothing but the truth. Forty groups of African mammals and probably two or three times forty species will be represented in their natural environment, doing normal and natural things. And when we say that in this great hall only truths are to be represented, we are committing ourselves to an enormous task; for we mean by such a statement that every detail in relation to an animal, its habits, and environment must be carefully studied at first hand by the men who are to prepare and assemble these groups. A vast amount of toil is involved in physical preparation, but, before that work is undertaken, labor equally great and even more important will be necessary to correct inaccurate theories that have persisted about little-known African animals.

Although, due to the fact that the gorilla is recognized by many as man's closest relative, the study of this ape is perhaps more interesting and more important than the study of any other animal, there is no other African beast that has been the center of so many fables and superstitions. What Huxley wrote about the world's knowledge of the real gorilla is almost as applicable to the situation today as to that of 1863. In regard to the difficulty of obtaining sound knowledge respecting the habits and mode of life of the man-like apes, he says:

to the ordinary explorer or collector, the dense forests of equatorial Asia and Africa, which constitute the favourite habitation of the Orang, the Chimpanzee, and the Gorilla, present difficulties of no ordinary magnitude; and the man who risks his life by even a short visit to the inhospitable shores of those regions may well be excused if he shrinks from facing the dangers of the interior; if he contents himself with stimulating the industry of the better seasoned natives, and collecting and collating the more or less mythical reports and traditions with which they are too ready to supply him.

In such a manner most of the earlier accounts of the habits of the man-like Apes originated; and even now a good deal of what passes current must be admitted to have no very safe foundation. The best information we possess is that, based almost wholly on direct European testimony, respecting the Gibbons; the next best evidence relates to the Orangs; while our knowledge of the habits of the Chimpanzee and the Gorilla stands much in need of support and enlargement by additional testimony from instructed European eyewitnesses.

Not are the inaccessibility of the gorilla forests and the persistence of the myths of an imaginative and superstitious people the only obstacles to the progress of the scientist who would separate the truth from the fiction in our natural history literature. When once an interesting tale has been well told, it is likely to become established through constant reiteration by men who are merely writers rather than observers. The naturalist going into the field to study an animal for the first time usually has read such writings and is under the spell of the erroneous impression that they convey. When he observes an animal in the

distance and is unable to distinguish clearly what it is doing, he naturally interprets its actions in the light of the tale he has read. I have known naturalists who were convinced in this way that they had observed something



A notable representation of the mythical gorilla, the bronze by Fremiet. It was suggested by the legend of the abduction of native women by vicious old male gorillas.

which they had not seen at all, and who then confirmed such natural history fiction as eyewitnesses. Early tales of the gorilla, most of them based on hearsay, have so much in common, and the reports of more recent explorers duplicate these early accounts in so many respects, that one is inclined to feel that writing gorilla stories has been a game of follow the leader.

Had the American Museum undertaken to prepare a gorilla group five years ago, using skins which could be purchased in the open market, and planning the group as carefully as possible in accordance with the accumulated data of the past seventy-five

years, I have an idea that that group would have had a much greater appeal to a public thirsting for excitement and sensation, than the group which will result from the knowledge recently acquired. Such an imaginary group would of necessity have shown the gorilla as a ferocious creature in a setting of gloomy forest or mysterious jungle. There would have been one specimen in a tree, another walking erect with a staff or club in one hand, and perhaps a third beating its breast with its fists and opening its cavernous mouth as though roaring with rage. A house or nest, ingeniously constructed somewhere between earth and sky, would have been required to make the picture complete. Taking the records literally, there would have been justification for depicting an old male in the act of crushing with his teeth the barrel of a hunter's gun.

It is not necessary to rely on the imagination altogether in visualizing the gorilla as he has long been conceived. The American Museum of Natural History has been the temporary custodian of one of the old representations so horrible and so realistic that it would terrorize the very animal it is supposed to portray. (Be it said to the credit of the Museum that, when this statue came into its possession, it was put away in the basement.) I refer to the bronze by E. Fremiet, the most striking sculpture of a gorilla that we have. It shows a beautifully modeled animal in the act of bearing away on his right arm a lovely native woman, who, by the way, has more of the earmarks of a Parisian model than of an African savage. The gorilla, of course, is walking erect, on his legs; one hand clasps his captive, the other hand contains a great rock, which presumably he is about to throw at his pursuers. Al-

though they have already succeeded in lodging a huge arrow in his heart, he apparently has an abundance of strength and energy to defy them and to make away with his prize.

While the number of mounted gorillas in the museums of the world is not very great, still many of these museum specimens are almost as misleading as Fremiet's bronze.

The gorilla group in Roosevelt African hall will be a great disappointment to that portion of the public which has expected and would prefer to see the gorilla made as human and as horrible as the imagination has painted him, for it will show the gorilla as a great amiable creature in a setting of extraordinary beauty. In the group nothing but facts and truth will be told—not all the facts nor all the truth, for additional researches will undoubtedly widen our knowledge of this animal—but the story of the gorilla as I found him in November, 1921, near Lake Kivu in the eastern Congo, on the glorious, forested slopes of the extinct volcanoes, Mikeno and Karisimbi. Three weeks with the gorilla is indeed a short time in which to learn his story. I do not pretend that my record is complete; but I was extremely fortunate in my opportunities for observation and in securing specimens and data. And to the tale that is told by my group there will ultimately be added, I hope, the other ninety-five per cent of the gorilla's story.

During the time I spent in the gorilla forest, I was constantly searching for a setting to be reproduced for the gorilla group. In the preparation of a habitat group, it is always a difficult undertaking to find a setting that is characteristic and that in addition has those qualities that contribute to an interesting and attractive composition, one



Map showing the location of the gorilla country and the route taken by Mr. Akeley on his recent expedition. Entering Africa at Cape Town, he traveled northward by rail, by boat, and on foot into the mountainous region just north of Lake Kivu, where he found gorillas.

that gives a comprehensive idea of the country and at the same time requires the minimum of expense in reproduction. Until the day that the last old gorilla was shot I had only the vaguest notion of what setting I should choose. It seemed to me that I could find nothing that was adequate. But when the old male of Karisimbi rolled down a steep incline, and came to rest against the base of a great dead tree clothed in mosses and in the rank growth of tropical vegetation, through the branches of which one looked out across a beautiful forested valley to the gorgeous pinnacle of Mikeno on the right and to the smouldering craters of Nyam-lagira and Chaninagongo in the distance, I realized that the old gorilla had found the setting that I sought. At no time has there been thought of looking farther. It is a place much frequented by the gorillas, where some of their favorite foods grow in abundance and where, their hunger satisfied





The peaks of the gorilla country at sunrise—Visoke summit just visible over the left shoulder of Mikenno (center), and Kirisimbi at the right. The location of the proposed gorilla sanctuary is marked by this triangle of mountains.

they bask lazily in the sunshine of their little empire.

The old male of Karisimbi will be shown beating his chest. This attitude should satisfy those who are loath to give up the sensational tales of gorillas until they learn that it does not indicate rage or ferocity. It is merely an expression of curiosity. The animal has seen a movement in the bushes in the valley below him and he rises up and beats his chest and perhaps barks—for the so-called roar of the gorilla of the Kivu region, at least, is best described as a long-drawn-out, throaty bark. The other male, the first gorilla that I ever saw alive, will be shown on all fours in the normal walking attitude. One hand will be poised, as he hesi-

tates in his advance and looks at the observer with the expression that he wore in life—an expression of passive interest. One old female will be lying lazily on her back against the base of the tree. When I came in sight of a troop that was unconscious of my presence, some of them were sure to be loafing about in some such attitude as this. A second old female, feeding on the vegetation, and a youngster of about four years will complete the group.

Before I discuss further the experiences which justify my belief that the gorilla is a good-tempered beast, who expresses himself by a bark rather than a terrifying roar, who touches the ground with his hands in walking, and is non-arboreal in his habits, it may



The summit of Chaninagongo draped in smoke and clouds, viewed from the spot on the slopes of Karisimbi where the last old male was killed. This silhouette of the extinct volcano is to be a detail of the painted background for the gorilla group in Roosevelt African Hall

be well to devote a little space to the sources of the prevalent conception which it is my purpose to controvert.

About the close of the sixteenth century, the story of Andrew Battell, an English captive of the Portuguese of Angola, established the idea that the ferocious beast walked erect, slept in trees, and was the terror of the natives. After a description which practically identifies his "pongo" as the gorilla, Battell says:

He differeth not from a man but in his legs; for they have no calfe. Hee goeth alwaies upon his legs, and carrieth his hands clasped in the nape of his necke when he goeth upon the ground. They sleep in the trees, and build shelters for the raine. They feed upon fruit that they find in the woods, and upon nuts,

for they eate no kind of flesh. They cannot speake, and have no understanding more than a beast. The people of the countrie, when they travaile in the woods make fires where they sleepe in the night and in the morning when they are gone, the Pongoes will come and sit about the fire till it goeth out; for they have no understanding to lay the wood together. They goe many together and kill many negroes that travaile in the woods. Many times they fall upon the elephants that come to feed where they be, and so beate them with their clubbed fists, and pieces of wood, that they will run roaring away from them. Those Pongoes are never taken alive because they are so strong, that ten men cannot hold one of them; but yet they take many of their young ones with poison arrowes.

Battell's uncomplimentary opinion of the gorilla was widely disseminated through the exaggerated translation of



THE KIVU FAIRYLAND

One of the wooded valleys of Mt. Mikeno in the home of the gorillas—an enchanted forest of graceful tree trunks, lacy foliage, ferns, beard mosses, and tangled vines. The most beautiful scenery in all Africa, Mr. Akeley believes, is in this mountainous region just north of Lake Kivu in the Belgian Congo



A SCENE ON MT. MIKENO

View of a peak of Mikeno from a trail along a ridge that overhangs one of the mountain's deep-cut valleys. It was on a steep trail at the base of the white cliff on the right slope of the peak that Mr. Akeley killed his second gorilla

it that appeared in 1748 in Buffon's *Histoire generale des Voyages*. In view of the fact that habits of the chimpanzee have frequently been attributed to the gorilla, it may be well to note that this book regards pongoes, joekos (chimpanzees), and oranges as a single species.

The account of an African missionary, Dr. Thomas S. Savage, based on skulls and information given him by the natives of the Gaboon region, appeared in the *Boston Journal of Natural History* in December, 1847. After giving a substantially accurate description of the gorilla's mode of progress on all fours, he adds that it is "said to be much inclined" to the walking posture. He speaks of their "dwellings" made of a few sticks and leafy branches supported by the crotches and limbs of trees, and of their exceeding ferocity and their habit of always taking the offensive. The native testimony which he records in the following paragraph has probably inspired in part at least the mounting of more than one ugly museum specimen.

It is said that when the male is first seen he gives a terrific yell that resounds far and wide through the forest, something like kh-ah! kh-ah! prolonged and shrill. His enormous jaws are widely opened at each expiration, his under lip hangs over the chin, and the hairy ridge and scalp is contracted upon the brow, presenting an aspect of indescribable ferocity. The females and young at the first cry quickly disappear; he then approaches the enemy in great fury, pouring out his horrid cries in quick succession. The hunter awaits his approach with his gun extended; if his aim is not sure he permits the animal to grasp the barrel and as he carries it to his mouth (which is his habit) he fires; should the gun fail to go off, the barrel (that of an ordinary musket, which is thin) is crushed between his teeth, and the encounter soon proves fatal to the hunter.

It was Doctor Savage who first gave the *Engé-ena* the name "gorilla,"

wisely avoiding the misused term pongo.

There is a striking similarity between the account of Doctor Savage and that given five years later before the Academy of Natural Sciences of Philadelphia by Mr. Ford, another visitor to the Gaboon. Even the episode of the animal's crushing the musket between his teeth is repeated by Mr. Ford, although he discredits the stories of elephant-driving and house-building as tales told to children by the natives. He does not pretend to have seen a gorilla's attack, but he describes the animal in vivid terms as he makes his onset, "with his crest erect and projected forward, his nostrils dilated, and his under-lip thrown down, at the same time uttering his characteristic yell, designed, it would seem, to terrify his antagonist."

The intrepid little French-American, Paul Du Chaillu, was the first white hunter to kill a gorilla. The account of his adventures appeared in print at that stage in the history of tales of travel when publishers, like the motion picture producers of today, feared to rely upon the unadorned truth to hold the public's interest. We have it on good authority, that the narrative was twice rewritten before his editors considered that it had sufficient popular appeal. His stories are the type that small boys carry away to the attic to devour on rainy afternoons. They are still occasionally read and they have done much to perpetuate the first erroneous reports of the gorilla. Familiar with the gorilla's reputation for evil, Du Chaillu naturally enough ran the whole gamut of emotions as he approached his first encounter. That passage from his book which at first reading is most damaging evidence against the great ape, appears as a

harmless recital when all the words and phrases that apply to the hunter's state of mind are dropped out. In spite of their fame as offensive warriors, the first gorillas surprised by Du Chaillu fled into the deep forest. The hunters pursued until they were exhausted but, "the alert beasts made good their escape." And the "charge" of his old male was proceeding hesitatingly, step by step, when Du Chaillu's gun interrupted it.

Although most of the reports of gorillas have been from the west coast, there had come to me considerable corroboration of the rumors that there were also gorillas in the Lake Kivu country of Central Africa. Before I left Africa in 1911, a report reached me that a man named Grauer had come out of the Kivu region with eight gorilla skins. Before my departure for the Kivu country in 1921, I received a letter from Mr. C. D. Foster, who had killed a male and a female and taken a baby on Mt. Mikeno. Prince Wilhelm of Sweden had hunted here, also, and Mr. T. Alexander Barnes was in the Kivu country hunting gorillas for the British Museum when we entered it.

At the time of my departure I had heard little of what these present-day hunters had to say of the Kivu gorilla, but I had never accepted the accounts of the Gaboon gorilla's ferocity. Having seen the "follow the leader" game played in the case of other animal stories by fellow naturalists in my own time, it was not difficult for me to disregard early accounts and enter upon my study of the gorilla with an open mind. If I was prejudiced at all when I entered the Kivu country in the fall of 1921, that prejudice was decidedly in favor of the gorilla. Basing my theory upon my observations of the

habits of the other apes and upon my general belief in the good temper of unmolested wild animals, I was prepared to find in him a decent and amiable creature. I was not ~~disappointed~~.

I saw no indication that the gorilla is in the least aggressive or that he would fight even on just provocation. I have trailed him through his jungles, come on him at very close quarters, and shot him without seeing the slightest intimation on his part of an intention to start a fight. The first gorilla that I ever saw alive was a lone old male, who might have been expected to show some war-like spirit if that had been a characteristic of his tribe. I saw his face—ugly and wrinkled, but mild and gentle—across the valley and caught a glimpse of his gray back as he went over a log and up the slope through dense vegetation. When I finally overtook him, I was first aware of his presence by his guttural bark. He was crouching motionless thirty feet away in the death-like silence of the sun-lit morning. There was no "devil's tattoo" of chest beating; no threat of a charge—although, had he been inclined to charge, he had merely to drop down on us. He barked four times. My shot cut his fourth bark short. So ended my first gorilla hunt. It had been a thrilling experience, but thrilling because of tradition rather than because of fact.

Those who have maligned the gorilla's good name have cited his "strange, discordant, half-human, devilish cry" and his beating of his chest "with his huge fists till it resounded like an immense bass drum," as his modes of offering defiance. In my opinion both of these habits have been misinterpreted. The only way I can describe the utterance of a gorilla is as a hoarse, guttural, prolonged bark. It

*Quote*



Enlargements from Mr. Akeley's motion pictures, the first pictures of any kind ever taken of live, wild gorillas. Although the animals were aware of Mr. Akeley's presence, they paid little attention to him, the old female even settling herself comfortably in the crotch of the tree as if to go to sleep. The bottom picture shows two of the gorillas with clasped hands, as the old one helps the youngster to descend. The gently sloping trunk on which the gorillas were perched when Mr. Akeley photographed them, was no more than ten feet from the ground

has no resemblance whatever to a roar and there is no resonance in the sound. I doubt if on a perfectly still day it could be heard for more than half a mile. In some cases it is a warning signal to the rest of the band; in others, it is an inquiring challenge addressed to the invader of his domain and has some such implication as the words, "Who are you? What are you doing here?"

I was keen to see a gorilla beat his chest and was fortunate not only in witnessing this action, but also in making a motion picture record of it. In this motion picture the female is shown in the crotch of a leaning tree, to which she had ascended with her two youngsters to get a better view of me. At a time when they were all but indifferent to my presence (although I was in plain sight), she suddenly rose up and beat her chest; then immediately dropped down again. A moment later she was making herself comfortable with the apparent intention of going to sleep if her youngsters would let her. One of the youngsters rose up on his legs two or three times, each time striking his chest once and, as he went down again, hitting the log once or twice with his hands. They made no vocal sounds and I could not hear the beating of the chest from where I stood operating the motion-picture camera, at a distance of perhaps two hundred feet. There was no wind to carry sound either to or from me. The beating of the chest is a nervous expression of curiosity, the equivalent of which we find in the actions of many of the smaller apes and monkeys, such as their habit of beating the ground or their perch with their hands or feet, while they are perhaps making vocal sounds.

The natives of this region have no fear of the gorilla. They wander

through the gorilla country to collect firewood and, during the dry season, pasture their cattle on the open places in the gorilla forest. We found fresh gorilla tracks on the fresh trail of a herd of cattle. Some of my guides and my gun bearer were trappers and hunters in the gorilla forests and were thoroughly familiar with them. At no time did the guides or gun boys show any indication of anything more than casual interest even when we approached very close to gorillas. In direct contrast to the behavior of natives on the elephant trail where they are terrified when unprotected by the rifle of the *bwana*, the gun boy who went with me on the gorilla hunt would hand me the gun as we were getting near a band and would go in front of me unarmed, cutting the nettles out of the way or clearing a path. Then, when he thought I might want to shoot, he would lie down on the ground in front of me. With dangerous game you can depend on your boys' dropping behind you, where they are ready to lead the retreat, if retreat becomes necessary. At no time did I see a gorilla move with a rapidity that would suggest the possibility of his overtaking a man in a fair race. The lumbering creatures with their comparatively short legs are not built for speed.

While I am certain that normally the gorilla is a perfectly amiable, good-natured creature who would not look for trouble, yet I am willing to concede that in regions where he is more or less in competition with the natives for food, and where he is constantly harassed in his efforts to fight hunger, an old male might occasionally become what may be called a "bad gorilla." No doubt from his standpoint a raid on the native gardens is justified, for so far as he knows the food in these gardens is

just as much his as the natives'. Now and then under such conditions a gorilla becomes conscious of his superior strength and may naturally enough grow bold and aggressive. And it is hard to imagine a more formidable opponent than an enraged gorilla. The strength of his arms, as one may judge from the measurements, is tremendous. This strength, backed by the great weight of his short coupled body, would make it useless for an antagonist to struggle against him in a hand-to-hand encounter.

Very few gorillas have been weighed. Mr. T. Alexander Barnes, a thoroughly dependable and thoroughly honest ob-



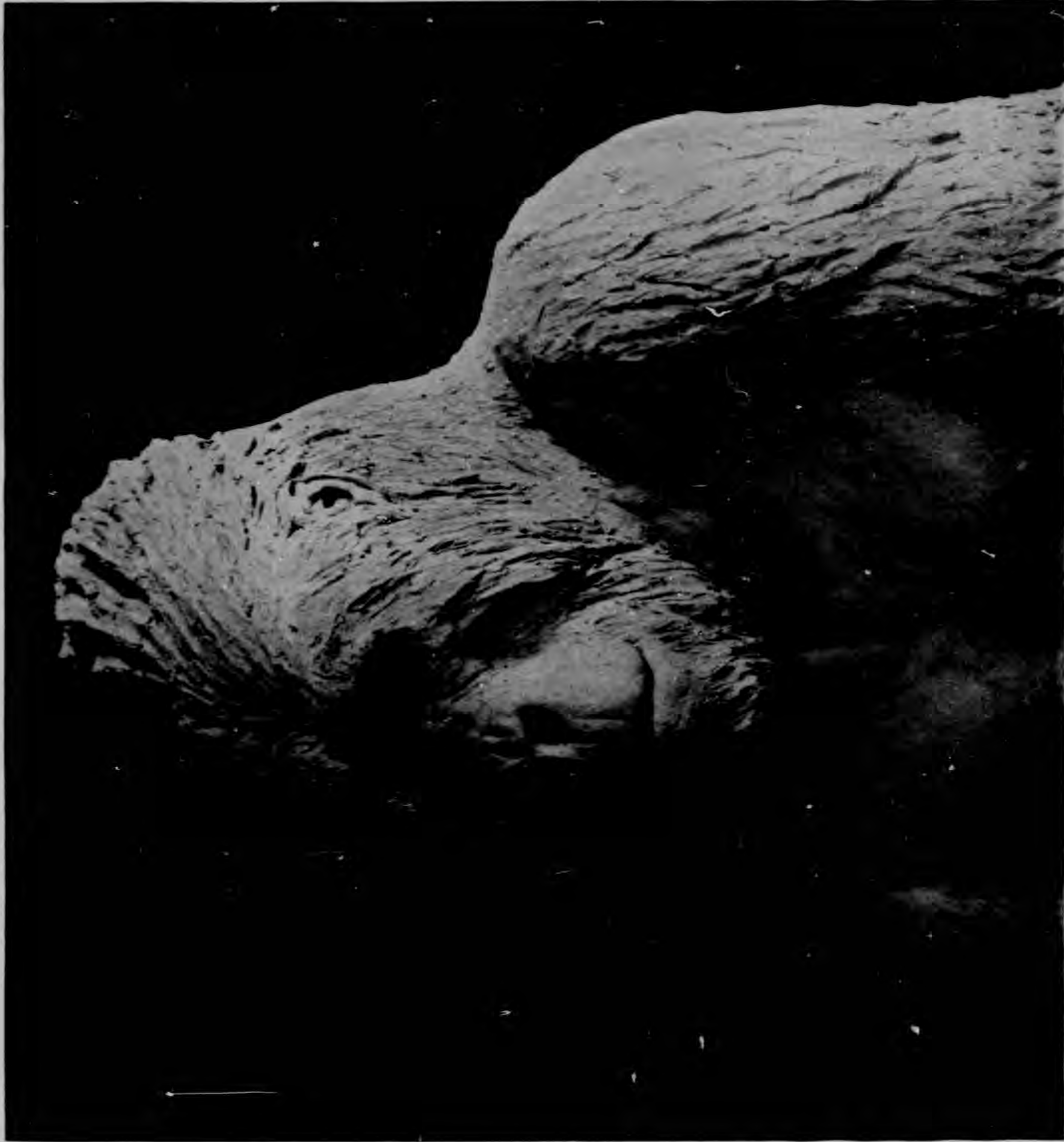
M'Gulu, a guide of the gorilla country, with one of the knives used by the natives in clearing away the nettles or cutting a path through the dense undergrowth of the gorilla forests. Progress is slow where such paths must be made



"THE OLD MAN  
OF MIKENO"

A portrait bust of his first gorilla, modeled by Mr. Akeley for casting in bronze. Through his sculptures, as well as through the written and the spoken word, Mr. Akeley has been telling the stories of African wild animal life as he knows it. A number of the incidents of his acquaintance with elephants and lions have already been recorded in bronze.

This bust of a gorilla, the benign expression and deep-set eyes of which are a contradiction of the age-old tradition of the ferocity of the big ape, is the first sculpture completed by the artist in a contemplated series representing gorillas. The bronze is his interpretation of the gorilla's "character," a study intended to convey to others his impression of the creature that he came to know two years ago in Africa.



server in describing a large male from the Kivu which has been mounted by Rowland Ward and Company, states that its weight was approximately 450 pounds. The weight is frankly estimated. As a matter of fact, the measurements of Mr. Barnes' gorilla are somewhat smaller than those of the old male of Karisimbi, which actually weighed 360 pounds. In another case, 700 pounds was alleged to be the weight of a gorilla, the skeleton of which was a little smaller than our Karisimbi male. At least we have a standard now to go by—the measurements of the skeleton of the Karisimbi male and its actual weight. They are given below:

Height	5 feet, 7½ inches
Weight	360 pounds
Chest	62 inches
Upper arm	18 inches
Reach	97 inches
Calf	15¾ inches

We are in the habit of speaking of the gorilla's long arms, but it is more accurate to say that his spinal column and his legs are short. Certainly, because of the greater correlation in the development of arms and chest, the length of the arm should be considered in relation to the thorax rather than to the spinal column. From the arm and chest measurements of man and of the gorilla, it appears that the gorilla's arm is relatively shorter than man's.

Fables of the capture of women by old males who carry them off to their fastnesses in the forest have long been circulated as evidence of the gorilla's strength and ferocity. These tales are as legendary as the fable of the ostrich that hides its head in the sand and believes that it has concealed its entire body, or of the elephant that fears the mouse because it might run up his nose. There is about as much inducement for a mouse to run up an ele-

phant's trunk as to make his way up a fire hose when the stream is turned on with full force. "The silly stories about their [the gorillas] carrying off women from the native towns," wrote Doctor Savage, ". . . have origin in the marvelous accounts, given by the natives to credulous traders." Eduard Reichenow thinks this fiction may have had its origin in an attack on a plantation, where food is competed for and where women do the agricultural work.

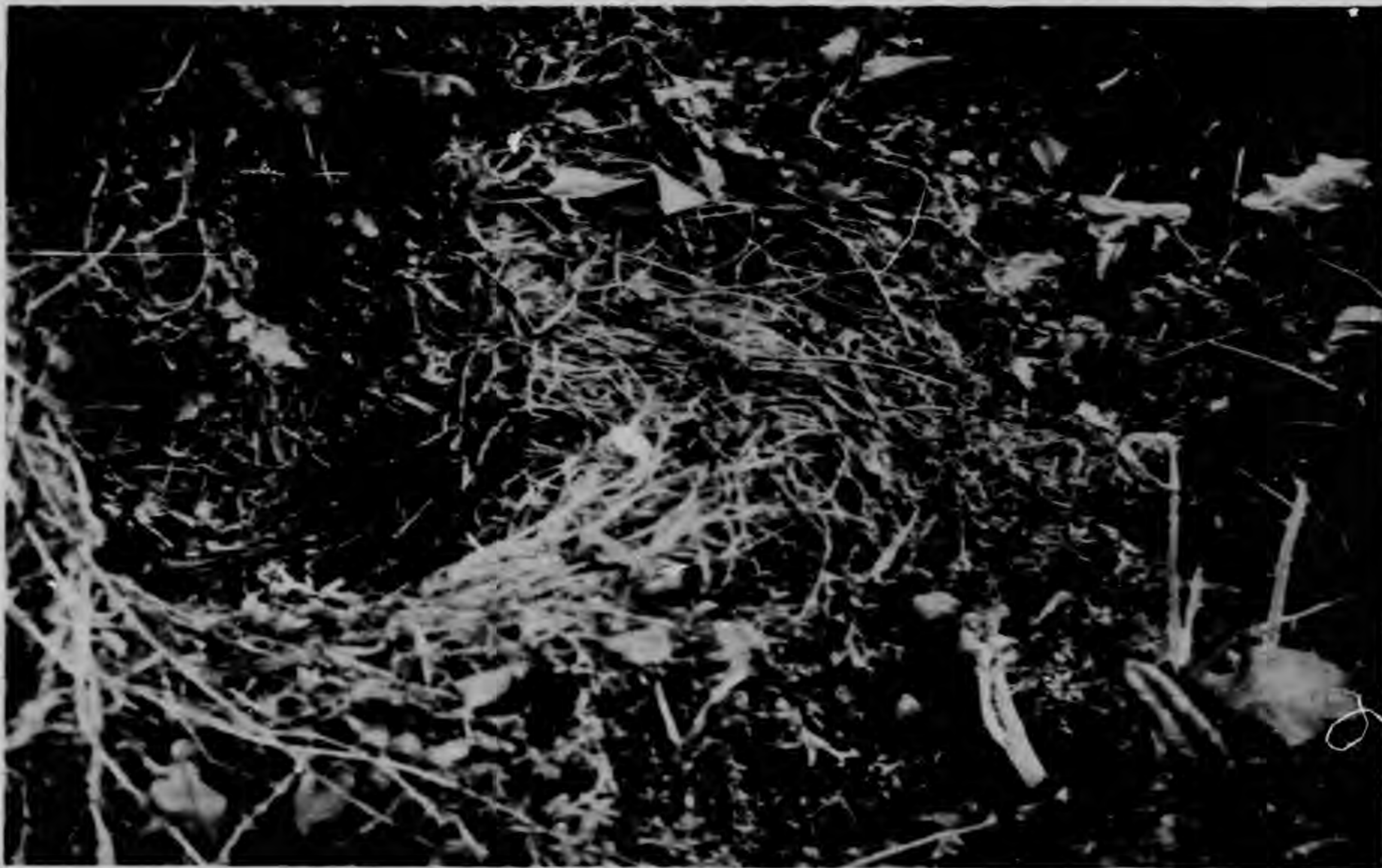
Contrary to popular theory, the gorilla is not a tree-living animal. Those already described as beating their chests before the motion-picture camera, were the only ones that any member of our party saw off the ground. On that occasion, one of the two youngsters climbed a nearly upright tree to a height of about ten feet. (As I write, there are three small boys at an equally great height in an upright locust tree just outside my window.) A few seconds later this first gorilla youngster joined the old female and the other baby in a second tree, the trunk of which slanted so that a dog could easily have run up it. Most of the tree trunks were so covered by moss and other vegetation that they would surely carry the marks if gorillas were in the habit of climbing them, but I saw no indication anywhere of trees having been climbed by gorillas. It is difficult to convince oneself that these heavy, rather sluggish creatures are any more arboreal than man, and I do not believe that they are. Mr. T. Alexander Barnes bears me out in this belief. In the *Wonderland of the Eastern Congo*, he writes, ". . . they never sleep in trees but prefer to make a nest or shelter on the ground. . . Judging from my observation it may be said that they scarcely ever climb trees and moreover are not partial to fruits and nuts, preferring to

feed on grass herbage and bamboo leaves." Reichenow admits that the gorilla to a greater extent than the chimpanzee is a stranger to tree-living; that he nests always on the level of the ground; that, if he climbs for food or at the approach of danger, he must come down the trunk he ascends, inasmuch as he cannot swing from one tree to another.

I cannot corroborate the evidence of these two hunters that nests are occasionally built by bending over young bamboos or other branches and weaving them together to form a springy platform. In no case did I see such a bed. There were many nests, sometimes as many as eight or ten in a group, some of them protected by the overhanging vegetation of a great tree trunk, while others were scattered

about in the open. However, they consisted merely of a hollowed-out spot where the gorilla had lain. The beds were constructed in the simplest possible manner wherever the gorilla decided to spend the night by drawing together whatever of leaves or débris happened to be within his arm's reach. Apparently none of the nests had been used more than once, as they almost invariably contained droppings that had not been trampled on or lain on. Perhaps the fact that the gorillas always sleep in fresh, clean beds is one of the reasons that they are so splendidly healthy and absolutely free from parasites, external or internal.

There has been a fairly general agreement among naturalists as to the fact that the gorilla progresses on all fours, but the three-and-a-half-century



A gorilla bed on the floor of the forest, made by drawing together the grasses, leaves, and débris that lay easily within arm's reach. Mr. Akeley observed many of these rude beds, frequently at the bases of trees from the mossy trunks of which trailed hanging vegetation sometimes screened the sleeping place

old fiction that he is much inclined to the erect posture is still popularly accepted. In spite of the fact that he seems to be evolving toward a two-legged animal, his body leans forward at an angle of less than 45 degrees and his hands touch the ground as he walks. His feet are placed squarely on the heel, bearing most of his great weight, but his fingers are doubled back so that only the knuckles touch the trail. As a matter of fact, the gorilla cannot straighten the fingers unless the wrist

sufficient to loosen their grasp. This peculiar characteristic, a legacy of his arboreal life, is probably a great aid to him as he grasps roots and branches in the tortuous ascent of a steep hillside.

I saw all told from twenty-five to thirty gorillas and got no hint that they ever progress except on all fours. Even when in going away from me they stopped to look back, they remained on all fours. The only occasion on which we saw gorillas in any other attitude was that recorded in my motion pic-



Plaster casts of gorilla hands and foot, made in the field when the specimens were taken. To the left are the hand and foot of a female. Note especially the development of the heel and the position of the big toe. The clenched fist to the right is that of the larger male

is bent. When the wrist is straight, as in the act of walking, the fingers automatically close like the claw of a bird when it settles on a perch. The preserved carcass of a young gorilla was brought back to the studio for reference and study. As a result of treatment, the whole muscular system of this preserved specimen is now more relaxed than it was when freshly killed, but even in its present condition, the weight of the body as it hangs with the fingers hooked over a support is not

tures, when the female and the youngster rose for an instant and beat their chests. It is difficult to imagine one of these bulky animals making progress in an upright position on his comparatively weak legs, and, if he ever does so, it must be with no more ease or grace than a heavily built trained dog would exhibit in making a similar attempt. One could scarcely expect to find an animal adapted for walking erect in that mountainous region; indeed, in that country of precipitous ascents



The lone male of Karisimbi, the gorilla shot by Mr. H. E. Bradley, one of Mr. Akeley's companions. In spite of the animal's great strength and his 360 pounds, he offered no defiance when attacked.

through dense underbrush, man himself is frequently forced to drop on all fours in order to make any progress on the gorilla trail.

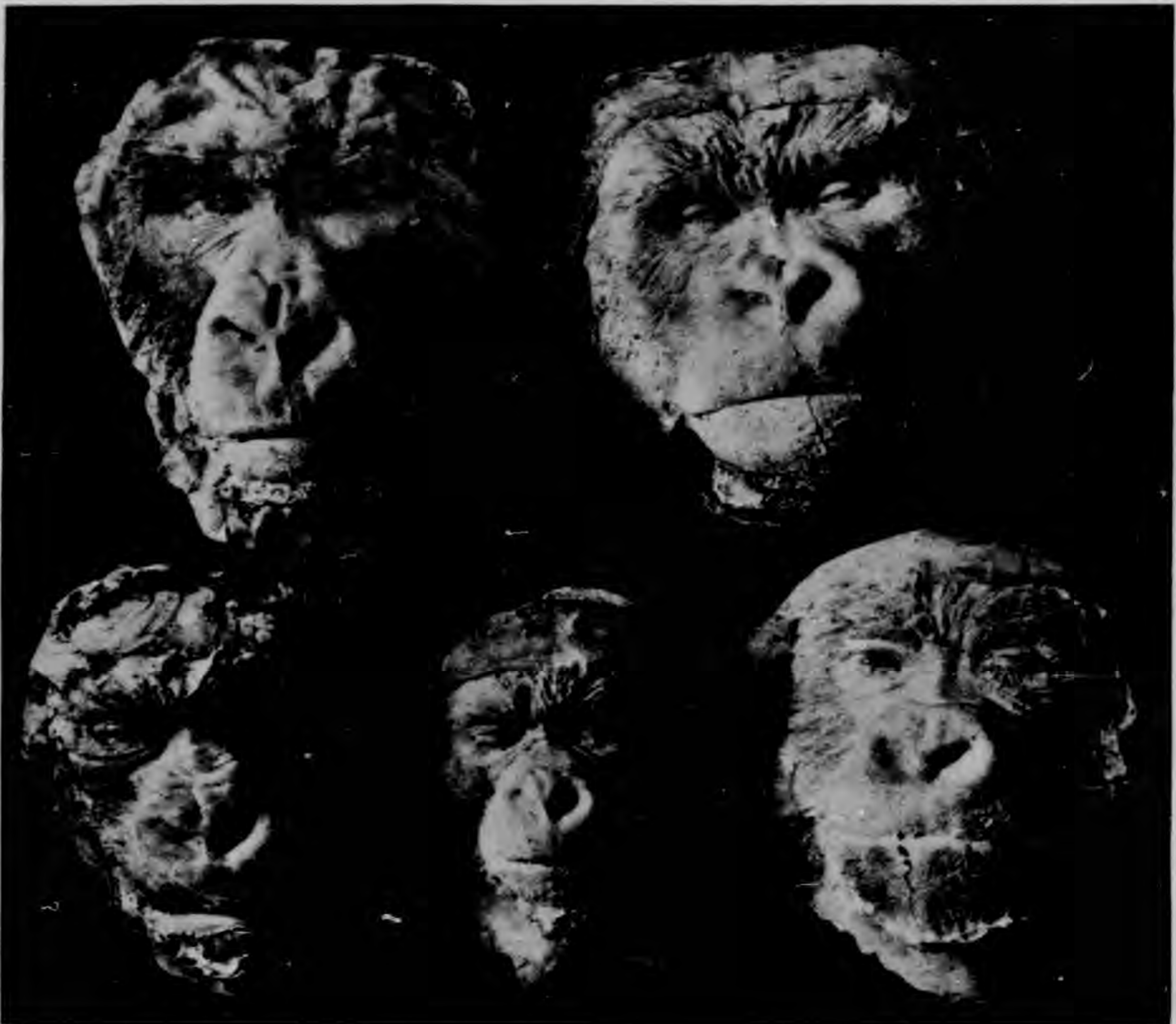
It is not strange that the average individual pictures the gorilla walking jauntily on two feet. The earliest wood-cuts showed him standing erect and encyclopedias and natural histories have continued to represent him in that way. One of the worst and most recent offenses is to be found in J. A. Thomson's *Outline of Science*, where a colored plate shows a gorilla with a horribly ferocious face walking freely erect. Hæckel in his *Anthropogenie* published a plate of a gorilla skeleton

side by side with that of a man and in the same posture. Museums have mounted skeletons in similar fashion up to the present day. This practice is justified inasmuch as the unnatural pose is for purposes of comparison, but unfortunately the visual image of such skeletons remains in the popular mind long after the explanation accompanying them is forgotten.

The death masks of my five gorillas are a priceless record. The first old male, one female, and the youngster were killed on a ridge of Mt. Mikeno and they bear unmistakable resemblances to one another. The other male and female, killed on the slopes of Kari-

simbi, likewise resemble each other, but their physiognomies are totally different from those of the Mikeno specimens. The feeding grounds of these two ridges were separated by a valley, which the gorillas were constantly crossing back and forth. The suggestion therefore is obvious even from this slight amount of material that the gorillas live in family groups with a tendency to interbreed.

Both of the males in the group were lone males at the time we came up with them. There was a considerable band—how many I do not know—on the occasion of the photographing of the female and the two youngsters. All the others remained out of sight in the vegetation beneath the slanting tree and, although, after completing the picture, I followed them for a considerable distance, catching occa-



Death masks of the five gorillas. Although a great part of their interest lies in the individuality of each countenance, there is marked "family" resemblance in the faces of the Mikeno gorillas (upper left and two lower left), and also in the faces of the Kirisimbi specimens (upper and lower right)



A tangle of tropical vegetation of low growth and splendid trees on the western slope of Mount Mikeno,—a typical view of the dense and beautiful forests of the gorilla country



Mr. Akeley's gorilla camp,—the skins in the foreground, the skeletons on the rack, and the preserved body of the young gorilla suspended from the ridge pole of the tent

sional glimpses of them, I saw no male. On the last day in the forest, I set out with the idea of securing one more specimen. Doubting whether it would be legitimate to use the two males already secured in a single group, I wanted to obtain another female in order to have a pair in excess. We found the fresh track of a single old male, which we followed up the slope through the bamboos, and when we finally came up with him, there were in addition to a number of females and youngsters at least two, and I believe three, other old gray-backed males in the troop. There were three in sight at one time and I am fairly certain that I saw a fourth disappear. I realized on the instant that it was perfectly legitimate to use two old males in my group. There was no valid excuse for killing another gorilla. And so, instead of firing my gun, I took the final shot with the motion-picture camera as the troop disappeared over the top of a ridge. Altogether I saw six or seven males at distances varying from ten to three hundred yards and no one of them stood erect and beat his breast.

After my first expedition into the gorilla country, I am more convinced than ever not only that the gorilla is one of the most fascinating and important objects of study in the realm of natural history, but also that his disposition is such as to permit the most intimate observation of his habits. A few days in the gorilla country and one instinctively falls into the way of referring to this amiable giant as "he" in the human sense. A few weeks of casual acquaintance and one is fired with a desire to ferret out the answers to a hundred questions about this little-known relative of man—questions of increasing importance to scientists and physicians in their efforts to understand and aid man himself. Probably no other project of so moderate a size is likely to lead to such immediate and valuable scientific results as that which will make of the Kivu region a sanctuary, where the gorillas under the protection of man may grow more and more accustomed to human beings and where through a series of years they may be observed and studied.







# BIOLOGIC ANTISEPSIS

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THERE are three methods of directly combating offensive and pathogenic bacterial infections, viz., asepsis, antiseptics and biologic antiseptics.

Asepsis is absolute surgical cleanliness. Germs are eliminated by mechanical and chemical cleansing processes and suitable protection.

Antiseptics is secured and maintained by means of chemical agents that destroy all bacteria and prevent their development.

Biologic antiseptics does not seek to eliminate bacteria but substitutes harmless, protective bacteria for pernicious, pathogenic organisms.

Although we have called it a new therapeutic method, biologic antiseptics is by no means a new discovery; it is, in fact, a very old idea, the original, natural method of combating sepsis and putrefaction. We call it new only in the sense of recognition as a distinct and systematized procedure.

Every infection is an indication for a change of flora. Change of the intestinal flora is not a reduction of the number of bacteria, but an exchange of pernicious putrefactive, poison-forming, "wild" (Herter) bacteria for the normal, protective flora by restoring the harmless, acid-forming germs which nature implants soon after birth in the intestine of every young mammal. An infected wound, an abscess, a chronic ulcer, a foul-smelling sore, is a lesion that demands a change of flora just as does a colitis.

When Lister introduced the use of the carbolic acid spray to combat sepsis in surgery, the amazing and revolutionary results, inspired hope that a panacea for troubles due to infection had been discovered. Suppuration of wounds had previously been regarded as a normal process so long as the pus was "laudable." "Pus

buckets" stood by the bedsides to receive the pus from dripping stumps suspended over them, and were emptied as regularly as the sap buckets in a maple sugar bush. No surgeon ventured to close a wound without drainage. A surgical ward was often as malodorous as a slaughter-house. The Lister spray changed the odor to that of carbolic acid and greatly lessened suppuration and gangrene; but evidence of carbolic acid poisoning was not infrequent and healing was delayed. Other chemical antiseptics were tried with varying results. Within the last forty years hundreds have been tried and rejected, and the search for a harmless chemical antiseptic still goes on. The great number of different chemical antiseptics employed in surgical practice is sufficient evidence that none is wholly satisfactory.

The reason for the acknowledged failure of chemical antiseptics is not far to seek. The bacteria that we endeavor to combat by chemical poisons are living cells. The tissues that we desire to protect are likewise living cells. It is evident, then, that when chemical antiseptics are brought in contact with the tissues, not only germs but connective tissue cells, delicate nerve filaments, and most of all the leucocytes—which form the front line of the brigade of tissue builders—are damaged as well as the bacteria present in wound infections. Any chemical agent that will destroy bacteria will certainly damage the far more delicate and vulnerable white blood cells which are the chief factor in all healing and tissue-repairing processes.

Because of these evident facts, many surgeons have wholly abandoned the use of antiseptics and germicides in surgery, except as cleansing agents, and depend upon asepsis instead of antiseptics. Asepsis has become, in fact, the classical method,

and one seldom sees nowadays anything resembling the elaborate chemical technic in general use twenty or thirty years ago. We are learning to respect the deft and marvelously efficient natural methods by which the tissues defend themselves against the attacks of bacteria as well as other agents hostile to the interests of the body. Much progress in many branches of scientific medicine has been made in recent times by recognizing, imitating, and in various ways aiding the natural processes of cure.

The underlying principle of biologic antisepsis is prophylaxis. By the establishment and maintenance of a normal environment for the body cells, their resistance is so reenforced that they are able to recover and retain the normal status. Nature's method is positive rather than negative. She prevents offensive and pathogenic organisms from developing by maintaining a luxuriant growth of harmless, aciduric organisms that produce conditions inimical and inhospitable to disease-producing bacteria.

That certain carbohydrates render invaluable aid in the creation of conditions favorable for the defense of the organism, as demonstrated by bacteriological experts, is a biologic fact which we are only just beginning to appreciate. Through the efforts of Tissier, Metchnikoff, Diasto, Herter, Kendall, Torrey, Rettger and others, the profession is just beginning to recognize the importance of changing the intestinal flora and keeping it changed through the reestablishment of the normal protective bacterial growth in the intestinal tract.

A few years ago, Wright of London called attention to the beneficial influence of hypertonic salt solutions through causing an outpouring of lymph with its healing enzymes, antibodies, lysins, opsonins and leucocytes. It is the purpose of this brief paper to call attention to another natural or biologic method of combating sepsis and promoting the healing of lesions due to infection, which offers the advantages

of the Wright method and is far more efficient, and which applies to external conditions an antiseptic method the potency of which has been long established in dealing with internal conditions,—a method which is purely biologic in its mode of action. This biologic method is based on the following simple, well-known facts:

Certain parts of the body, though the most exposed to infection, are the least subject to attack by infectious disease. This is particularly true of the stomach, in which pathogenic organisms are rarely found so long as it continues to make hydrochloric acid. The contents of the colon and the secretions of the vagina are normally acid, and so long as this acid condition is maintained, infection rarely occurs. The stomach is protected by the acid gastric juice, the colon and the vagina by an aciduric flora which Nature provides for the purpose,—the *b. acidophilus* in the colon, and *b. döderlein* in the vagina. Kendall tells us that aciduric bacteria possess "the unusual property of growing in fermentation media of a degree of acidity incompatible with the development of *all other known bacteria*."

In the normal nursing infant, the stools are slightly acid and altogether non-putrefactive. This is due to the six or seven per cent of lactose in the mother's milk. When the diet of the child is changed so that the intestinal residues contain no lactose and much putrescible material, the aciduric flora and acid products disappear, and putrefactive and pathogenic bacteria with alkaline products take their place. To restore the aciduric flora, it is only necessary to supply to the colon the sort of carbohydrate required by acidophile bacteria, and they quickly reappear. Nature supplies the culture to the adult just as she does to the infant. Carbohydrate is the natural protective means by which putrefaction is prevented. It is for this reason that milk sours, while meat putrefies. The Bedouins preserve meat by immersing it in camel's milk. I preserved a beefsteak intact and free

from taint in buttermilk for seventeen years. Lactose is the real protective agent.

An infected wound, an open sore, or a suppurative cavity, is in a condition similar to that of an infected colon. In every wound there are putrescible substances, dead cells, fragments of tissue and lymph, and no protective carbohydrate, and if pathogenic and putrefactive bacteria are present infection and putrefaction are likely to occur. This is, in fact, what happens unless special precautions are taken to avoid contamination. Chemical agents of various sorts will, of course, prevent bacterial growth, but they also tend to hinder healing.

By the employment of a simple biologic method, the development of pathogenic bacteria may be prevented and healing promoted instead of hindered. All that is needed is to supply suitable carbohydrate to the exposed surfaces. The effects are of two distinct orders. First, the concentrated, highly soluble carbohydrate causes an outflow of serum or lymph from the denuded tissues. The effect of this bathing of the exposed tissues with fresh lymph is most salutary. Bacteria are destroyed, damaged cells are repaired and the growing tissues are fed. Second, the carbohydrates applied render impossible the development of putrefactive or pathogenic species of bacteria and, being non-toxic, they do not in the least interfere with natural healing processes. Pernicious organisms simply cannot grow in the presence of a liberal amount of carbohydrate of a sort readily available as nutrients for acid-forming bacteria. Under such conditions, wound infection cannot occur, chronic ulcers rapidly heal, infected wounds become sweet and clean over night, and suppurating cavities dry.

The best carbohydrates for the purpose are lactose and dextrin so blended as to make a smooth and adhesive magma when water is added in right proportion. I have made use of this simple but most effective biologic antiseptic for some years with most gratifying success. Following

are some of the conditions in which biologic antisepsis has been found serviceable:

#### OFFENSIVE DISCHARGING WOUNDS OR SORES

The effect of a carbohydrate dressing applied to a foul-smelling sore or wound is shown by the following case.

Mrs. A., aged 50 years, was brought to the hospital (B. C. Sanitarium Clinic), suffering with cancer of the left breast. The breast had been removed, but the disease had returned, and had extended until it covered a nearly circular area five to six inches in diameter. The whole surface was covered with putrid, sloughing masses of flesh from which issued a copious discharge. A penetrating and disgusting odor arose from the sore, which made the care of the patient most disagreeable for physician and nurses. The dressing was applied at night and the next morning the offensive odor had wholly disappeared. In a few days the appearance of the diseased area had greatly improved. Pain was relieved and the patient's condition greatly ameliorated, although no hope of a cure could be entertained. The local extension of the disease seemed, indeed, to be slowed, although numerous metastases which had already developed were, of course, uninfluenced.

The method is equally applicable in cases of gangrene. I have employed it with most satisfactory results in cases of diabetic and of senile gangrene. Other therapeutic measures, diet, insulin, light rays, etc., were, of course, employed, but the simple painless, inoffensive, emollient, carbohydrate dressing, seemed to aid the healing process and was a real comfort to the patient.

In cases of advanced cancer of the uterus, with the usual offensive discharge that makes miserable the lives of the patients' friends as well as their own, biologic antisepsis is a veritable boon. A liberal application of the carbohydrate every day or, in mild cases, every other day, will wholly eliminate the unpleasant odor and lessen the discharge. The external irritation resulting from the discharge quickly dis-

appears and the patient no longer suffers ill-effects from the absorption of putrefaction products. The tampons, when removed, are odorless or slightly sour instead of having the usual disgusting odor of putrefying flesh.

#### VARICOSE ULCERS

Chronic sores, such as indolent or irritated varicose ulcers, generally heal rapidly under dressing with a paste prepared by mixing the dry carbohydrate with twice its volume of water. When there is much serous oozing, the dry powder is preferable.

#### OPERATION WOUNDS

The carbohydrate dressing is equally effectual for treating infected operation wounds that heal slowly. Exposure to the sunlight or to the rays of an arc lamp daily, or twice a day, greatly expedites the healing process. Applied after operation this dressing affords perfect protection against sepsis.

#### COLOSTOMY WOUNDS

When freely applied to wounds or openings that communicate with the intestine, the offensive odor usually present is practically eliminated. The excoriation of the skin that develops around such openings is prevented, and healing is greatly facilitated. Recent wounds, the healing of which is prevented by contamination with fecal matter, take on almost at once a healthy appearance under this carbohydrate dressing.

For several years, I have made use of carbohydrates in gynecological practice. Of a great number of agents, old and new, none has proved so valuable. In simple vaginitis, with or without erosions of the mucous membrane, the lesions disappear, often with almost incredible rapidity. When cervicitis with erosions of the *os uteri* exists, as is often the case, the cervicitis must be dealt with by more radical measures, as by the use of ionization, diathermy, electro-cautery or enucleation, according to the indications in each indi-

vidual case, although in most cases, there may be observed marked improvement in the cervicitis, a lessening of the discharge, and often almost complete disappearance of granular erosions. When the erosion is superficial, it will disappear in a few days. I recall two cases sent to me two years ago (1924) by physicians with a diagnosis of cancer of the cervix, in which the lesions disappeared completely in less than a week and have not returned. In one of these cases I had removed a cancerous uterus a year before by vaginal hysterectomy, and the sore that appeared at the site of the operation gave rise to a bloody discharge and certainly had a most suspicious appearance; but after a week's carbohydrate treatment, no trace of it could be seen, and it has not reappeared.

#### PRURITUS VULVAE AND ANI

When the pruritus is due to an infective discharge from the vagina or rectum, as is often the case, relief may generally be obtained by cure of the discharge by the use of biologic antisepsis. In cases of vaginal discharge, this is accomplished by daily hot irrigation, followed by tamponade with gauze, after introducing half an ounce of the dry carbohydrate.

In cases of proctitis, the rectum is irrigated daily with a hot salt solution (teaspoonful to the pint, 120° F.), and two or three ounces of carbohydrate paste (equal parts of the dry powder and hot water) are injected into the rectum to be retained.

The pruritus may be promptly relieved by touching with a napkin moistened with boiling water. The contact should be brief enough to avoid blistering. A temperature of 120° F., or above, is powerfully analgesic. Such applications, repeated for five or six minutes, will afford relief usually for several hours in pruritus either with or without any skin eruption.

#### BIOLOGIC ANTISEPSIS IN OBSTETRICAL PRACTICE

The bacteriologists have shown us how nature protects the vagina from infection

by maintaining an acid condition of its secretions by developing an aciduric flora. The alkaline secretion of the cervix uteri renders it more vulnerable, and it is in the cervical canal rather than in the vagina that pathogenic organisms like the gonococcus and streptococcus are implanted. In most cases of chronic vaginal discharge, the source is found to be the cervix rather than the vagina. As soon as the infection of the cervix is cured, the vaginal discharge usually disappears.

At one period, some time after the introduction of the carbolic acid spray into surgery by Lister, chemical antiseptics were quite extensively used in obstetrical practice, but the results were so unsatisfactory that at the present time most obstetricians prefer careful asepsis to the use of chemical agents of any sort. That asepsis, even when conducted in the most conscientious and thorough-going manner possible, is not altogether satisfactory, however, is clearly shown by the frequent development shortly after confinement of symptoms evidently due to infection. One of the mildest and most constant of these is the lochial discharge which is so constantly present that it is regarded as physiological. A frequent slight rise of temperature, the so-called "milk fever," to say nothing of "milk leg," and other still more serious complications, are clearly due to bacterial infection.

It is easy to understand why infection occurs, for it must be rare, indeed, that a child is born without the mother undergoing more or less laceration of the tissues, quite sufficient to open the door for the entrance of streptococci and other pus-producing organisms. A hardy savage woman possesses such a high degree of resistance that she is protected by natural immunity, but a civilized woman is by no means so well prepared to resist the invasion of parasitic organisms, and hence is more liable to infection. The parturient woman is, in fact, especially liable to infection, not only because of the numerous ruptures in the protecting mucous membrane of the vagina,

but because the normal acidity of the vaginal secretions is displaced by alkalinity during the lying-in period; evidently, this menace should not be disregarded.

If a woman not pregnant should receive by accident the same sort of injuries to the vaginal tissues that occur at childbirth, her wounds would be treated in precisely the same manner as though they had occurred in any other part of the body, and especial care would be taken to avoid sepsis. The laws of nature are not set aside in behalf of the lying-in woman. She enjoys no exemption from liability to infection. Why, then, should not a woman who has given birth to a child have the benefit of the same careful technic to combat infection as would be used under ordinary conditions?

After watching the work of Kister at King's Hospital, London, nearly forty years ago, and adopting his methods in dealing with surgical cases during and after operation, it occurred to me to apply the same methods to obstetrical cases. I was at first deterred from so doing by the apprehension that harm might result from interference with the lochial discharge. When I mustered up courage to make the attempt, however, I was greatly surprised to find that with antiseptic dressing little lochial discharge appeared. Neither was there the usual slight rise of temperature during the few days immediately following confinement.

Several obstetricians who, at my suggestion, have tried the method of biologic antisepsis, have reported most excellent results. The lochia is very greatly diminished or wholly absent, the patient has no rise of temperature, the so-called milk fever does not appear, nor other complications commonly experienced by lying-in women as the result of infection. The only objection to the use of antisepsis in obstetrics has been the possible injury through the absorption of the chemical agents employed. This objection does not apply to biologic antisepsis, which does not interfere with any natural function,

promotes healing and renders the lochia less necessary by suppressing the development of pathogenic bacteria.

The method of application in obstetrical practice is very simple. After thoroughly cleansing the parts following the delivery, and repair by proper suturing of all tears, two or three ounces of dry powder are introduced into the vagina and retained by tamponade with several feet of plain, two-inch gauze. The best method of introducing the powder is the following:

Holding the blades of a closed speculum in the left hand, fill the cavity between them with the dry carbohydrate, then place the speculum; open the blades in the usual manner, and insert the gauze packing. If necessary, two or three lengths of gauze may be used for the first two or three days. The quantity of powder introduced at each dressing should be at least half an ounce. Change the dressing daily for a week, irrigating the vagina with a one per cent salt solution, at a temperature of 115° F.

It is my belief that if biologic antisepsis were universally employed by obstetricians, the perils and inconvenience of child-bearing would be so greatly reduced that the ordeal would be regarded with much less apprehension by potential mothers, and the birth-rate would probably be materially increased.

#### PROCTITIS AND COLITIS

Chemical agents can render little service in the treatment of proctitis and colitis for the reason that they destroy the protective flora as well as the infecting organism. Nature's mode of protecting the intestine is not to keep it free from bacteria but to maintain a harmless acid-forming flora, by this means rendering the territory inhospitable to putrefactive and pathogenic organisms, just as we keep our front lawns free from weeds by maintaining a vigorous growth of grass which completely occupies the soil.

The protective flora are more easily destroyed than the pathogenic organisms

because the latter are to a large extent spore-bearing and hence highly resistant; so when chemical antiseptics are employed, the colon is left wholly without protection from infection by pathogenic organisms which quickly restore the pernicious flora when the immediate effect of the antiseptic application has passed off. The situation is the same as that of a lawn that has been newly plowed or spaded. The ground is bare and weeds quickly make their appearance.

Colitis and proctitis are due to infection, and the only way a real cure can be accomplished is by changing the flora; that is, the infecting organisms must be got rid of and the normal, aciduric flora must be established in their place. This cannot be done by merely introducing, either directly or indirectly, *b. acidophilus*, *b. bifidus*, or other acidophile organisms. More important, even, than the introduction of cultures, is the provision of suitable nutrient media. For this, carbohydrates are absolutely essential. All carbohydrates are good, but lactose and dextrin have been shown to be by far the best for the purpose. When these are introduced daily into the colon in sufficient quantities, they supply the condition fundamentally necessary for the development of protective flora. This done, the protective organisms quickly develop. Nature attends to this without assistance. It is no more necessary to introduce acidophile cultures into the interior of the body in order to develop an aciduric flora than it is to inoculate milk with sour milk germs in order to cause it to sour. Lactic acid-producing organisms are everywhere present in vast numbers. A solution of carbohydrates left to itself always sours through the growth of acid-forming organisms that require oxygen, the ordinary sour milk germs. A solution of carbohydrates within the body also sours, but through the development of acid-forming organisms that are able to grow in the absence of oxygen. Nature supplies these organisms, *b. acidophilus*, *b. bifidus*, etc., just as freely and promptly as she

does the germs that sour milk. The only essential thing is the carbohydrate in solution.

For fifteen years I have been treating proctitis and colitis by injecting into the rectum and the colon liberal quantities of lactose and dextrin in solution after first cleansing the colon with enemas, repeated as often as necessary, with water at a temperature of 112° to 118° F. Very hot water is necessary to relieve colonic spasm and to stimulate a healthy action of the infected mucous membrane. The introduction of lactose and dextrin in solution into the rectum or lower bowel, provides a nutrient medium suitable for the development of a luxuriant protective flora whereby the growth of pathogenic organisms is prevented, while the repair of damaged cells and tissues is encouraged.

If is, of course, essential in cases of colitis and proctitis, that the upper part of the intestinal tract as well as the lower colon, should be freed from putrefactive and other pernicious bacteria. This can be accomplished only by such regulation of the diet as will eliminate putrefactive residues while supplying the colon with the carbohydrates necessary to encourage the development of a protective flora; that is, by changing the intestinal flora. By the thorough-going application of these measures, I have seen many hundreds of persons suffering from colitis and proctitis rapidly restored to health.

In some extreme cases in which the greater part of the colon has become diseased, a cure may be greatly accelerated by appendicostomy, which renders possible thorough irrigation of the colon once or twice a day, with a hot, normal saline solution, followed by an emollient carbohydrate solution, thus putting the diseased area in the best possible state of defense against the invading organisms.

#### SUPPURATING CAVITIES AND WOUNDS

While well drained cavities have a very strong tendency to heal, the healing

process is sometimes greatly delayed or even arrested. In such cases, especially when there is a profuse discharge of pus, biologic antisepsis proves highly serviceable. After cleansing with a warm, normal saline solution, the abscess cavity is irrigated with the carbohydrate solution, four ounces to the pint.

In the case of suppurating wounds, the wound should be covered with the powdered carbohydrate after washing with hot, normal saline solution, at 105° F.

Chronic discharges from the ear generally disappear under daily treatment with carbohydrate. After cleansing the ear thoroughly with a hot normal saline solution, the cavity is packed with the dry carbohydrate, which is held in place with a little cotton.

In cases of ozena and offensive nasal discharges, the dry powder should be introduced into the nasal cavity by free insufflation, after cleansing the cavity with a spray or careful irrigation with a warm saline solution, two ounces to the pint.

#### SKIN ERUPTIONS

Cases of chronic eczema often recover with surprising rapidity under the use of suitable carbohydrates, which should be employed both externally and internally; internally, in connection with an antiseptic diet to change the flora and keep it changed; externally, to combat the local bacterial process.

Itching may be completely relieved by very hot applications as suggested for pruritus ani. The relief afforded by these very hot applications is instantaneous and usually lasts for several hours, often an entire night. The hot applications are not only palliative but curative. They stimulate normal cell activity. It has recently been shown by Roucayrol of Paris, and other French investigators, that high temperatures (117° to 120° F.) promote cell rejuvenation and encourage the development of immunity.



For local applications, a magma is prepared by adding to the dry carbohydrate twice its volume of boiling water. All the water should be added at once and the mixture should be stirred rapidly until smooth, then spread on a soft cloth and applied to the affected surfaces like a poultice. The whole is covered with mackintosh to prevent evaporation. The dressing is changed morning and night.

In cases of acute erythema such as ivy poison, sunburn and other acute affections of the skin, prompt relief is obtained by hot applications followed by a carbohydrate poultice.

Eczema and other eruptions of the scalp generally yield to hot applications made in the manner described, followed by a carbohydrate poultice (see the foregoing), which should be applied at night on going to bed. It may be removed in the morning. In very obstinate cases, the poultice should be employed both day and night.

In this paper I have sought to show that the method of combating pathogenic organisms by means of carbohydrates may be applied to external as well as internal conditions, and with an equal degree of success. It cannot be claimed of course, that carbohydrates constitute an infallible preventive of sepsis, but the field for the application of biologic antisepsis, external

as well as internal, may be larger than we at present apprehend it to be.

#### SUMMARY

1. Biologic antisepsis is the natural method of combating sepsis.

2. Its underlying principle is prophylaxis—the prevention of the development of putrefactive and pathogenic organisms by the maintenance of a vigorous growth of aciduric organisms.

3. It has been demonstrated by bacteriological experts that certain carbohydrates render invaluable aid in creating and maintaining the conditions most favorable for the defense of the organism from pathogenic bacteria.

4. The best carbohydrates for this purpose are lactose and dextrin so blended as to make a smooth and adhesive magma when water is added in the right proportions. This combination makes a simple but most effective biologic antiseptic.

5. Biologic antisepsis is of equal value in both internal and external conditions, and has been used with success in the following conditions: Offensive, discharging wounds or sores; varicose ulcers; operation wounds; colostomy wounds; pruritus vulvæ and ani; proctitis and colitis; skin and scalp affections; also in gynecological and obstetric practice.



## THE RELATION OF INTESTINAL BACTERIA TO HUMAN WELFARE

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A normal adult, enjoying a normal, mixed diet excretes daily from his alimentary canal a mass of bacteria that is conservatively estimated to number some thirty million of millions. This goes on continuously day after day and month after month. One marvels at the perfection of that alimentary incubator and cultural medium which permits of such a remarkable output of microbes with so little tangible evidence to the possessor thereof. Indeed, not one person in a thousand has even heard that the bulk of the daily fecal mass weighing some three ounces is composed largely of the bodies of bacteria, each separate one of which is scarcely one twenty-five thousandth of an inch in diameter.

The question has often been asked, Are these bacteria that grow so abundantly and so rapidly in the alimentary canal useful, or are they indifferent, or are they harmful? The answer is not so easily given although much effort has been expended in studying the problem. Thus, it is stated by competent authorities that the alimentary canals of polar animals—bears, for example—are much less populated with bacteria than are the bears of temperate climates. Nevertheless it seems to be quite certain that the alimentary canals of polar bears, brought to captivity in warmer countries soon become as densely inhabited by microbes as those of indigenous bears, and no definite sign or symptom has thus far been detected which would suggest that the acquisition of these multitudes of intestinal bacteria has caused them either harm or discomfort.

### ATTEMPTS TO REAR STERILE ANIMALS

Attempts have been made to raise sterile germ-free chicks, hatched from germ-free eggs. Aside from the very great difficulty in finding eggs that were free from bacteria (for less than three per cent of eggs are sterile within the shell), no very definite results have accrued, because the chicks do not thrive very well in the highly artificial environment that is entailed by complete sterility of food, air, water and habitat. These experiments were performed, however, before the highly interesting food accessory substances, vitamins, were well known, and it may be that a lack of these essential factors was responsible for the poor condition of the chicks after some fourteen days of

germ-free existence. In any event, control chicks, kept under normal, every-day conditions, did much better for a corresponding period of time. Also, the sterile chicks rather quickly became normal when they were placed in their usual germ-infested environment.

Experiments upon guinea pigs, delivered by Caesarian section, were equally inconclusive. The tangible results of these attempts to rear sterile animals seem to be, first, that such delicately nurtured specimens are not to be compared with those reared under natural conditions, and second; that, after all, bacteria are unavoidable natural messmates of living things and the best that can be hoped for at present is to reduce to a minimum the hazards from the disease-producing kind.

Another line of approach to the problem of the significance of intestinal bacteria is through the study of the microbial population of the alimentary tract from immediately after birth to adult age.

#### NATURE'S BACTERIOLOGICAL SEEDING OF THE INTESTINAL TRACT

At birth, as might confidently be expected, there are no bacteria in the alimentary tract. Within a few hours, however, the first organisms make their appearance and from that time until death they are present continually and in vast numbers.

To digress for a moment. It may well be asked, Why does not one sterilize the intestinal tract, and thus get rid of this horde of microbes? The answer is that any germicide thus far known would be toxic enough to kill the patient long before the micro-organisms could be significantly reduced in numbers. Also starvation will not eliminate them. A man who refrained from all food for 30 days still had hundreds of millions of bacteria in his intestinal tract. It is very obvious that reformation rather than annihilation must be the method of approach to the control of the alimentary bacteria.

To return to the story. The first organisms that appear within the alimentary canal of the newly born are adventitious germs that are found in the environment of the child. In unclean surroundings the kind and numbers are much more numerous than in clean surroundings. This at first sight might appear to be most prejudicial to the babe unfortunate enough to be born to poverty and filth. In spite of environmental microbial handicaps, however, Mother Nature has reared babies from prehistoric times with, on the whole, unequivocal success. The abrupt change, microbially speaking, that occurs in the normal nursing's alimentary canal as soon as the breast milk flows freely and is

ingested normally, gives the clue to the reason for this apparent miracle.

Seventy-two hours after birth, or thereabouts, the bacteria that may be found within the intestinal tract of the healthy breast-fed infant increase greatly in numbers and become restricted to about three principal kinds. This is quite the reverse, it will be seen, of the condition that prevails for a day or two after the new born makes its bow to the world. Then the numbers of bacteria are rather small, and the kinds are, or may be, rather numerous. These new bacteria, which appear so abruptly, and increase so rapidly, are furthermore of the same sort whether the babe be born in Australia or in Russia. They have a name, *Bacillus bifidus*, which has been conferred upon them because they grow with bifidated ends in culture tubes outside the body. In this respect they are quite unique among bacteria, and this is of great help in identifying them.

Also, and this is very important, they are strong lactic acid producers. The comparatively few other bacteria that occur naturally in the infantile alimentary tract at this period of life are also lactic acid producers. It is this lactic acid, produced by the fermentation of the sugar lactose in breast milk, that is so important in the first weeks of life, shielding the immature intestinal tract of the young child from the activities of predatory microbes that may, and undoubtedly do, gain access there. It is a fact long known to physicians that normal breast-fed babies are singularly free from typhoid, dysentery and cholera. These deadly diseases may rage in a community, taking their toll of life, but the normal nursling, provided it is exclusively breast fed, enjoys striking immunity. No inconsiderable part of this apparent resistance to infection with filth bacteria of the kinds just mentioned is attributable to the fact that the lactic acid engendered by the active development of *Bacillus bifidus* and its associated organisms creates conditions within the alimentary canal that are unfavorable to the growth and even the survival of the typhoid, dysentery or cholera microbes. They neither gain a foothold, nor do they grow in the normal nursling alimentary canal. Herein lies the secret of Mother Nature's remarkable success in bringing the tender defenseless infant through a most trying and critical period of its existence. The natural seeding of the intestinal tract, that most favorable culture medium for bacterial growth, with *Bacillus bifidus*, a microbe harmless for the host but antagonistic to predatory bacteria, is one of Nature's masterpieces. It

would appear that Mother Nature was a wonderfully clever bacteriologist ages before mankind even dreamed that microbes existed.

#### BAACTERIOLOGICAL CHANGES CAUSED BY ADULT FOOD

A time comes when the mother is no longer able to provide the nutriment requisite to the needs of the growing child, and resort is had to food from new sources. This food differs in two distinct ways from the breast milk; first, it is not sterile as a rule, and second; it departs from the maternal pabulum in its relative proportions of carbohydrate, protein, fats and salts. If the new food is carefully prepared and handled, the microbial menace is not great. On the other hand, the change in composition of this new food brings new complications that must be met and surmounted.

The outstanding change from the microbial standpoint is the altered proportion of protein to carbohydrate. In breast milk the ratio of protein to carbohydrate is about 1:4. In artificial feeding, this ratio frequently changes to less than two parts of carbohydrate for one of protein. At first sight this might seem a trifling variation, and, in so far as it affects the well-being of the young child, it frequently makes little discernible change in the visible picture. The bacteria of the intestinal tract are, however, very responsive to dietary change, and the general reaction of the normal intestinal bacterial flora to a dietary substitution such as that suggested here is unmistakable. The dominant lactic acid producing *Bacillus bifidus* tends to disappear, and more versatile bacteria take its place.

In explanation of this statement, it should be pointed out that the principal reason for the prominence and dominance of *Bacillus bifidus* in the normal nursing intestinal tract is the ever present lactose, which permeates the alimentary tube from the duodenum practically to its lower end. There are some additional facts about lactose, which cannot be entered into here.

With the advent of artificial feeding, other carbohydrates are substituted for lactose. Also, the amount of total carbohydrate is proportionally and relatively lowered, while the protein is raised. The net result is that carbohydrate is much reduced in the lower levels of the intestinal tract, and for several reasons it may be, and usually is, absent entirely therein for a part at least of each 24 hours. Under these conditions, it is quite clear that bacteria dependent upon a continuous supply of carbohydrate for their nutrition will find conditions

periodically unfavorable, and inasmuch as millions are developing each hour, the general effect of the change in diet with restriction of carbohydrate will be distinctly adverse to the perpetuation of *Bacillus bifidus*; it tends to disappear.

At the same time the remarkable nutritive conditions prevailing in the intestinal tract offer opportunity for development of more adaptable bacteria, and one kind in particular. *Bacillus coli* seems to be peculiarly congenial to the new conditions. It is not without significance that this new organism, the colon bacillus, is very widely distributed in the alimentary tracts of adolescent mammals as well as man. This might be expected if the general conditions of foods, temperature and intestinal environment were similar in this great group of animals.

The colon bacillus, more adaptable and more versatile than *Bacillus bifidus*, can therefore accommodate itself equally readily to the carbohydrate or to the protein residuum that is found in the lower portions of the alimentary canal under the new dietary régime. Partly because of this plasticity, the colon bacillus thrives and becomes the most prominent organism of the large intestine during normal adolescence.

Unlike *Bacillus bifidus*, it produces rather less acidity from its action upon carbohydrates, and in intercarbohydrate periods it produces no acid; it produces indol and other products of protein putrefaction instead. It is obvious, therefore, that *Bacillus coli* does not completely take the place of *Bacillus bifidus* as a microbial protector against alien bacteria, including dysentery and cholera. This is rather well borne out by the infrequency of dysentery or cholera in babies that are nourished entirely at the breast, and by the rather marked susceptibility of artificially fed young children to these diseases, especially dysentery.

#### THE FOOD REQUIREMENTS OF BACTERIA

There is another aspect to this highly significant adaptability of colon bacilli, and of many other bacteria as well, to alterations in diet. Bacteria in general require some protein in their dietary to meet their structural requirements, because bacteria, like all other known living things, are nitrogenous organisms. Life on this planet is built around nitrogen as a corner stone. The amount of nitrogen required for structural purposes, however, is comparatively little: sixteen thousand million colon bacilli would weigh scarcely one milligram, and fully 85 per cent of this mass of bacterial cells is water. Less than 7 per cent

of their dry weight is nitrogen, hence small amounts of suitable nitrogenous substances suffice to provide the requisite material from which microbes fabricate their substance.

The energy requirements of bacteria, on the contrary, are large, relatively speaking—many hundred times the structural requirement. Also, and this is important, the energy-furnishing moiety of food for bacteria is non-nitrogenous. If nitrogenous substances alone are available for energy, the nitrogen must be eliminated first, as waste. Carbohydrates, on the other hand, particularly the simpler sugars, are excellent sources of energy, and bacteria will utilize available carbohydrates in preference to proteins for their energy needs, provided a choice is offered. They are quite human in this respect; a young boy will usually choose candy in preference to beefsteak.

#### BACTERIAL DR. JEKYLLS AND MR. HYDES

The waste products resulting from the two classes of foods that are utilized for energy by bacteria, proteins and carbohydrates respectively, are widely different. A few illustrations will make this clear.

The diphtheria bacillus cultivated in a broth medium from which sugar is excluded produces a powerful, soluble poison, which, when freed from all bacteria, still causes the essential symptoms of diphtheria when it is injected into guinea pigs. As little as 0.05 cubic centimeters of such medium frequently contains enough of the poison to kill the animal. If some glucose is added to the broth medium before the diphtheria bacillus is allowed to grow, the result is wholly different. Not only is there no poison detectable in the culture, but now it actually contains lactic acid. This is the essential constituent of buttermilk. The colon bacillus, described above, produces a foul-smelling substance, indol, when it is cultivated in the sugar-free broth medium in which, it will be recalled, the diphtheria bacillus forms its toxin. The addition of some glucose to the broth medium before the colon bacillus is allowed to grow, changes, however, the growth products in an equally striking manner. Lactic acid is now produced in the sugar broth, whereas indol was obtained from the corresponding medium from which sugar was excluded.

A large number of similar experiments could be cited, in each of which a particular microbe has been shown to produce some poisonous or disagreeable or otherwise distinctive substance in the broth cultures, and in which, in almost every instance, the addition of glucose or some other simple sugar to the broth medium prior to the growth of the

bacteria reforms the microbe, as it were, and causes it, as the result of its utilization of glucose for energy in place of the nitrogenous constituents, to produce the chemical equivalent of buttermilk-lactic acid. "The sugar spares the nitrogenous constituents of the broth medium," in the language of the physiologist. It will be seen from these experiments that many bacteria are in reality Dr. Jekylls and Mr. Hydes, a startling confirmation of the Robert Louis Stevenson story in microbial life.

A word of caution must be injected here, however. It is not to be inferred that the cure for all human ills is to feed sugar. Far from it. Returning for a moment to the conditions in the alimentary canal of the normal nursing, it will be recalled that during the period of full breast milk feeding, the sugar of the breast milk is present throughout the entire alimentary canal, and continuously. Under these conditions the bacteria that are found normally are lactic acid producers. This acid is sufficiently abundant and potent to make conditions throughout the intestinal tract unsuited for predatory microbes, which are not able usually to develop in the presence of this acid environment, even though the other nutritive substances be suitable to sustain these alien bacteria. The lactic acid, in other words, is a potent barrier, protecting the immature intestines against the onslaught of alien invading micro-organisms. Also, and this is suggestive, even if small numbers of disease producing bacteria should by mischance gain access to the intestinal tract, they too would become lactic acid producing microbes as long as there is sugar present that could be utilized for their energy needs. Time does not permit of a more adequate discussion of the Dr. Jekyll and Mr. Hyde of bacteriology and its relation to the microbes of the intestines. Sufficient has been said, however, to suggest the importance of the proper kinds of bacteria in the intestinal tract of the young child.

It has been suggested that Mother Nature practised bacteriology in a very efficient and effective manner before man emerged as a biological species from his mammalian ancestry. Scarcely a day passes even now that does not reveal additional evidence of the wonderful versatility and comprehensiveness of natural processes. But mankind, even from the dawn of historic times, also has employed bacteria in a very practical manner.

#### WHAT THE "MILLET SEED OF THE PROPHET" DID BACTERIALLY

The nomad of the desert, from the time of Abraham, has been



dependent to a large degree upon the offerings of his flocks and herds for his sustenance. In the hot, arid lands where he wanders, food undergoes decomposition rapidly, and no ice man is available to sell him relief for a price. Among the essential marital armamentaria of the nomad is a lump of casein—milk curds—wrapped in a dirty rag to prevent its drying. This lump of casein is cast into the skin which contains his freely drawn milk, and allowed to remain there until the fluid sours. Then the casein ball, rejuvenated somewhat in the process, is returned to its shroud and the nomad knows that his soured milk will not rot, nor putrefy; in this soured condition it retains its food value until it is used up.

The pious Mohammedan who uses this casein ball senses that it has caused a miracle to take place in his milk, and he gratefully—and how appropriately—calls his casein ball the Millet Seed of the Prophet. What he has actually done, as we know now, is to seed his freshly drawn milk with the active lactic acid bacteria that are carried along in the lump of casein. They are an insurance policy, guaranteeing that his soured milk shall not support the growth of putrefactive microbes and thereby become unfit for food—quite similar in essential details it would seem to the seeding of the nursing intestinal tract with *Bacillus bifidus*.

It remained for a great scientist, Metchnikoff, to study this remarkable phenomenon. Metchnikoff became convinced that premature senility in man is frequently associated with putrefactive changes induced in the intestinal tract by putrefactive bacteria. It was brought to his attention that the Bulgarian peasants enjoyed, or did enjoy, long life. Upon investigation he found that soured milk was an important item in their diet. To make a long story a short one, he obtained a microbe, which he called *Bacillus bulgaricus*, from the casein balls the Bulgarians used to induce souring in the freshly drawn milk of their herds, and found it would indeed induce souring in milk, and very rapidly. He tried to implant this Bulgarian bacillus in the intestinal tract of man, and thereby to induce lactic acid formation, thus eventually to crowd out the malignant microbes that may be causing putrefaction. The experiment was not successful. We now know why it was unsuccessful.

The Bulgarian bacillus is a milk parasite. It has been passed from the nomadic milk pail to the casein ball, and back again for countless generations, but it has never had a chance to accommodate itself to the actual conditions within the intestinal tract of man, where it was sup-

posed to grow. The Bulgarian bacillus, in other words, was trained to the conditions of the milk pail, but not the conditions within the intestinal tract. Many bacteria produce lactic acid, but relatively few grow well in the alimentary canal.

#### THE CORRECT USE OF BACTERIAL LACTIC ACID THERAPY

There is a microbe, however, in fact there are several microbes that will and do grow in the intestinal tract, producing lactic acid there *provided the diet of the person is correctly adjusted to support the growth of the organisms*. It is to these bacteria that science is gradually turning to bring about the desired result. One of these has already been discussed, namely *Bacillus bifidus*. This organism appears spontaneously in the intestinal tract of the normal nursing about the third day of life. It is an organism that has populated the alimentary tracts of normal breast-fed babies since, and probably long before, the Bulgarian bacillus was introduced to the nomadic milk pail. Substituting *Bacillus bifidus* for *Bacillus acidophilus*, which is in many ways more convenient than *Bacillus bifidus* to handle on a large scale, Metchnikoff's dream of supplanting malignant microbes in the alimentary canal is gradually coming true; and even though this brilliant scientist failed in one essential detail of his experiment, his remarkable insight is not dimmed thereby.

Curiously enough, scientists are even now falling into the same difficulty that Metchnikoff encountered. They have failed to realize that both *Bacillus bifidus* and *Bacillus acidophilus*, cultivated outside the body on artificial media, lose their original ability to cope with the conditions within the alimentary canal, and thereby become as ineffective as the Bulgarian bacillus for intestinal implantation. One does not train for football by a correspondence course, and bacteria that are kept in the quiet, hot house condition of pure cultures upon artificial media, outside the body, in the laboratory, lose sooner or later their ability to grow in, and to dominate, the intestinal environment. It is essential that bacteria designed for intestinal implantation be obtained from the intestine itself at suitable intervals.

This subject of intestinal bacteriology, and all the complications that are of necessity associated with it, is still a very young one. Scarcely a beginning has been made in unfolding its many aspects. Nevertheless, some real progress has been made.

#### EVIDENCE THAT LACTIC ACID THERAPY REDUCES DISEASE IN GENERAL

One of the mysterious benefits that has accrued from the elimination of harmful intestinal bacteria has come from an entirely unexpected source. It has been found, for example, that the elimination of bacteria that cause intestinal disturbances from the life of a community not only reduced microbial intestinal disease, as might confidently be expected, but also it seemed to reduce somewhat the incidence and severity of illness in general. This has been shown very well in the death rates of cities that periodically in the past were visited by typhoid, carried in drinking water. The installation of suitable filters not only reduced the typhoid death rate, which is to be expected, but it also reduced the general death rate to a degree not predictable by the removal of typhoid germs alone. The impression is gaining ground that the correct use of bacterial lactic acid therapy for the alimentary tract reduces to a degree the morbidity and mortality due to general microbial disease. It must not be inferred that this is a well substantiated phenomenon as yet, but the evidence is on the whole promising.

#### THE MODERN DISTURBANCE OF THE MAN-MICROBE BALANCE MUST BE COUNTERACTED

Acute microbial disease in general (apart from pandemic disease, as epidemic influenza, which thus far has eluded the best efforts of science), has distinctly been restrained in its severity, and restricted in its distribution, as a direct result of the remarkable development of the last quarter century in bacteriology and sanitation. No small part of this remarkable achievement is directly associated with the bacteriologic control of food, water and milk. In large centers, at least, the water is chlorinated, the milk is pasteurized and no inconsiderable part of the food is sterilized; at least it is largely freed from microbes. This is a striking contrast to the conditions that prevailed when the generation that is now passing was in its youth. It is really a miracle, and of greater significance to the human race than most of the events since historic times. We accept this miracle as an accomplished fact, and very properly, but perhaps we may overlook some of the possible effects that are of lesser significance.

Man for countless generations has developed in the closest relationship with his inevitable microbial messmates. Now, suddenly, the bacteria of lesser resistance to disinfecting agents—heat, chemicals, ultra-violet light—are abruptly eliminated from his food. The bacteria

thus eliminated include the majority, if indeed not practically all, of the normal lactic-acid producing kinds. The more resistant organisms, however, many of them spore formers, and therefore difficult to kill, are still poured into the intestinal tract, as before. The important fact to visualize is that these hardy microbes are freed to no slight degree from the competition of the normal lactic acid bacteria that were formerly more numerous within the alimentary canal and there restrained their development. Among these more resistant types are the gas bacillus, putrefactive organisms, and many of unknown potentialities. As a result of this disturbance in the alimentary canal of the man-microbe balance, new adjustments will undoubtedly take place, with ultimate effects that cannot be foreseen.

Physiologically, therefore, the perfectly pasteurized man is a new development in the history of the human race. This is not to be construed as a polemic against pasteurization, however. Pasteurization, generally speaking, has been of untold benefit to humanity. On the other hand, man-microbe balances, which have been in operation for untold ages, cannot be brusquely upset without leaving some evidence of their passing.

Mother Nature will still probably see to it that *Bacillus bifidus* will appear in the immature, nearly defenseless alimentary tract of the nursling about the third day of life, and continue to thrive there as long as the mother can supply the dietary needs of the infant. When man takes over the feeding of the child, and, with his present unintelligent *microbiphobia* unwittingly encourages abnormal intestinal implantation with undesirable microbes, a new chapter begins, the outcome of which is still to be revealed. The most important factor after all is, however, that when such conditions are recognized, they can and will be corrected.

## APPENDIX 8

### NORMAL COLON HABITS

By J. H. KELLOGG,\* M.D.

*The numbered notes ("1," etc.) refer to the list of references at the end of this Appendix.*

THE capacious colon of man and other mammals is provided by Nature to serve as a reservoir for the accumulation of alimentary residues and body wastes and their evacuation at regular intervals. This arrangement permits the disposal of refuse with the least possible interference with movement and other bodily activities.

The possible injury resulting from the overaccumulation of residues, and especially the fact that food residues readily undergo putrefaction and other changes resulting in the production of highly toxic substances, render the question of the proper spacing of the evacuations of the colon reservoir one of high importance. The researches of Bouchard,<sup>1</sup> Metchnikoff,<sup>2</sup> Christian Herter,<sup>3</sup> Combe,<sup>4</sup> and other physiologists and clinicians have clearly shown that the stasis or prolonged retention of food residues, bile, and other body wastes results in the development in the colon of a great number of parasitic bacteria and other organisms, some of which produce violent toxins, while others under special conditions become highly virulent, giving rise to colitis and other infections of the colon, small intestine, and gall bladder, and even penetrate the blood vessels, producing infections of the kidneys and urinary bladder and other parts. Putrescible accumulations of refuse in the colon afford favorable conditions for the development of amœbæ and scavenger parasites of other sorts.

Delayed evacuation necessarily results in accumulation of residues and undue distension of the colon with CO<sub>2</sub> and various noxious and malodorous gases, which are chiefly the result of the decomposition of carbohydrates and sugars. Fats give rise to butyric acid and other toxic products. Undigested protein encourages the rapid development

\* See footnote to Appendix 3.

of vast numbers of proteolytic or putrefactive bacteria, *B. coli*, *Cl. Welchii*, the gas bacillus, *Cl. sporogenes*, *Cl. putrificus*, and scores of other organisms which, according to Strassburger, may attain such prodigious numbers as 300 trillions in 24 hours. It is evident, then, that the evacuation of the colon residues at reasonably frequent intervals is desirable, while retention in the colon for a sufficient length of time to permit putrefactive changes to take place is in every way undesirable and may become a menace to life and health.

The colon, or large intestine, is about five feet in length. It is automatically divided into three sections: (1) the right, the cæcum and ascending colon; (2) the transverse colon; and (3) the left, the descending or distal colon, at the lower part of which the pelvic colon initiates bowel action by means of the "call," a desire for evacuation caused when residues are pushed forward from the pelvic colon into the rectum.

### Eating Causes Evacuation

As shown by the x-ray observations of Hurst of London, "the time required for [passing through] each part of the colon—ascending, transverse, and descending—is about two hours. That is, about the same period is occupied in passing through the 2 feet of colon between the cæcum and the splenic flexure as through the 22½ feet of small intestine.<sup>3</sup> The movements of the human colon, however, appear to be less active at night than during the day."

The careful studies of Hurst showed that the activity of the colon is greatly accelerated during the taking of food. He found that, apart from meals, progress through the colon was slow, but that during each meal there was perceptible advancement of the contents. More progress occurred, for example, during the dinner hour than during the previous four hours.<sup>6</sup> Says Hurst in relation to the rate of movement of food in the colon:

"If approximately nine hours are required for material to reach the descending colon in man, the waste from food taken at 8 o'clock in the morning might be discharged at 5 o'clock in the afternoon. If defecation should occur regularly at 4 o'clock, however, the waste from breakfast must be retained for another twenty-four hours."<sup>7</sup> In other words, if the bowels are moved but once daily, a large amount of residue which has reached the lower bowel and is ready for evacuation will be delayed for 24 hours or more, during which putrefaction, gas formation and various highly undesirable changes will occur.

The above facts indicate that, under normal conditions, an intake of food is usually followed by an output of residue of a previous meal—the natural result of the forward movement of the colon contents due to the act of eating, which pushes the residues forward into the pelvic colon, an automatic and highly efficient discharging device. The common practice of moving the bowels only once a day leads to the retention of residues for at least 36 hours, often several days, during which time a high degree of putrefaction may be attained, especially when free use is made of meats and other animal proteins.

From the above it is very clear that the number of evacuations will be strongly influenced by the number of meals, since, as pointed out by Hurst, the taking of food is the chief cause of colon activity. If a person takes but two meals a day, the contents of the bowel may not be advanced toward the exit with sufficient rapidity to secure more than two movements during the waking hours. If, however, the diet is of such a character that a good intestinal flora is maintained, and if the entire colon contents are evacuated every 24 hours, no harm will result, because putrefaction is inhibited, and toxins, virulent bacteria and other harmful factors are absent.

The number of evacuations per diem is influenced to a marked degree by the amount of exercise taken. The movements of the diaphragm in breathing aid the colon by compressing and advancing its contents toward the exit. The amount of help which the colon receives from the diaphragm depends largely, however, in sedentary persons, upon the maintenance of an erect posture.

### The Protective Germ

Tissier,<sup>8</sup> an assistant of Pasteur, began in the latter part of the last century and continued for many years an exhaustive study of the intestinal bacteria. He discovered in 1900 that the stools of infants, though sterile at birth, within a few hours become contaminated and show the presence in great numbers of the colon bacillus and other germs found in adult stools. These harmful bacteria are speedily driven out by a new germ which appears in the stools within two days after the infant begins to nurse, and within two weeks the newcomer occupies the entire field. This germ, the *Lactobacillus acidophilus*, produces lactic acid in such quantities that the growth of putrefactive and other harmful bacteria is inhibited and they quickly disappear.

The rapid development of the *Lactobacillus acidophilus* in the infant's intestine is the result of the presence in the mother's milk of a large percentage of lactose, or milk sugar. So long as the diet of the infant contains this sugar in sufficient amount, the *Lactobacillus acidophilus* continues to flourish. Dextrin, a derivative of starch, likewise encourages the development of the aciduric flora.

It is clearly evident that beneficent Nature has provided in the *Lactobacillus acidophilus* a highly efficient means of protecting the infant mammal against the invasion of its intestinal tract by putrefactive and other disease-producing germs. So long as the intestinal flora remains strongly aciduric, that is, 85 to 100 per cent *Lactobacillus acidophilus*, it remains free from the intestinal infections which produce diarrhea, gas, and other disturbances to which bottle-fed infants are much more subject than are those who are breast-fed.

### The Quintuplets Confirm Doctor Tissier's Discovery

The experience of the famous quintuplets affords a convincing demonstration of the protective value of *Lactobacillus acidophilus*. Owing to their mother's illness, they were never breast-fed, and hence missed the opportunity to develop a good protective flora. Although reared on breast milk, at four months they developed grave bowel troubles with highly offensive stools and great gas distention and were very ill. When, at the suggestion of the writer, Dr. Daloe<sup>10</sup> gave them soy milk cultures of *Lactobacillus acidophilus*, they quickly recovered and have since, now more than three years, been kept free from bowel troubles by the daily use of the culture. The quintuplets required the artificial culture for the reason that although they had been fed with breast milk from their fourth day, they had missed the protection of the *Lactobacillus acidophilus* which infants normally receive in the act of nursing.

When the colon is emptied with normal frequency, that is, within less than 24 hours after the food is taken, the time between intake and output is insufficient for the development of advanced putrefaction; and if the diet is of proper character, an aciduric flora, once established, may be maintained. One-a-day stools always show a putrefactive flora.

In the examination of many thousands of stools made at the Battle Creek Sanitarium, occasionally one has been found which showed 75 per cent acidophilus and freedom from evidence of putrefaction. Such



stools were invariably from persons whose diet approximated the normal primate dietary.

### The Intestinal Flora of Apes is Protective

Bacteriological examinations recently made of the stools of a nine-year-old chimpanzee showed a well developed protective flora, 85 per cent *Lactobacillus acidophilus*. The animal was thoroughly healthy and had never suffered from bowel trouble. The animal's keeper informed me that the stools were never offensive. Evacuations occurred four or five times daily.

Carl Akeley informed the writer that in his studies of the gorilla in its native African wilds, he observed that the animal evacuated several times daily, and that the stools were free from putrefactive odor; also that the complete alimentary tract of a gorilla which he dissected, showed nothing in the slightest degree offensive. He added with emphasis, "It was the cleanest thing, internally and externally, that I ever encountered in my life."

### Apes and Savages Evacuate Three or More Times Daily

On inquiry at the London Zoo in reference to the bowel habits of the chimpanzee and other large apes, I was told by the keeper that they moved their bowels regular'y four times a day. Dr. Hornaday informed me that the anthropoids of the Bronx Zoological Garden evacuated three times a day. At the Washington Zoo the keeper stated that the chimpanzee Koko normally evacuates four to six times a day.

At the present time, the writer has an aciduric flora showing an acidophilus percentage of 80 to 90, which has been maintained at the present level for several months.

A questionnaire sent to a large number of missionary physicians located among wild and primitive people brought 140 replies. The evidence obtained from these original sources clearly indicates that among native tribes which have been uninfluenced by the customs of civilization and who still adhere to primitive habits of diet, living a free and active life, two or three evacuations occur daily, the number of evacuations depending upon the number of meals eaten. These primitive people are keen observers. They give great attention to the bowels, carefully training their children in correct bowel habits. A single daily movement is regarded by them as constipation, and

gives rise to alarm. The one-evacuation-a-day habit appears only among those classes or castes whose habits are sedentary.

Said Dr. F. D. Shepard, an American surgeon who had practised thirty years in Turkey, "The universal habit is to move the bowels three times a day."

### One-a-day Constipation

A physician writing from South Africa said: "A native called on me yesterday morning and asked for medicine to relieve a dreadful constipation. I said to him, 'When did your bowels move last?' he replied, 'This morning, Doctor.' 'But I understood you to say you were constipated.' 'Yes,' replied the native, 'I am horribly constipated. My bowels move only once a day.'"

This state of one-a-day constipation is very prevalent in many highly civilized countries, but by no means universal. Among working men the habit of two or three evacuations daily is quite common.

The advantage of suppressing putrefaction in the intestinal canal by frequent evacuation is shown by the fact that among people who move the bowels frequently, bowel troubles and other disorders associated with intestinal infections and intoxications are relatively infrequent. For example, of 112 American physicians practising among the natives of the following countries, 43 reported that they had never seen cancer of the bowels: Mexico, Palestine, Arabia, Turkey, Egypt, South Africa, East Africa, Central Africa, Nigeria, Japan, Syria, Korea, Persia, Siam, India, Asia Minor, New Hebrides. Appendicitis was likewise infrequent.

Dr. Davidson of Travancore,<sup>11</sup> India, wrote me in reply to a questionnaire: "Appendicitis is very rare here. Only 6 cases out of 1000 operations." An annual report of the Mayo Clinic showed 19 per cent of all cases examined to be suffering from appendicitis and 21 per cent of all cases operated upon.

### Lord Dawson on Intestinal Toxemia

When the bowels move but once a day, the residues of a test meal are, according to Hurst, J. T. Case, M.D., and other X-ray experts, retained in the body 53 to 54 hours, or 2¼ days. In the meantime seven other meals have been taken and the residues of these meals are still retained, so that the colon, which at the most should never contain the residues of more than three meals, contains the residues

of six, or more than twice as many meals, and naturally becomes distended with putrefying residues and overdistended by gases, the result of putrefaction and fermentation. This stretching of the intestinal walls causes redundancy, atrophy and inability to evacuate completely. Pouches and diverticula are formed, and colitis develops with its long train of ills and a predisposition to appendicitis and diverticulitis.

The highly beneficial results which follow the adoption of the practice of evacuation after each meal bear very eloquent evidence of the physiologic value and correctness of this practice. Among the 200,000 persons who have visited the Battle Creek Sanitarium for medical relief during the last 30 years, many have become convinced of the great importance of regular after-meal evacuations. The writer has been informed by a very large number of persons that they had experienced notable relief from headache, dullness, inability to concentrate, deficient appetite, foul breath, coated tongue, chronic fatigue and other symptoms usually attributed to intestinal toxemia, and had noted a remarkable increase in endurance and working power. One well-known college professor, who for years found it necessary to rest a couple of hours in the middle of the day, within three weeks after the adoption of the practice of evacuating after each meal reported himself, as he said, "able to keep up a full head of steam the entire day, thereby adding two hours to my working day."

### **The After-Meal Evacuation Habit is Easily Acquired**

Strong evidence that after-meal evacuation is physiological is afforded by the ease with which the habit is acquired. Many years ago, I received a letter from the superintendent of an institution for the care of idiotic and feeble-minded children in which the writer stated that having heard of my advocacy of the three-a-day evacuation practice, she thought I might be interested in an observation she had made. She stated that she had often been complimented on the fact that her institution was free from the bad odors usually present in such establishments because of the lack of intelligent control of evacuations by the inmates. She said she was often asked the question, "How do you manage it?" The answer was, "After each meal I place each child upon the toilet. Nature does the rest."

If in addition to a regular visit to the toilet within an hour after each meal a person whose bowels move but once a day will add to a

laxative diet some colon-stimulating food accessory, and if prompt attention is habitually given to the "call," which indicates readiness for action by the colon, the colon usually may be easily trained to prompt elimination of its contents after every intake of food. Sometimes the colon becomes so sensitive to the stimulus of eating that a visit to the toilet is found necessary immediately after the meal is finished and in many cases even when an apple or fruit of other sorts is taken between meals.

When an x-ray examination shows that the colon is permanently crippled, the colon should be emptied daily at bedtime by an enema of 3 or 4 pints of water at 105°-110°. This harmless mechanical means may be used indefinitely without injury, and often when intelligently used will effect a cure of a badly crippled colon by training it to normal activity. In every case of serious colon function impairment a competent physician should be consulted.

*Colon Poisons*—Numerous highly poisonous substances have been found in the fecal matters of both animals and human beings by various investigators. Brieger and Selmi found muscarin, cholin, cadaverin, putrescin, neurin, neuridin and saprin, all highly potent toxins.

Dr. R. L. Benson in an article in the *Canadian Medical Association Journal* (February, 1937, p. 129), stated that "the colon contains enough histamin to kill a regiment."

### Symposium on the Colon by the Royal Society of Medicine

Several years ago, the Royal Society of Medicine of Great Britain held a symposium on the subject of alimentary toxemia in which numerous eminent medical men participated. Prof. Dixon of King's College, London, called special attention to sepsin, a very virulent toxin produced by streptococci which is always found in lean meat that has been long hung and in the stools of meat eaters. Many cases have been reported in which meat dealers have died from septicemia after receiving a small wound when cutting meats.

Barger and Walpole called attention to two poisons produced by the putrefaction of sepsin which raise the blood pressure, an observation of much importance for the reason that, as stated by Dr. Dixon, "In recent years it has been shown by different workers in our Cambridge laboratory that any drug that has the power of considerably raising blood pressure will, when injected into the circulation of healthy animals, bring about degeneration of the middle coat of the

arteries." These effects were observed in young animals as well as older ones. Bain found these colon poisons present in the blood of persons who have high blood pressure. It has been shown, according to Dr. Dixon, that the same effects are produced by these colon poisons that are known to be caused by digitalis, nicotin "and the inhalation of tobacco smoke."

Said the eminent Sir Lauder Brunton, "The *Bacillus coli* seems to have a special power of producing fatigue toxins, and many people in whose intestines it exists in great abundance suffer from constant weariness and a feeling of fatigue."

Said Dr. Mantle, "Rheumatoid arthritis and other joint symptoms may arise from poisons absorbed from the intestinal mucous membrane. The joints are especially susceptible to certain poisons."

Said Sir Lennox Wainwright, "I am quite sure of this, that the mental effect on many patients of prolonged intestinal toxemia is such as to make them almost demented."

"The state of the tongue may be a good index of intestinal health, and a foul condition of the breath speaks volumes of what may be suspected lower down, although the patient may not be constipated."

Lord Dawson of Penn, physician to King George V, drew the following picture of persons suffering from intestinal toxemia, the result of intestinal stasis: "The sallow, dirty complexion, the inelastic skin, the dusky lips and nails, the dirty tongue, evil-smelling breath, constant abdominal discomfort of one kind and other, doughy, inelastic abdomen, cold extremities, the physical and mental depression, are among the prominent features."

There are perhaps no medical questions which during the last 40 years have received more attention and been more widely discussed than those relating to the facts and effects of intestinal toxemia. At the present time I think it may be safely said that by far the great majority of leading clinicians will agree with Metchnikoff that "The microorganisms inhabiting our bodies have set going there a poison factory which shortens our existence and by secreting poisons which penetrate all our tissues, injures our most precious organs, our arteries, brain, liver and kidneys."

According to Tissier of the Pasteur Institute, student assistant of Pasteur, 90 per cent of all the bacteria in the intestine of a child brought up under biologic conditions (lacto-vegetarian diet) belong to the group of acid formers, and the protective *Lactobacillus acidophilus* is present to the extent of more than 70 per cent. Dr. Dæoe

reports that the flora of the Dionne quintuplets is maintained at 85 per cent aciduric by the daily use of soy acidophilus milk.

The writer found the intestinal flora of a nine-year-old chimpanzee to be 80 per cent *Lactobacillus acidophilus* and has under observation a child of two years whose intestinal flora has been carefully watched since birth and has rarely been found less than 90 per cent aciduric. At the time of this writing the percentage of *Lactobacillus acidophilus* in this case is 95.

The contaminated condition of the human colon is due, as Herter has shown, to the character of the diet of the average man. All uncooked meats contain great numbers of streptococci and other poison-forming and disease-producing bacteria with which meats become infected in the process of slaughtering. Herter found that a watery extract of the feces of a carnivorous animal produces speedy death when injected into the body of a guinea pig or a rabbit, while a similar extract of the feces of an herbivorous animal does not.

### Reforming the Colon

The colon, more than any other organ, needs "return-to-Nature" training. It must be remembered, however, that the colon is sick, not sluggish; that it is crippled, not lazy; that it needs help, not punishment, feeding and coaching, not drugs or mineral waters. Constipation is largely a deficiency disease. Every organ of the body has special needs which the daily food must supply. The denatured food-stuffs in current use by so-called civilized people, are greatly lacking in colon nutrients. The colon needs bulkage, emollient, lubricating mass, to awaken the activity of its muscular walls; vitamins to activate its nerves and glands, and special nutrients to feed its protective microorganism, the *Lactobacillus acidophilus*. All of these essential colon nutrients are found in a properly balanced lacto-vegetarian diet.

Colons differ greatly as regards the nature of the impediments which hinder their normal functioning and which prevent the establishment of a normal aciduric flora. By careful study and persevering effort in the application of available helps, with very rare exceptions, every colon not organically diseased may be made to function normally.

Drugs of every sort must be sedulously avoided. All are harmful when habitually used. The colon should never be forced, except in emergency, by the use of stimulating measures. Drugs make matters

worse by causing irritation, congestion, colitis, spastic contraction, diverticuli and appendicitis.

Colons which do not readily respond to a carefully regulated diet, efficient colon-helping food accessories, exercise, and other simple corrective measures, should be studied with the aid of the x-ray, and competent medical advice should be sought.

### Résumé

In the limited space allotted me, I have endeavored to make clear in the foregoing paragraphs the following points:

1. An evacuation by the colon of residues and wastes soon after each meal is the normal, or physiologic, order of colon functioning. Within 12 or 14 hours after food is eaten, it has traveled almost the entire 30 feet of the small intestine, residues being found in the lower colon within two or three feet of the exit.

The taking of a meal awakens the colon to activity, and by pushing the food into the rectum, creates a desire for evacuation. When the after-meal call has been lost, it may be re-acquired by habitually visiting the toilet and making an attempt to evacuate.

2. Through the protective action of the *Lactobacillus acidophilus*, discovered by Doctor Tissier, of the Pasteur Institute, Nature has provided for the prevention of the development of putrefactive and disease-producing bacteria in the digestive tract. The only conditions required are, maintenance of the physiologic rhythm of evacuation and adherence to the primitive, or biologic, bill of fare. This supplies the nutrients necessary to maintain an aciduric flora, which not only prevents putrefaction but is a physiologic stimulus to colon activity.

3. Neglect to empty the colon soon after eating, leads to accumulation and prolonged retention of residues in the colon and resulting putrefaction, with the formation of highly poisonous products which are by many eminent authorities believed to be a prolific cause of disease, degeneracy, and premature senility.

4. The normal diet of man (lacto-vegetarian) is non-putrefactive. Fresh fruits and vegetables and other plant foods are presented to us by Nature in an absolutely sterile condition. Dairy products contain many bacteria, but of a harmless sort, protective, in fact, because they produce lactic acid.

Fresh meats swarm with noxious colon germs with which they become infected in the act of slaughtering. Ordinary cooking does not

destroy meat germs. Canned meat is cooked for three hours at a temperature of 240° F. to prevent spoiling.

5. Through mistreatment, and especially by the use of cathartics and laxative drugs, the civilized colon has become badly crippled; but by proper treatment and training, it may be reformed and in most cases made to function normally after each meal, and with such results in improved vigor, increased efficiency, sense of fitness and well-being, as to well repay the effort required.

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## COMPARISON OF METHODS OF ROENTGEN EXAMINATION OF THE COLON

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Twenty-nine years ago I gave my first opaque enema under fluoroscopic screen control. The publications of Pfahler and a few references from foreign literature constituted the stimulus for the undertaking. Bismuth subnitrate was the opaque salt, suspended in buttermilk. The chief aim of the study was to determine the position of the transverse colon and of the right and left colic flexures. To emphasize the contrast presented by the elaborate roentgen study of the colon as practiced now, with indications for its use covering a very wide range of pathologic possibilities, I was asked to offer a review of the evolution of the technic of x-ray examination of the colon, followed by an evaluation of the different methods.

Routine practice in intestinal x-ray examinations includes the opaque meal, with appropriate screen or film observations of the opaque residues as they move along the large bowel (fig. 1), followed by the contrast enema (fig. 2) administered under screen control by the physician-radiologist himself, with appropriate film records during the course of the fluoroscopy, and subsequent observations after the patient has attempted to expel the contrast fluid. The combination of these two series of observations constitutes what we are pleased to call a complete gastro-intestinal roentgenologic study. Much of its value lies in the fact that it is done as a routine, and this routine is justified by the frequency with which colonic lesions are encountered when only pathologic conditions of the upper part of the abdomen are suspected and vice versa. The same justification

exists for a routine complete gastro-intestinal x-ray study in every case of suspected lesion anywhere in the digestive tube as there is for the complete clinical work up considered good and accepted procedure in the general examination of any patient. There is the difficulty of financial objections in many cases, but radiologists have made a sincere effort to cooperate with the other clinicians in keeping their services within reach of the needy.

On the whole, it may be said that the colonic study with the opaque meal gives information more especially regarding function, whereas the contrast enema



Fig. 1.—Carcinoma of transverse colon easily recognized on the films following an ordinary barium sulfate meal. Easily seen on the fluoroscopic screen.

affords data relating to organic lesions, the two methods overlapping somewhat in their usefulness and yet often supplementing each other in a very precise manner. The opaque meal study is time consuming, sometimes extending into three days, whereas the contrast enema or some elaboration of it can be accomplished within a short time in one day. The presence of such a condition as anal insufficiency may necessitate the use of the barium meal study even though the contrast clysis would be the method of preference. There is also a use for the oral contrast method, preferably by the employment of timbrathor, in cases in which the contrast enema has revealed a serious obstruction and the

radiologist does not wish to force passage of the stricture and yet wishes to obtain information regarding the digestive tube proximal to the stricture. Haensch of Hamburg, a pioneer in this work, in 1911 called attention to the fact that in many cases of colonic obstruction the stricture offered little hindrance to the passage of relatively dense bowel residues coming from above while resisting the passage of the fluid contrast enema



Fig. 2.—A case of multiple diverticula of the colon with obstructing per-diverticulitis, illustrating the difficulty in passing the opaque elysma higher than the obstruction, although with a previous barium sulfate meal, residues of which are seen in the diverticula, an obstruction was noted. It is not wise to persist in the attempt to fill the colon by enema.

(fig. 2); he thought that the long continued effort of the colon to force fecal residues caudad through the narrowed lumen resulted in the development of a funnel effect, which operated to offer a valvelike opposition to the ascent of the fluid enema. Umbrathor, being an aqueous solution of thorium dioxide, remains fluid and presents no possibility of impaction above a stricture, an accident needlessly feared if one takes the pre-

caution to follow up the examination with subsequent observations to note possible impaction. Finsterer saw no objection to barium sulfate for this study, for, if impacted, it could be removed by the operation that was indicated in any event. However, the use of the aqueous solution instead of the opaque salt suspension removes this objection entirely.

The contrast meal had its inception early in the history of roentgenology through the work of Cannon and Williams, Hemmeter, Rieder, Pfahler and a host of others. Air injections into the colon were practiced as early as 1907 (Pfahler, Cole and others) principally

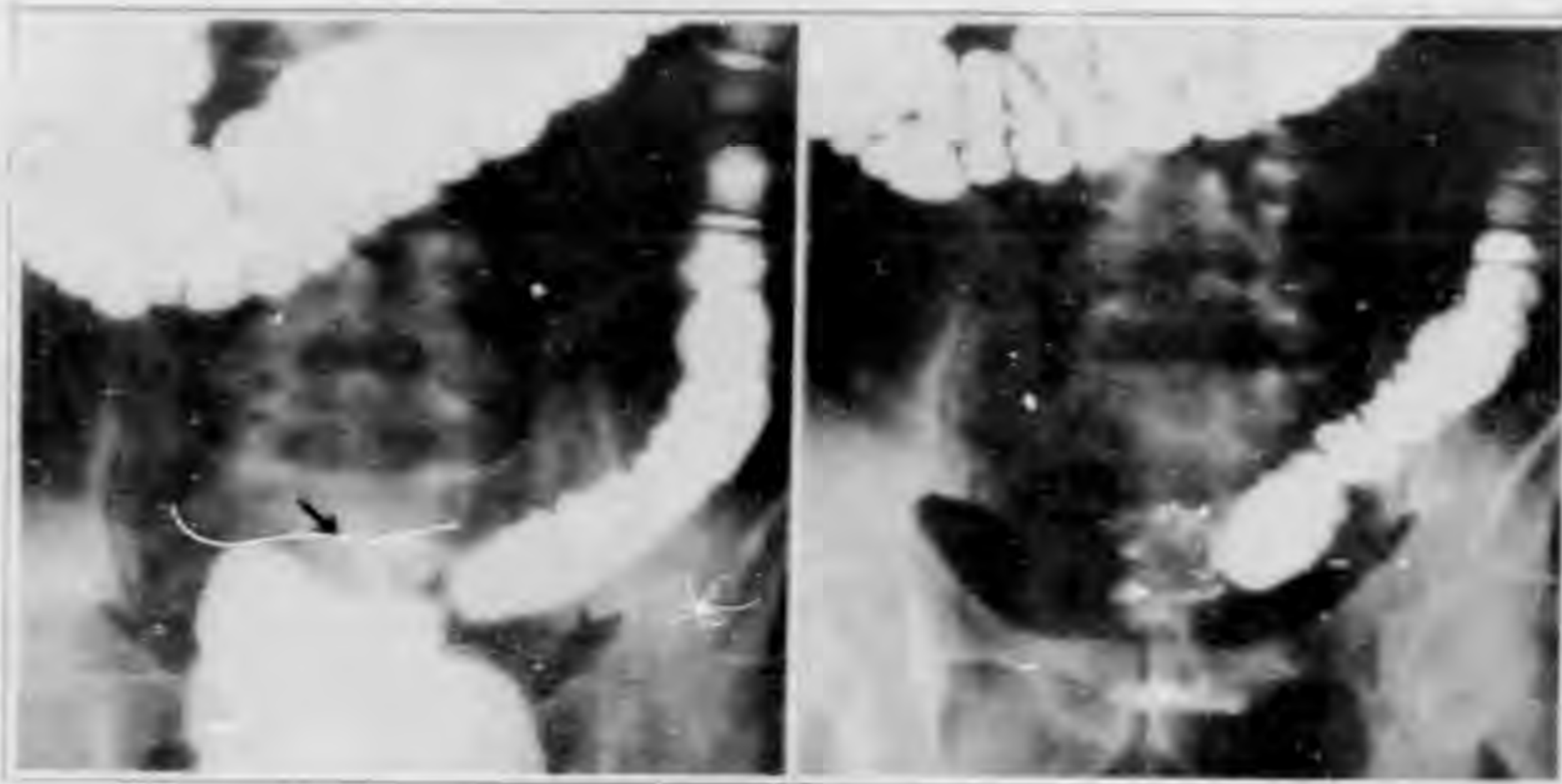


Fig. 3.—Simple opaque enema, followed by expulsion of as much as may be possible, often reveals the site of obstruction and its nature without resort to more complicated diagnostic x-ray studies. In this case there is a carcinoma of the lower sigmoid, not as yet offering any serious obstruction.

for the purpose of studying the relationship of intra-abdominal tumors lying outside the digestive tube and to afford greater visibility of the liver, spleen, gall-bladder and kidneys, the increased translucency of the air-distended bowel offering a marked contrast to the denser shadows of the organs or tumors in question.

The efforts of Pfahler and of Cole, and especially the work of Haenisch published in 1910 and 1911, definitely established the contrast enema as a dependable method of colonic diagnosis, especially in relation to gross pathologic alterations. Various improvisations of apparatus were utilized for the screen study of the contrast enema, the final and best known one being

the "trochoscope" of Haenisch, the forerunner of the present day horizontal fluoroscope, widely adopted, and copied and improved. Roentgenoscopy was also greatly facilitated by the introduction of the author's foot switch, automatically cutting off the room illumination whenever the x-ray current was turned on.<sup>1</sup> With the fluororadiographic switch it became easy to turn the patient or tilt the table to any desired degree during the course of the screen study and to make appropriate film records without loss of time. As early as 1909 this technical procedure became a part of our routine practice. The single contrast enema, thus employed under

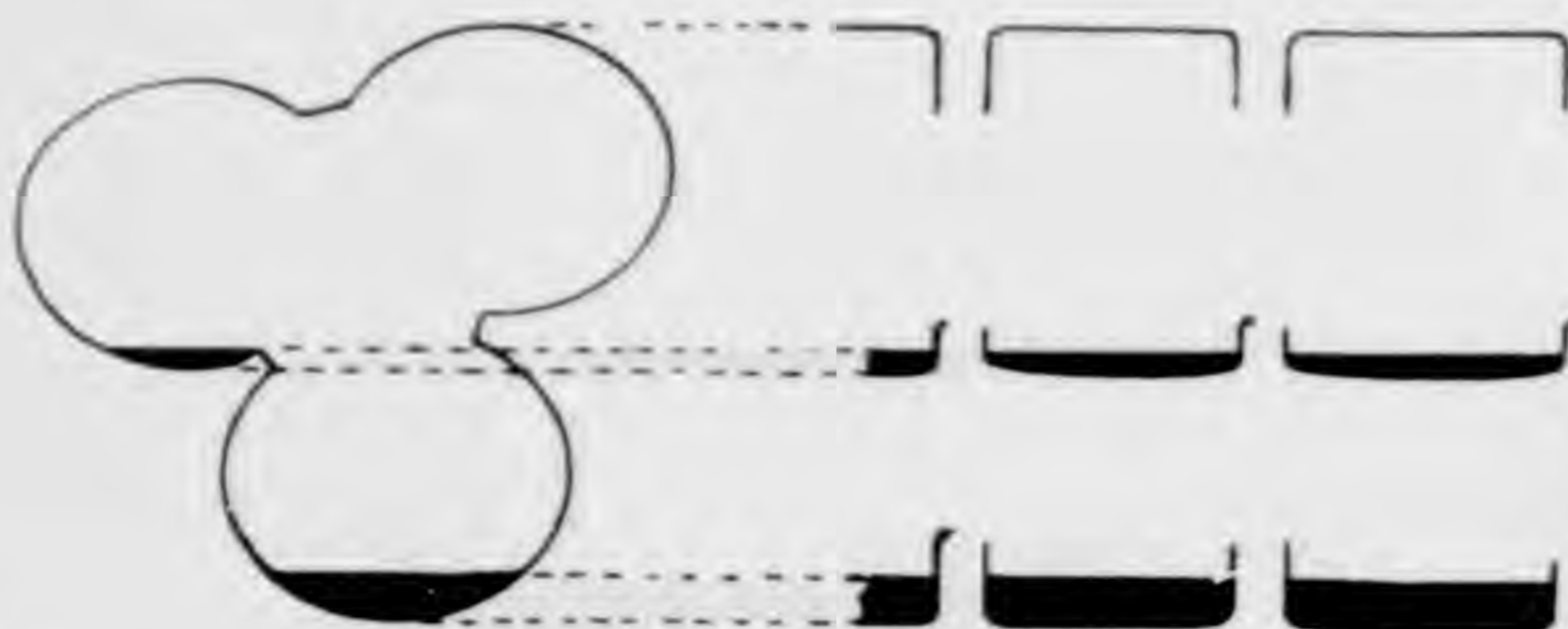


Fig. 4.—Illustration borrowed from Schina showing diagrammatically the three rows of colonic haustra. It sometimes occurs that only two rows are visualized with opaque material, the other row being filled with stagnant opaque material or with gas. Under such circumstances it is possible to make an erroneous diagnosis of colon polytosis.

roentgenoscopic control, is the most expeditious, simple, convenient and generally useful method of study of colonic morphology. It should be administered by the roentgenologist himself at a rate sufficiently slow to allow adequate screen study and such fluororadiographic film records as seem required. One hears of instances in which a nurse technician or other lay assistant administers the opaque enema as she would an ordinary cleansing enema, after which the patient is removed to

1. The author believes that in 1909 he was a pioneer in the use of such a foot switch. He later described to the engineers of a well known concern manufacturing x-ray apparatus his desire for a double fluorographic foot switch, one pedal being for use in fluoroscopy at around 5 milliamperes of current, the other for radiographic work at 50 milliamperes or more, as required. The fluoroscopic pedal also extinguished the overhead room light whenever the screen was in use. The controls were arranged before beginning the screen study, so that at any moment during the course of the fluoroscopy it was easy to interpose a cassette and make an instantaneous film record (recently called "spot film") of any desired phase of screen observations without a moment's delay. From this request was evolved the present fluororadiographic switch, which adds so much to the comfort and facility of roentgenoscopy of the colon.

the roentgenographic table for a film. But this is faulty practice; it is imperative that the eyes of the physician radiologist should follow every inch of the ascent of the opaque column, for his experience and medical training will enable him to recognize and record roentgenographically aberrations from the normal (fig. 10) which would not be otherwise discovered even on the final films. From my earliest roentgenoscopic studies



FIG. 5.—Roentgenogram made at once after evacuation of the ordinary opaque enema. A record of this kind, when the enema has been successfully expelled, demonstrates the elasticity of every inch of the colonic wall and the fact that the lumen is clear of tumors. (Contrast this film with figure 6, which under similar circumstances shows a tumor in the right half of the transverse colon.)

on the colon it has been my practice, as a necessary part of the procedure, to turn the patient into the left oblique position (figs. 8, 11 and 12) and often also to the right, to observe the filling of the rectum and sigmoid and to make film records ("spot films") with the film cassettes placed in the most favorable position under screen guidance and exposed without interruption of the fluoroscopic examination. Straight lateral films of

the rectosigmoid are sometimes helpful in recording for later study the appearance of the posterior wall of the rectum, which would otherwise be missed because of the impossibility of proper fluoroscopic vision through such dense parts.

Preparation of the colon by preliminary cleansing of fecal residues seems ideal. A day or two of liquid petrolatum by mouth or perhaps even an ounce (30 cc.) of castor oil, followed by enemas in the early morning the day of the examination, causes the least disturbance



Fig. 6.—After attempt at pulmic evacuation after opaque enema, it is easily recognized that the right half of the transverse colon is the seat of an irregular filling defect around which barium residues are noted. Serial films over this part of the colon, made during fluoroscopy, confirmed the diagnosis of carcinoma.

of colonic function. As a matter of practice the cleansing preparation is not usually requested, for recognition of the residual accumulations of intestinal content through the defects in an otherwise uniformly even density of the contrast shadow of the colon at once furnishes data concerning colonic stasis and gives some aid in determining the type of constipation.

A careful analysis of the problem postulated in each case will often lead to the opaque enema as the first

x-ray procedure in the study of a suspected colonic lesion. This is true whenever the lesion is thought to be of an obstructive or potentially obstructive nature, when the retention of the accumulated opaque materials from the previously given opaque meal above the site of obstruction might prove embarrassing. For example, if carcinoma of the colon is suspected, one proceeds at once to the contrast enema, supplementing it later by



Fig. 7.—So-called spot film made with a fluororadiographic switch, under fluoroscopic control, without interruption of the fluoroscopic examination. Fine detail is recorded, as in this case of carcinoma of the descending colon.

air injection and stereoscopic films should the conditions seem to indicate.

It remained for Fischer in 1923 to popularize the idea of the double contrast method, combining the contrast enema with air insufflation of the colon. His technic required the introduction of the ordinary contrast enema of about 1 liter, administered under roentgenoscopic control and assisted by manipulation with the palpating hand or by turning the patient, after which a roentgenogram was made. He then proceeded to make an



inflation of the colon without much regard for possible overdistention, although he did sometimes allow the patient partially or completely to evacuate before injecting the air. His patients were prepared by preliminary administration of a laxative sufficient to clear the colon of all foreign material, sometimes supplemented by cleansing enemas. Fischer introduced the enema by the gravity method and the air by an ordinary handblower. He thought a mixture of about four parts of air to one of opaque clysmia desirable, and he placed the patient in whatever position was most suitable for demonstrating the segment of colon under study. He particularly favored the right and left lateral positions, with the rays directed horizontally, parallel with the floor, and the film held vertically, and he evolved an elaborate analysis of the various fluid levels and mural contours.

The next stage of technical progress in colonic investigations with the roentgen rays was the development of methods for showing the internal mucosal relief of the digestive organs (figs. 5, 6, 8 and 13). Akerlund, Berg, Chaoul, Schwarz, Frik, Gilbert and many others might be mentioned, all of them basing their studies on the original work of Forsell. In this country Weber, Gershon-Cohen and others have led in reestablishing interest in air injections of the colon following the barium sulfate enema and have brought the "combined method" or "double contrast method" to a high state of refinement in technic and interpretation in the search for some means of making an earlier diagnosis of carcinoma of the colon, in differentiating various types of colitis and particularly for the discovery of small polypoid growths (fig. 13) and mucosal ulcerations.

Proper double contrast study for delineation of the mucosal pattern requires thorough preparatory cleansing of the colon to remove scybala, organic debris, mucus and the like. This is best accomplished by the administration for several days of liquid petrolatum, or by 25 or 30 Gm. of castor oil administered the night before, with ordinary cleansing enemas of tap water rendered slightly astringent with 1 per cent of tannic acid. These should be given warm, at low pressure, with the patient lying supine and with the enema tip inserted not more than an inch (2.5 cm.). The last cleansing enema should be terminated an hour or more, better three hours, before the attempt at x-ray study.

The use of salines or other purgatives should be proscribed, for they provoke hyperemia and turgescence of the mucous membranes, as do also strong soap enemas, and lead to colonic spasticity and retention of the opaque enema, the expulsion of a goodly portion of which before the insufflation is so necessary to success. Such preparation is contraindicated in suspected acute inflammations, such as appendicitis, sigmoiditis or diverticulitis, in suspected acute obstruction and in advanced cachexia or impending syncope. The insufflation becomes an unsatisfactory method when the patient cannot expel the opaque enema. In marked atonicity of the colon, the use of a cold contrast enema enables the patient to make a better expulsion of opaque material preparatory to the insufflation.

I was called in consultation in two cases of colonic diverticula in which rupture of a diverticulum occurred during rectosigmoidoscopic manipulations, one of them an examination and one a treatment. In both cases an emergency operation was demanded as a life-saving measure. But in addition to gross rupture necessitating immediate laparotomy there is the somewhat greater likelihood of the passage of air through small openings in diverticula with subsequent infection of the peritoneum. Overdistention with the opaque enema may also be somewhat hazardous for the same reason.

There are also the cases in which insufficiency of the anal sphincter inhibits the use of either the barium sulfate enema or the insufflation of air. In such, the oral use of umbrathor or of some similar preparation is likely to give some help. Schwarz has described a method of introducing the contrast enema through a rectal tube surrounded by a cotton pack and held in place by adhesive plaster.

In daily practice it transpires that the examination of the colon usually begins with the contrast enema. The patient is in the supine position, with the tip inserted only an inch or so within the sphincters. The examiner's eyes are duly prepared for roentgenoscopy. Cassettes are ready at hand and the controls are so arranged that immediate x-ray films may be made without loss of time or interruption of the screen study should something be noted worthy of record. The flow is started and careful scrutiny of the lower part of the rectum and anal region is begun the moment it com-

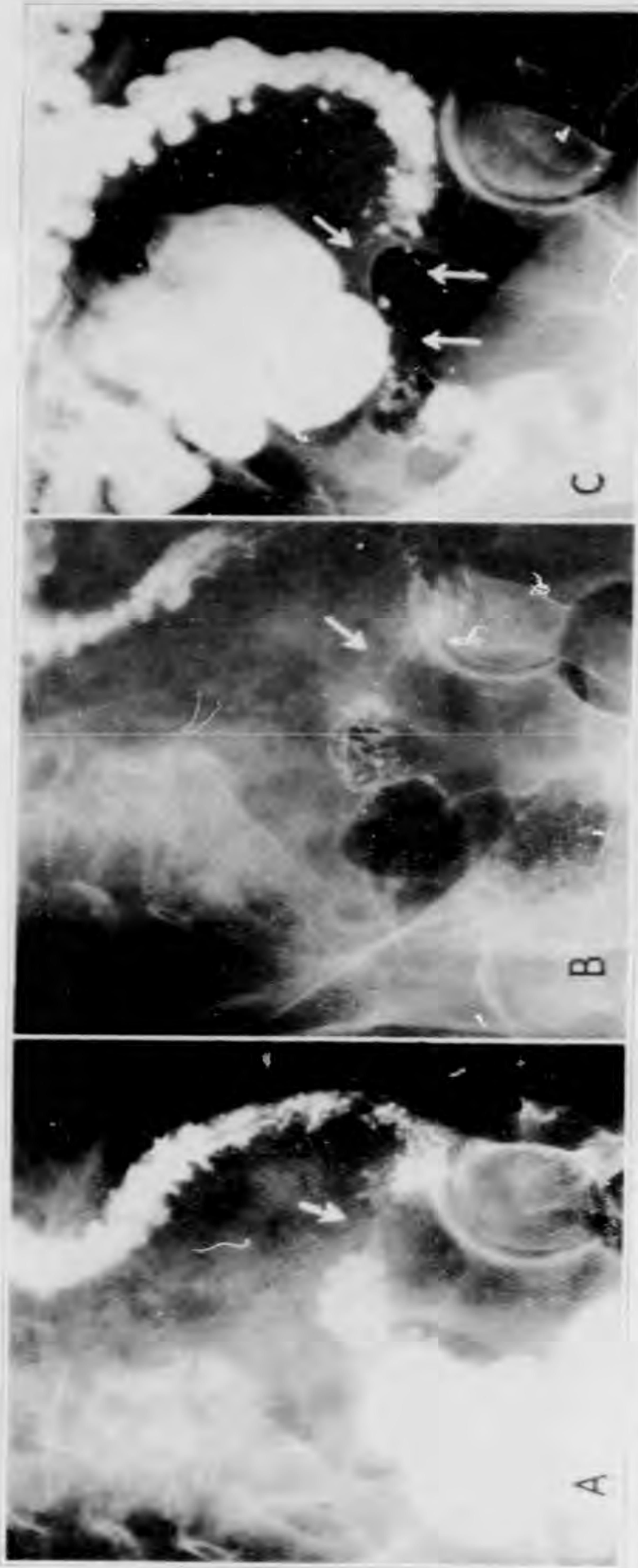


Fig. 8. Case illustrating the value of patience and deliberation in x-ray study of the colon. The patient presented an obstinate constipation with marked left-sided tenderness coinciding with a resistant area. At *A* one sees a filling defect in the sigmoid visualized with the primary opaque claytha. At *B* this structure in the sigmoid is further shown by injection of air following partial evacuation of the opaque claytha. The diagnosis as to whether the stricture is malignant or benign is still in doubt. By reintroducing some opaque material and waiting five or six hours (*C*) the presence of multiple diverticula is recognized, and the diagnosis of diverticular tumor is clear.

mences to visualize. Occasionally at the moment of beginning the opaque injection a small anal lesion (fig. 10) can be detected which is soon overshadowed by the rectal mass.

As the opaque column begins to ascend the sigmoid, the patient is partially turned on one side, usually the left, so that every inch of the advancing colonic shadow



Fig. 9.—Annular carcinoma of rectosigmoid associated with diverticula of the sigmoid. Resection of the tumor required removal of a portion of the fundus of the bladder and the sigmoid to a point above the obstruction, with end-to-end anastomosis.

may be studied. Palpation is employed as needed. Care is taken to avoid confusion of small gas or air pockets in one of the colonic haustra (fig. 4) with a polypoid growth. In spite of all precautions, small rounded fecal residues may lead to similar confusion. Serious error may result from failure to recognize these possibilities. Straight lateral films with the patient turned completely on the left side sometimes bring out small defects

in the rectal shadow from intrinsic disease or from extension of disease from the prostate, bladder or other genito-urinary organ.

These observations completed, the patient is turned once more on the back and the progress of the opaque enema further observed. Too much haste must be avoided. A relatively small amount of contrast material will suffice to visualize the entire colon without over-distending it if one is not too precipitate. Impatience and press of work are incompatible with successful fluororadiography of the colon, especially if one wishes to combine contrast methods. Overdistention must be avoided if it is desired that the patient shall be able to

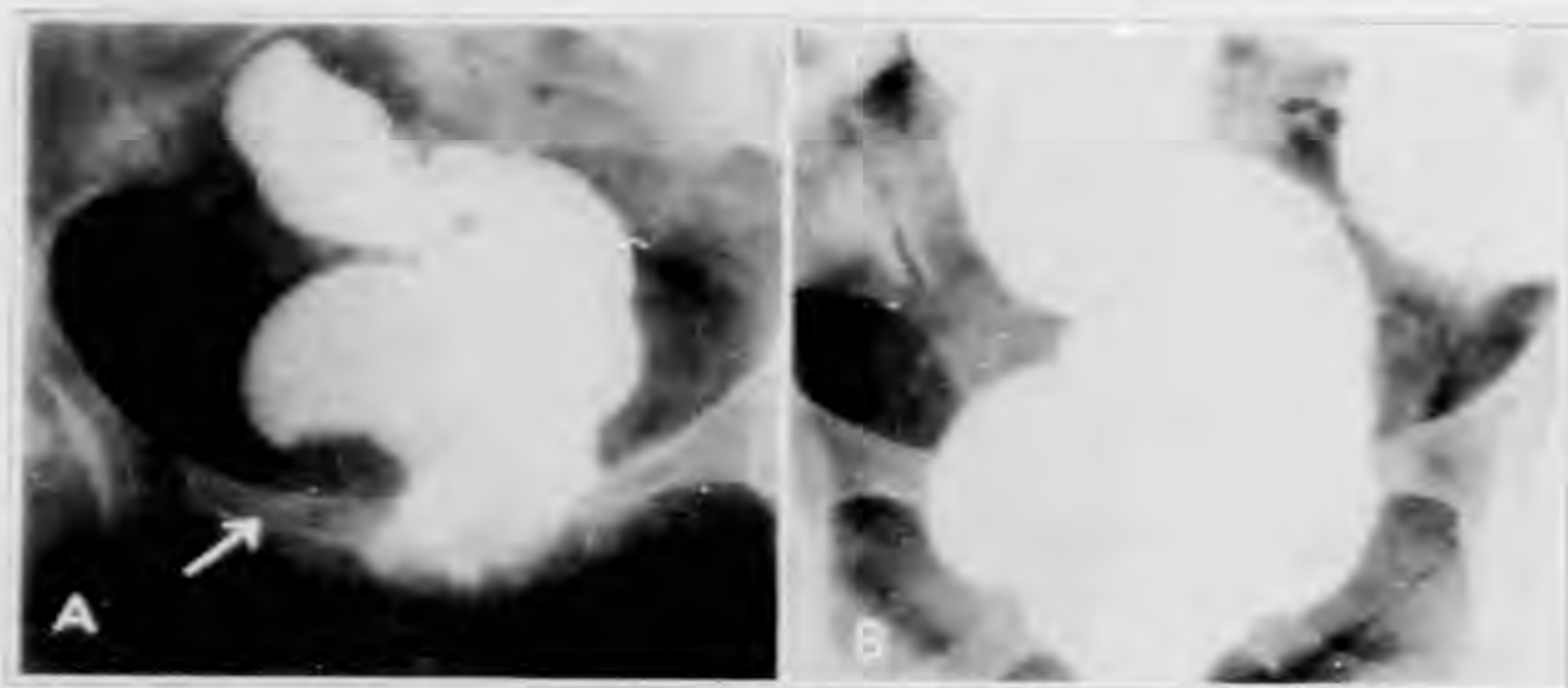


Fig. 10.—This case illustrates the necessity of having a physician-radiologist conduct the entire examination of the colon by enema under fluoroscopic control. In this case a definite filling defect is seen in the rectum before it becomes completely filled with the opaque enema; for with complete distention with the opaque enema the defect due to the carcinoma is entirely hidden by overlying shadows.

make a satisfactory expulsion of the contrast fluid preparatory to the possible use of insufflation.

Again the patient is turned as needed to bring into unobstructed screen vision the two legs of the splenic and hepatic flexures. Intestinal coils may be pushed aside by palpation through the abdominal wall with the protected hand or the nonopaque wooden palpator.

Finally attention is given to the cecum. If the colon is of the irritable spastic type, the head of the opaque column will have reached the cecum quickly, and in most cases several feet of ileum will fill. Marked insufficiency of the ileocolic valve is one of the roentgenologic characteristics of the irritable colon, as was shown by Guido Holzknecht and Singer in Vienna

twenty-five years ago. In cases of suspected ileocecal tuberculosis this filling of the ileum is helpful, permitting scrutiny of the terminal coils of ileum for possible ulceration. It is also helpful in granulomatous ileitis. But when it is desired to make insufflation studies after expulsion of the contrast enema, this filling of the terminal ileum by the opaque enema constitutes a distinct complication.

More satisfactory study of the cecum and ascending colon is possible if the patient is allowed first to expel part of the contrast enema, the object being to clear the rectum and sigmoid and to diminish the amount of opaque material in the rest of the colon distal to the hepatic flexure. This is particularly required when the cecum is elongated so that it extends into the true pelvis



Fig. 11.—It is necessary as a routine practice to make an oblique film of the sigmoid in all colonic examinations (B) as well as a film in the usual (A) anteroposterior or posteroanterior projection. In this instance the diverticula would have escaped detection had not the oblique observation been employed.

or when the sigmoid loop turns to the right. With the protected hand or palpator the cecum may be moved about to test its mobility and to make compression for the purpose of bringing out small defects on the anterior or posterior walls. This maneuver also insures complete filling of the cecum and ascending colon and thorough admixture of the opaque material with any residual nonopaque residues. With such palpation and compression it is possible to detect even small ulcerations, polypi and diverticula on the anterior or posterior walls which might otherwise escape recognition. Compression may also be accomplished by interposing a loofah pad and making pressure with it by pushing on the screen. These devices together with appropriate turning of the patient usually permit satisfactory study

of the cecum, appendix and terminal ileum. The cecal region is perhaps the least satisfactory of all segments of the colon for study with insufflation because of the confusing shadows resulting from air-filled coils of terminal small bowel, and it is here that the single contrast enema least needs supplementing.

Sometimes the patient expels the enema so completely that it is necessary to make a supplementary injection and partial expulsion before proceeding with the insufflation; but usually the difficulty is that the colon is insufficiently clear of the opaque fluid or that a satisfactory coating of the mucosa is not achieved. It is sometimes best to wait a little while, ten or fifteen minutes, before asking the patient to evacuate, and then

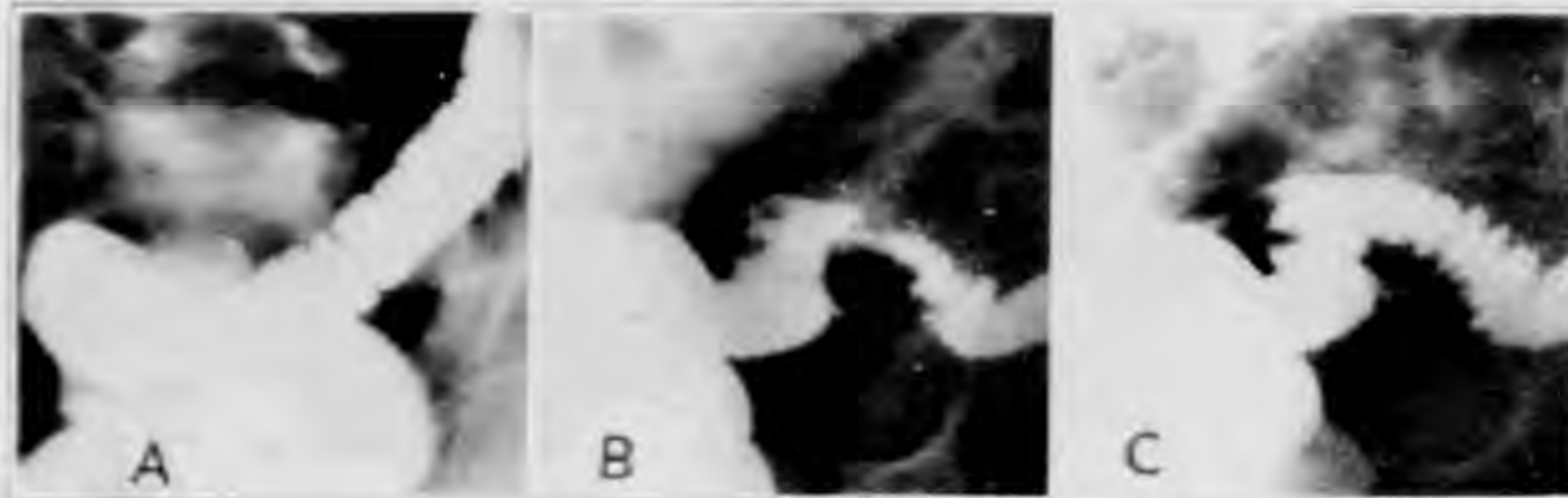


Fig. 12.—Diverticulosis of the sigmoid completely hidden in the usual anteroposterior or postero-anterior film (A) but nicely visualized in the oblique projection (B). The differentiation between carcinoma and diverticulitis was based on the difference in caliber of the sigmoid at the site of the lesion (B) following the administration of antispasmodics (C). At operation the surgeon was undecided as to the diagnosis and did a colectomy. Five years later the patient is still in excellent health and the colectomy is still not closed.

he should be advised not to attempt too thorough expulsion of the contrast enema. It is better to evacuate too little and be sent back several times. Too violent expulsive efforts are likely to eliminate the mucosal coating completely. At once, after the proper degree of evacuation, as noted on the screen, has been achieved, another film or two may be exposed and the insufflation made. If the evacuation is still insufficient, the patient may be given a drink of ice water or an injection of double strength solution of posterior pituitary or of pitressin.

It will be apparent to those not personally familiar with the double contrast method that it is very much a time-consuming proposition, and in a busy office it

On December 20 the culture was fixed in formalin and stained with hematoxylin. Two drawings of the stained specimen were made (figures 2 and 3), showing the amorphous center and its crown of actively growing tissue.

Even after seventy-five or eighty days, cultures of connective tissue made by the first two methods had about the same appearance, all of them resembling the later stages of the culture of the iliac vessel first described.

By the same method a few fragments of adult dog tissues, such as thyroid and periosteum, were cultivated, and several generations of connective tissue cells were obtained.

Frequently the cultures of Rous sarcoma died after a few days. The plasma became liquefied and the tissue disintegrated. Nevertheless, a small fragment of it could be kept in active life for forty-six days.

*Culture of the Rous Sarcoma.*—On January 24, 1912, a small piece of a Rous sarcoma was cultivated in hypotonic plasma. The growth was rapid and abundant. On January 26 the fragment was surrounded by an immense number of radiating fusiform cells and by a peripheral crown of round and polygonal cells. On January 26 and 29 the culture was washed for three or four minutes in Ringer's solution and put in a new medium. On January 30 fusiform cells only could be seen in the culture. On January 30 and on February 1, 3, 5, and 7 the culture underwent its third, fourth, fifth, sixth and seventh passages. The growth was not very active. On February 7 the culture was divided into two parts. One of these was washed and underwent its eighth passage on February 9. After the ninth and tenth passages on February 10 and 12, a microbial colony appeared in the medium. Nevertheless the active part of the culture could be extirpated without being contaminated and underwent its eleventh passage on February 15.

Afterwards the growth was small but aseptic. After the twelfth passage on February 17 the tissue produced a partial liquefaction of the medium with division or dissociation of the new tissue. Nevertheless, after the thirteenth passage on February 20 and the fourteenth passage on February 22 the tissue began to grow more abundantly and regularly without liquefaction of the medium. From February 24 to March 1 the culture underwent its fifteenth, sixteenth, seventeenth, and eighteenth passages. The growth was abundant and the culture increased very much in size. On March 5 a marked retraction of the plasma occurred. After the nineteenth and twentieth passages the growth became very small and death occurred without any apparent cause.

When the tissues were cultivated according to the third method the appearance of the cultures was different. Instead of being interrupted, the growth was continuous, and as there was no sectioning of the plasma, there was, as a consequence, no retraction.



intervals, to differentiate between polypoid, small gas bubbles and retained scybala.

There is another diagnostic pitfall in relation to polypoid; viz., small boluses of gas in the third row of haustra (fig. 4). Ordinarily in the flat film one sees only two rows of haustral sacculations, since most of our studies are made with opaque or relatively opaque contrast mediums and without stereoscopic films. But the longitudinal bands of the colon and the haustral contractions form three rows of sacculations, the third one of which tends to accumulate small quantities of air or gas which, by being superimposed on the other shadows, may simulate polypoid.

Still another device may aid in recognizing small intraluminal tumors, provided they exceed a centimeter or so in diameter; viz., observation of the contracted colon following expulsion of the contrast enema. This may show a localized fusiform enlargement of the bowel representing the localized bulging of the visualized mucosa where the colonic walls are propped apart by the nonopaque and otherwise invisible tumor mass (figs. 5 and 6).

The mucosal pattern method is also of value in selected cases. Sometimes the mucosal pattern is nicely exhibited spontaneously during the single contrast method or after partial expulsion or after insufflation. For artificial demonstration of the internal relief of the bowel without insufflation, the same special pains must be taken to cleanse the colon as with the preceding methods; then one injects slowly and without overdistention the opaque material (colloidal thorium or other agent selected), after which compression is made and maintained at suspected sites while Potter-Bucky diaphragm films are made for record and further study. Such films are preferably stereoscopic.

The inconvenience of the artificial mucosal relief method is probably out of proportion to its practical importance. To those who are especially devoted to this method, Schwarz remarks that the expensive umbrathor has an astringent content which probably explains its usefulness. If an ordinary contrast enema is rendered slightly astringent by the addition of 1 per cent tannic acid it seems to answer the purpose equally well at a fraction of the cost. Especially in cancer it has not yet been shown that the demonstration of the

mucosal pattern aids materially in the diagnosis. The presence of an intact mucosal relief pattern does not exclude carcinoma, for in some cases, especially the early ones which it is so desirable to recognize, the lesion may make a considerable submucous extension before breaking through the mucosa. More important than the mucosal relief pattern is the constant finding of a circumscribed narrowing of the lumen or encroachment into the lumen, and a delineation of the exact contours of the afferent and efferent stretches of mucosa in the vicinity of the defect. The mucosal pattern method depends chiefly on one's success in coating with the opaque materials the wall of the colon so well that the lateral contours of the mucosal lining are traceable as accurately as though drawn in with a sharp pencil.

55 East Washington Street.

1912

2

ON THE PERMANENT LIFE OF TISSUES OUTSIDE OF  
THE ORGANISM

By ALEXIS CARREL, M.D.

## ON THE PERMANENT LIFE OF TISSUES OUTSIDE OF THE ORGANISM.\*

BY ALEXIS CARREL, M.D.

(From the Laboratories of The Rockefeller Institute for Medical Research, New York.)

PLATES 75 AND 76.

### INTRODUCTION.

It is known that the life of a tissue cultivated *in vitro* is very short.<sup>1</sup> Generally, in three to fifteen days after the preparation of the cultures their growth becomes less rapid and eventually stops completely. The tissues then die and the cells disintegrate.

The purpose of the experiments described in this article was to determine the conditions under which the active life of a tissue outside of the organism could be prolonged indefinitely. It might be supposed that senility and death of the cultures, instead of being necessary, resulted merely from preventable occurrences; such as accumulation of catabolic substances and exhaustion of the medium. The suppression of these causes should bring about the regeneration of old cultures and prevent their death. It is even conceivable that the length of the life of a tissue outside of the organism could exceed greatly its normal duration in the body, because elemental death might be postponed indefinitely by a proper artificial nutrition.

In the following experiments I sought not a complete solution of the problem of prolonging indefinitely the life of tissues *in vitro*, but the facts that would show in which direction we should proceed in order to secure a complete solution, if such a solution be possible.

In September, 1911, I tried to increase the duration of the life of cultures of connective tissue.<sup>2</sup> The cultures were washed for

\* Received for publication, March 15, 1912.

<sup>1</sup> Harrison, Harvey Lectures, Philadelphia and London, 1911-1912; *Jour. Exper. Zool.*, 1910, ix, 787; Carrel and Burrows, *Jour. Exper. Med.*, 1911, xiii, 387.

<sup>2</sup> Carrel, *Jour. Am. Med. Assn.*, 1911, lvii, 1611.

several minutes in Ringer's solution and were then placed in a new medium. As a consequence, the growth was observed to become more rapid. By repeated washings and passages the occurrence of senility was prevented, and the length of life was very much increased. Some cultures could be maintained in active life for fifty, fifty-five, and even for sixty days.<sup>3</sup> These results showed that the early death of tissues cultivated *in vitro* was preventable, and, therefore, that their permanent life was not impossible.

Subsequently, I developed other techniques by which it might be possible to obtain permanent life of tissues. The ideal method would have been to give to the cultures an artificial circulation by which they might have secured their nutrition and eliminated their waste products. It was attempted to place the tissues in a thin layer consisting of cellulose and coagulated plasma, and through this a slow stream of serum flowed. But it appeared soon that better results could be obtained by a simpler and more indirect method. Instead of establishing a circulation of the medium through the tissues, it was easier to have the cultures pass from medium to medium. The media usually employed consisted of Ringer's solution and hypotonic plasma. It was found that the resistance of a tissue placed in a non-nutritive, but preservative medium was very much stronger if the temperature was low. The cultures were, therefore, placed under conditions having two alternate phases: there was a phase of active life at 38° C. during which the tissue grew, used its medium, and was surrounded by its catabolic products; and a phase of latent life at 0° C. during which it was washed free of its products, to be subsequently placed in a new medium.

In February, 1912, this technique was modified and the phase of latent life in Ringer's solution in cold storage was replaced by a phase of active life in serum in the incubator. Instead of being interrupted, the life of the tissues was continuous and their growth more rapid.

#### METHODS.

The methods chiefly employed were three. They are as follows: *Technique I.*—The original piece of tissue and the surrounding

<sup>3</sup> Pozzi, *Bull. de l'Acad. de méd.*, 1912, lxxvii, 26.

new cells were extirpated with a cataract knife from the fragment of coagulated plasma that contained them. They were washed for several minutes in Ringer's solution at the temperature of the laboratory, and were then placed in a new medium composed of one or two parts of distilled water and of three parts of normal plasma, to which a drop of embryonal or muscle extract was added. The washings and passage were made either before the appearance in the culture of the symptoms of senility, or when these were still very slight. The passage was repeated more or less frequently according to the rate of the growth and to the conditions of the cells.

*Technique 2.*—In the second method the washing of the cultures was more prolonged and was performed while the tissues were in cold storage. The life of the cultures was maintained under conditions in which two phases alternated: a phase of active life in a plasmatic medium in the incubator, and a phase of latent life in Ringer's solution in the refrigerator.

*Technique 3.*—In the third method the cultures were maintained in a condition of continuous life by alternating passages from plasma to serum at the temperature of the organism. The cultures were prepared in the following manner: A piece of silk veil about one centimeter square was placed on a cover glass and moistened with a drop of plasma. A fragment of tissue was deposited in the centre of the square and covered by a few drops of plasma. Afterwards the culture was sealed on a hollow slide, put in the incubator, and allowed to grow. After a few days the silk veil together with the coagulated plasma and tissue, was detached from the cover-glass with a knife. As the silk veil acted as a skeleton for the plasmatic jelly, the original fragment, and the new tissue cells, the culture could be handled easily without folding and retraction of the medium, and without deformation of the cells. The veil and the culture attached to it were placed in a tube containing homogenic serum, which was kept at incubator temperature. After a few days it was put again in plasma, and subsequently the two phases alternated regularly.

*Experiments and Results.*—A great many experiments were performed. In most of the cultures were used connective tissue of

blood vessels, heart, skin, muscles, peritoneum, and spleen, of fourteen to twenty day old chick fetuses. In other cultures were employed fragments of the Rous sarcoma, and in a few cases, tissues of adult dogs. Many cultures survived six to fourteen or fifteen passages in a condition of interrupted or continuous growth. A few cultures were transplanted seventeen, eighteen, and even twenty or more times. Some are still living and have reached the beginning of the third month of their life *in vitro*. It was possible, therefore, to study the morphological and dynamic characters of tissues cultivated for more than two months outside of the organism.

#### MORPHOLOGICAL CHARACTERS.

The appearance of the cultures grown by technique 1 was almost identical with that of the cultures grown by technique 2. The fragment of tissue was surrounded rapidly by cells spreading in a thin layer through the medium. After section of the plasma, the new tissue retracted around the original fragment forming an opaque crown. During the period of washing there was no modification of the culture, but as soon as the culture was put in a new medium in the incubator, elongated cells began to grow from the edges of the old plasma and to spread into the new medium. After a few passages the original fragment appeared diminished in size and surrounded by a dense envelope of a greyish tissue from which radiated a great many elongated cells, living and dead.

The original fragment was often encircled by several concentric rings, each representing a period of active life. Soon the rings were united in a homogeneous tissue. When they remained distinct, however, they might indicate the number of passages undergone by the culture, as the age of a tree can be read on a section of its trunk. Progressively the original fragment disappeared and was replaced by an amorphous yellowish substance. The form of the culture was also modified. At the beginning of the growth the culture appeared like a thin plate, but it grew progressively more and more like a flattened sphere in the center of which were accumulated a few foreign bodies and pieces of old plasma (figure 1), which were encysted by the living cells. After about forty days the

cultures of connective tissue generally took the typical appearance represented in the drawings (figures 2 and 3) of a culture fifty days old.

*Cultivation of Connective Tissue (Experiment 715).*—A short segment of the iliac vessels of a twenty-one day old chick fetus was extirpated on November 1, 1911, and placed in hypotonic chicken plasma and muscle extract. A large growth of connective tissue cells developed in the next few days.

On November 3 the plasma was cut and the culture was placed in Ringer's solution in cold storage from 9:52 A. M. to 10:35 A. M. Afterwards, the first passage into a new medium was made. A large growth resulted.

On November 6 the second passage was made after washing in Ringer's solution and keeping in cold storage from 9:55 A. M. to 10:58 A. M. At 2:30 P. M. fusiform cells had already invaded the new medium.

On November 9 the third passage was made after washing for six minutes in Ringer's solution, and on November 13 the fourth passage was made after washing in Ringer's solution and keeping in cold storage from 9:50 A. M. to 10:42 A. M. The iliac vessels were becoming progressively smaller, while a thick crown of cells in concentric lines surrounded the original fragment.

On November 16 the culture was washed in Ringer's solution and in cold storage from 9:20 A. M. to 10:12 A. M., and then placed in a medium composed of plasma and muscle extract. There was a large growth (fifth passage).

On November 20 the culture was washed in Ringer's solution in cold storage from 9 A. M. to 11:12 A. M., and then transferred to plasma and muscle extract (sixth passage).

On November 24 the culture was placed in a medium composed of hypotonic plasma and embryonic extract (seventh passage), after having been washed in cold storage and in Ringer's solution from 9 A. M. to 10:18 A. M.

On November 25 a large growth of cells was seen in the medium. The original fragment had almost completely disappeared, and the culture has a tendency to take a spherical form.

On November 28 the culture was placed in Ringer's solution and in cold storage from 9:30 A. M. to 12:02 P. M. and afterwards in hypotonic plasma and embryonal extract (eighth passage), and on November 29 a large growth was observed. The culture assumed the form of a flattened sphere, the center of which was clear and amorphous.

From December 2 to December 12 the culture underwent its ninth, tenth, eleventh, and twelfth passages. Before each passage it was washed for four or five minutes in Ringer's solution at the temperature of the laboratory.

On December 14 the culture was composed of a central amorphous part of a thick ring of new tissue, and of a peripheral crown of elongated cells radiating through the culture medium.

On December 15 the culture was placed into a new medium after having been washed for four minutes, and on December 16 a large growth through the new medium was seen. The rate of growth had markedly increased.

On December 18 the culture was washed for three minutes and underwent its fourteenth passage, in which a rapid growth of elongated tissue cells was observed.



On December 20 the culture was fixed in formalin and stained with hematoxylin. Two drawings of the stained specimen were made (figures 2 and 3), showing the amorphous center and its crown of actively growing tissue.

Even after seventy-five or eighty days, cultures of connective tissue made by the first two methods had about the same appearance, all of them resembling the later stages of the culture of the iliac vessel first described.

By the same method a few fragments of adult dog tissues, such as thyroid and periosteum, were cultivated, and several generations of connective tissue cells were obtained.

Frequently the cultures of Rous sarcoma died after a few days. The plasma became liquefied and the tissue disintegrated. Nevertheless, a small fragment of it could be kept in active life for forty-six days.

*Culture of the Rous Sarcoma.*—On January 24, 1912, a small piece of a Rous sarcoma was cultivated in hypotonic plasma. The growth was rapid and abundant. On January 26 the fragment was surrounded by an immense number of radiating fusiform cells and by a peripheral crown of round and polygonal cells. On January 26 and 29 the culture was washed for three or four minutes in Ringer's solution and put in a new medium. On January 30 fusiform cells only could be seen in the culture. On January 30 and on February 1, 3, 5, and 7 the culture underwent its third, fourth, fifth, sixth and seventh passages. The growth was not very active. On February 7 the culture was divided into two parts. One of these was washed and underwent its eighth passage on February 9. After the ninth and tenth passages on February 10 and 12, a microbial colony appeared in the medium. Nevertheless the active part of the culture could be extirpated without being contaminated and underwent its eleventh passage on February 15.

Afterwards the growth was small but aseptic. After the twelfth passage on February 17 the tissue produced a partial liquefaction of the medium with division or dissociation of the new tissue. Nevertheless, after the thirteenth passage on February 20 and the fourteenth passage on February 22 the tissue began to grow more abundantly and regularly without liquefaction of the medium. From February 24 to March 1 the culture underwent its fifteenth, sixteenth, seventeenth, and eighteenth passages. The growth was abundant and the culture increased very much in size. On March 5 a marked retraction of the plasma occurred. After the nineteenth and twentieth passages the growth became very small and death occurred without any apparent cause.

When the tissues were cultivated according to the third method the appearance of the cultures was different. Instead of being interrupted, the growth was continuous, and as there was no sectioning of the plasma, there was, as a consequence, no retraction.

Moreover, as the plasma was supported by its skeleton of silk, the culture could not take a spherical form, and the tissue grew in a thin layer; that is, under the best conditions for a tissue deprived of circulation. The plasmatic jelly was adherent to the silk veil, and the tissue imbedded in the plasma grew as in an ordinary culture. The cells could use the silk threads as a support, but they seldom did. The purpose of the silk was merely to give such a consistency to the medium that it would not fold over or become spherical during the passages in plasma and in serum.

Normal heart was cultivated according to this technique. Its appearance after a few passages was the same as after a few days. The size of the growth alone was modified.

By the same procedure many fragments of the Rous sarcoma were also cultivated. They could be kept in a condition of active and continuous development for more than fifteen days. But the medium was progressively overcrowded with dead cells and the growth of the tissue became more irregular and less abundant. The fragments could not adapt themselves to their new conditions of life and were less resistant than normal connective tissue.

The appearance of the cells growing in cultures of normal connective tissue often varied periodically. During the first few days of growth the fusiform cells were long and thin and contained clear cytoplasm. After four or five days they became larger and their cytoplasm was darker and filled with large fatty granulations. At the same time the rate of growth diminished. After being washed and transferred to a new medium, the appearance of the cells was again modified. They regained their original appearance and the rate of growth was accelerated. Instead of being periodical, the morphological modifications might be continuous. For instance, in the cultures of spleen the original fragment was surrounded during the first phases of active life by an envelope of ameboid cells. After a few days long chains of fusiform cells appeared around the fragment, while the ameboid cells died and disappeared. Ultimately the fusiform cells were replaced by small polygonal cells which spread around the fragment in a continuous layer. In the culture of the Rous sarcoma the round cells disap-

peared after a few days, while the elongated cells were still growing after forty days. In a culture of heart very large ameboid cells wandered out from the central fragment for more than two months. At the beginning of the third month of its life the culture was composed of elongated cells radiating through the old plasma. They were apparently the result of the development of the large ameboid cells.

#### DYNAMIC CHARACTERS.

The rate of growth could be appreciated by the rapidity with which the cells, after a passage, appeared and spread in the new medium. The nature of the medium, its osmotic tension, the way in which the plasma was cut, the amount of old plasma left around the cells, the form of the culture, and the frequency of the passages, often had a marked influence on the rate of the growth. The oscillations in the rate seemed generally to be the result of accidental causes, but it was very difficult to exclude the possibility that they might be due to causes inherent in the condition of tissues liberated from the control of its organism. Generally, after the first passage the cells appeared in the medium without a latent period. This was true even in the culture of periosteum and of other tissues of adult dogs. Two or three hours after a passage many elongated cells were observed growing out from the edges of the old plasma into the new medium, and they soon surrounded the central piece by a dense layer. The rapidity of their growth often diminished after a few passages, but afterwards increased progressively. The rate of growth of a culture forty or forty-five days old was more rapid than when it was ten or fifteen days old. It seemed that the older a culture was, the quicker it grew. The rate of growth of a fifty-four day old culture of connective tissue from the portal vein was more rapid than at the beginning of its life *in vitro*. The rate of growth of a culture of heart was greater at the beginning of the third month of its life outside of the organism than at any other period.

These accelerations of the growth were possibly functions of the age of the culture. But the number of the experiments was not large enough to exclude the possibility that they were due to other causes.

The size of the cultures underwent also many modifications. For long periods of time, the cultures increased in size, diminished, or were not modified.

The diminutions in size were due chiefly to accidental causes, such as destruction of cells during the handling of the cultures, folding of the plasma, and concentration of the medium, but especially to microbial infection.

In a few experiments marked increase in size was observed. The tissue of a culture of portal vein had been considerably reduced after infection, and for several generations it increased but slightly. Then the growth became more active and after the fiftieth day the volume of the tissue increased rapidly. In a culture of connective tissue which had remained very small for two months, a great acceleration of growth and a marked increase in size was observed after sixty days. In another instance a culture of heart became so large after sixty-two days that it had to be divided into several parts.

It is generally difficult to ascertain whether or not the mass of the tissue actually increases, because changes in the density of the tissue can be mistaken for a change in its mass. Nevertheless, the observation of a culture of a diluted suspension of cells demonstrated that a real increase in the volume of the tissue could take place.

*Culture of Cells Suspended in Ringer's Solution.*—On February 1, 1912, a nine day old chick embryo was cut into very small pieces, and to the pieces an equal volume of Ringer's solution was added. The suspension was centrifugalized for five minutes, and a drop of the supernatant fluid was then added to a culture medium. On February 2 many isolated cells were seen in the peripheral part of the medium. On February 5 the number of these cells had increased very much. The part of the plasma where they had grown was resected, washed, and put in a new medium. The culture underwent its second, third, fourth, and fifth passages on February 2, 10, 13, and 16. The cells had then increased so much in number that they formed a real tissue, and had the appearance of an ordinary culture. The life of these cells afterwards was like that of other cultures.

Since a few scattered cells could generate a culture similar to the culture of fragments of tissue, it is absolutely certain that the cells multiply and that they do not merely wander from the central piece.

Generally, the cultures remained very small in spite of their constant growth, and often they did not increase at all in size. It is probable that the limitation of growth is due to certain mechanical conditions. Cultures have a tendency to become spherical. The nutriment that reaches the center of such cultures is insufficient, but that which is supplied to the periphery is abundant. Hence, the cells at the periphery multiply ceaselessly. But as soon as cells are isolated from the medium by a sufficient thickness of new tissue, their nutrition probably becomes deficient and they disintegrate. While the culture increases constantly by its periphery, it diminishes in its center and therefore its volume does not increase.

A tissue deprived of circulation probably cannot grow in a nutritive medium beyond a certain volume which is a function of its permeability to the medium and consequently of the thickness of the culture. If the culture be spherical its volume will remain very small, since the nutrition of its center is insufficient. From a theoretical standpoint, on the other hand, a tissue growing in a very thin layer could increase indefinitely. It is for this reason that the tissues were cultivated on a silk veil, for the veil prevented the plasma of the culture from retracting and becoming spherical.

The attempt was also made to ascertain whether tissues after a long period of life *in vitro* could retain their normal functions. The experiments were carried out with fragments of chick fetus heart, which, as is well known, can grow and pulsate for several days when kept at a proper temperature in plasma. In December, 1911, it was observed that when the pulsations of a culture of heart stopped, they began again after the tissue had been washed and transplanted into a new medium. Then in January, 1912, the attempt was made to determine the interval during which the cardiac muscle would retain its property of contracting rhythmically. Three experiments gave positive and identical results. One of these will be described.

*Cultivation of the Heart (Experiment 720-1).*—On January 17, 1912, a small fragment of the heart of an eighteen day old chick fetus was cultivated in hypotonic plasma. The fragment pulsated regularly for a few days and grew extensively. After the first washing and passage on January 24 the culture grew again very extensively, but there were no rhythmical contractions. On

January 29 and February 1, 3, 6, 9, 12, 15, 17, 20, 24, and 28, the culture underwent eleven washings and passages. It became surrounded by fusiform cells and many dead cells. There were no pulsations. After the twelfth passage the culture did not grow at all. Then the tissue was dissected and the old plasma was completely extirpated. A small central fragment was removed, washed, and put in a new medium. On March 1 it was pulsating at a rate that varied between 60 and 84 per minute. On March 2 the pulsations were 104 at 41° C., and on March 3, 80 at 40° C., but on March 4 the pulsations were very weak and stopped altogether at 2 P. M. On March 5 the culture underwent its fourteenth passage, and the pulsations reappeared immediately. They became weak again on March 7. On March 8 the fifteenth passage was made. On March 9 the pulsations were again 80 to 82 per minute at 40° C., and on March 12 they were 60 per minute. They then became slower and weaker. After the sixteenth passage on March 12 the pulsations were irregular, and the fragment beat for a series of 3 to 4 pulsations, and then stopped for about 20 seconds. After the seventeenth passage on March 16 regular pulsations at 52 beats per minute reappeared, and the tissue grew abundantly. After the eighteenth passage on March 19 the pulsations were irregular.

It was thus demonstrated that a fragment of chicken heart could still pulsate rhythmically at the beginning of the third month of its life outside of the organism. It showed, consequently, that a fragment of tissue living *in vitro* could retain its normal function for a long time.

The maximum age that tissues living *in vitro* can reach is still undetermined. Many cultures have died after less than two months, but a few were very active at the beginning of the third month of their life outside of the organism. Generally, the tissues seemed, after a time, to adapt themselves to their new condition, and after the fourteenth or fifteenth passage, very few cultures died spontaneously. In the handling and changes required by the passages, the cultures were exposed to many accidents, chiefly to microbial infections. In case of a local infection the part of the culture that was not yet infected was resected with a cataract knife and placed in a new medium. Often the culture recovered and produced several generations of cells that were free from microbial infection. But when infection was generalized, the tissues always died rapidly. Many cultures died of sepsis. In the description that follows is an illustration of this kind of death.

*Culture of Portal Vein (Experiment 483).*—On September 27, 1911, a fragment of the portal vein of a chick fetus sixteen days old was cultivated in three

parts of chicken plasma and two parts of distilled water. The tissue grew very extensively. On October 2 the culture was divided into three parts. One was washed in Ringer's solution for five minutes and put in a new medium. On October 7 it had grown extensively and was again divided into two parts. One part was washed and transplanted into a new medium and a large growth followed. On October 9 and 12 the third and fourth washings and passages took place. On October 14 a very large growth of long, clear, slender fusiform cells was present. On October 16 the growth had stopped and the cells were large and contained very large fat granules. On October 16 the fifth washing and passage took place, and on October 17 the growth of fusiform cells, which were again clear with few granules, was very active. After the sixth passage on October 20 retraction of the medium occurred, and the growth of the tissue was slight. By October 22 the original fragment had diminished greatly in size. On October 23 and October 26 the culture underwent its seventh and eighth passages, and on October 27 the original fragment was no longer to be distinguished. The culture was composed of an amorphous central part around which a crown of active tissue had developed. The tissue was disposed in concentric circles and from its peripheral part elongated cells radiated through the culture medium (figure 1). After the ninth and tenth passages on October 30 and November 4, a great increase in the rate of the growth was observed, but after the eleventh passage on November 9 the culture assumed a spherical shape, but grew extensively nevertheless. On November 10, 13, 16, and 18, the twelfth, thirteenth, fourteenth, and fifteenth passages took place. The rate of growth was very rapid. One hour after the fifteenth passage, the fusiform cells had already invaded the new culture medium, but on November 19 a large microbial colony appeared on one side of the culture, and on November 20 the culture was invaded by a great many bacterial colonies. The death of the tissue occurred soon after.

Nearly all the cultures made in the latter part of 1911 died in the same manner after one to two months. By slight modifications of the technique, however, infection was almost completely eliminated in the experiments made in the beginning of 1912.

Of sixteen cultures of heart and blood-vessels made on January 17, 1912, five were still very active in March, 1912, and of the five active ones, two heart cultures previously described grew slowly, but pulsated, and another heart culture, which pulsated from time to time, produced a large growth of ameboid and fixed cells which covered an extensive area of the medium. In this instance after having been motionless for two months, the central part of the culture manifested strong rhythmical contractions on the sixty-fifth day of its life *in vitro*. Moreover, two cultures of connective tissue made on January 17 were growing actively at the beginning of April. The rate of growth and the increase in their volume became very much greater as they grew older.

## SUMMARY AND CONCLUSION.

In two series of experiments made at the end of 1911 and at the beginning of 1912, new techniques were developed with the view of investigating the problem of prolonging indefinitely the life of tissues isolated from the organism. These techniques are far from perfect and will doubtless be modified in the future. But they have already permitted the establishment of new facts.

Fragments of connective tissue have been kept *in vitro* in a condition of active life for more than two months. As a few cultures are now eighty-five days old and are growing very actively, it is probable that, if no accident occurs, the life of these cultures will continue for a long time.

In some cases the rate of growth of the tissues increased in direct ratio to the age of the culture.

Fragments of heart pulsed rhythmically at the beginning of the third month of their life *in vitro*.

These facts show that experiments made with these or with more perfect techniques and followed over long periods of time may lead to the solution of the problem of permanent life of tissues *in vitro*, and give important information on the characters acquired by tissues liberated from the control of the organism from which they were derived.

## EXPLANATION OF PLATES.

## PLATE 75.

FIG. 1. A thirty day old culture of connective tissue. The center of the culture consists of debris of old plasma. Around it is a ring of concentric layers of very active new tissue.

## PLATE 76.

FIG. 2. A fifty day old culture of connective tissue. Active tissue is encircling a piece of old plasma.

FIG. 3. Peripheral part of the same culture.



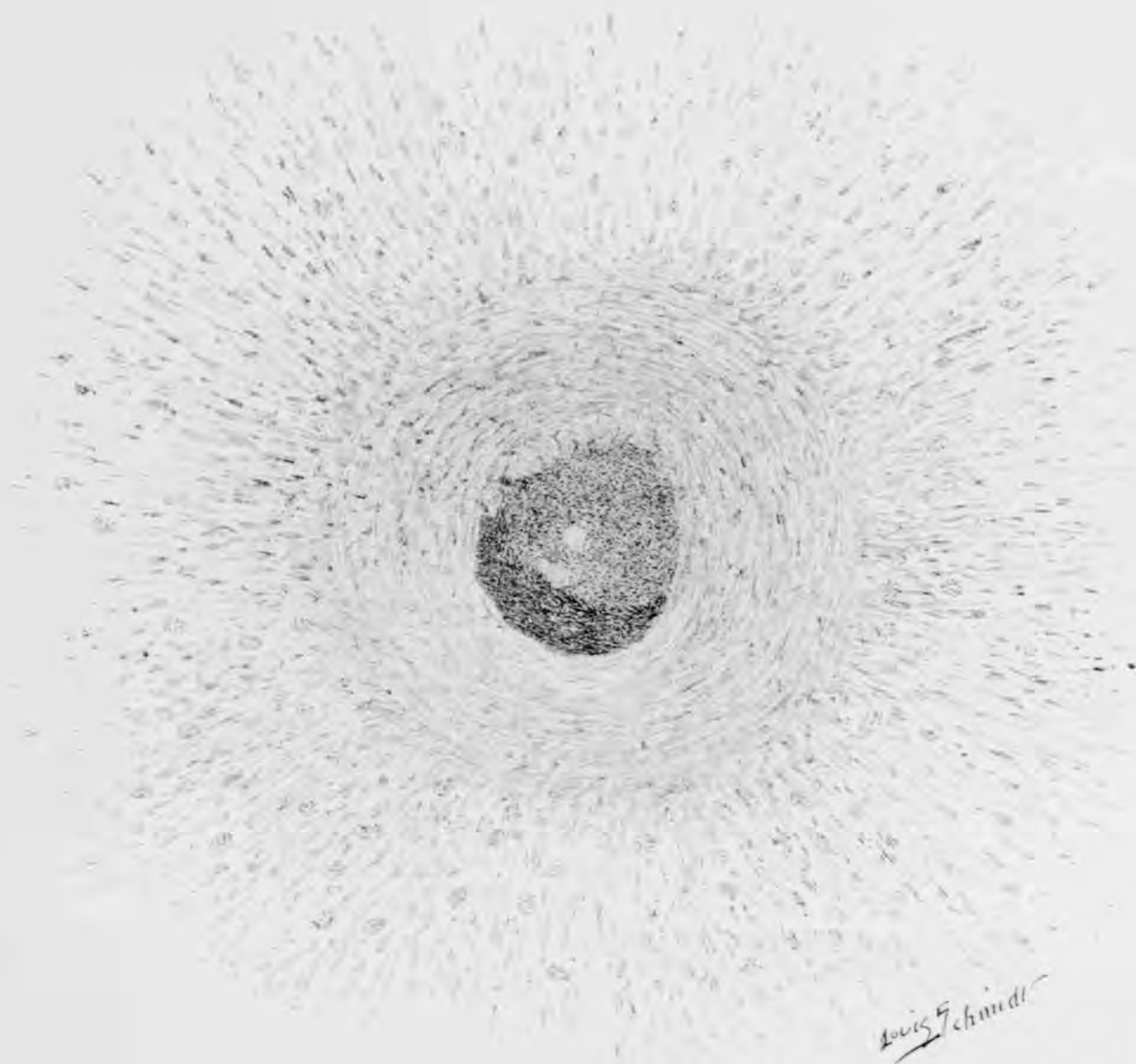


FIG. 1.

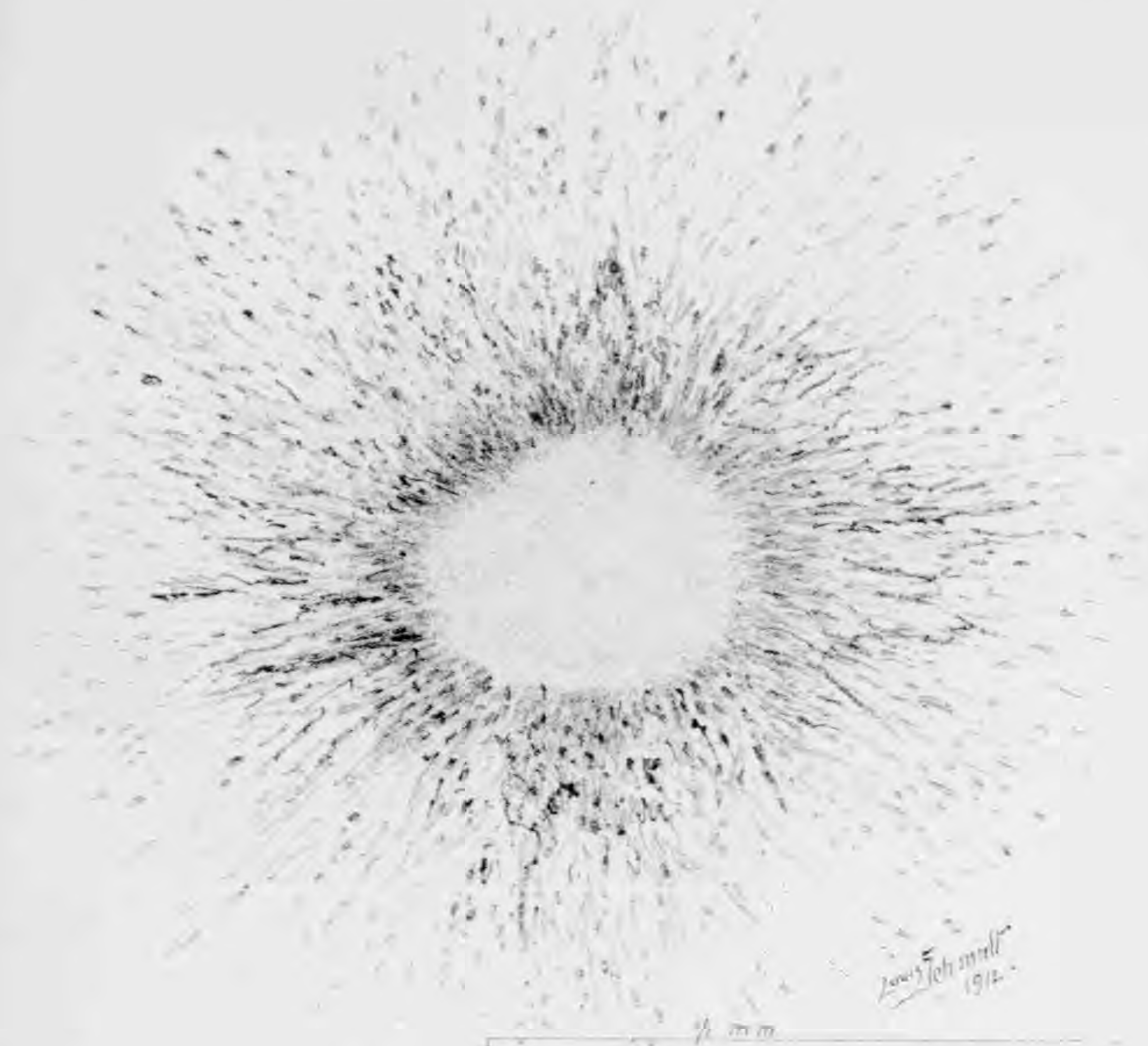


FIG. 2.



FIG. 3.

*W. C. C. C.*

REPORTS OF THE NATIONAL COMMITTEES ON  
STANDARD PHYSICAL EFFICIENCY TESTS

FOR THE Y.M.C.A., Y.W.C.A., CLUBS AND  
INDUSTRIAL ASSOCIATIONS

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# STANDARD PHYSICAL EFFICIENCY TESTS FOR THE Y. M. C. A., Y. W. C. A., CLUBS AND INDUSTRIAL ASSOCIATIONS

## A Study of Physical Efficiency Tests

This committee is composed of:

- F. J. Smith, National Physical Secretary, Canadian Y. M. C. A.'s, Rep. Canadian Y. M. C. A.
- Dr. John Brown, International Physical Secretary of the Y. M. C. A., Rep. American Y. M. C. A.
- A. H. Wyman, Director of Industrial Work, Carnegie Steel Co., Rep. Boy Scouts.
- F. W. Rubien, Secretary, Amateur Athletic Union, Rep. Amateur Athletic Union.
- Miss Helen McKinstry, Director Physical Education, Central Br. Y. W. C. A., Rep. Women and Girls.
- H. C. Reuter, American Gymnastic Union, Rep. American Gymnastic Union.
- William H. Ball, Chairman.

We were assigned the task of studying the Physical Efficiency Tests that have been used by the organizations represented on the Committee, for the definite purpose of discovering and recommending a basis or standardization for such work.

The Committee discovered that because of the very recent entry of industry into the realm of physical training that no physical efficiency tests had yet been used by them.

It was found that twelve tests are being used by the groups represented by the Committee, six being exclusively for boys, three for men, one for girls, one for men or boys, and one for men or boys or women or girls. Four of the physical tests are a part of a general intellectual, physical, social and character test; four are distinctly *group* athletic competitions; one is an *individual* athletic contest; one is a combination *gymnastic and athletic* test; and one an individual aquatic test. Most of them have a general common procedure, to the extent that they have a *purpose* or *objective*, that a *group of test events* are used, that a *scoring table* is essential, and that awards are given those who pass the tests.

## STATEMENT REGARDING EACH TEST.

These various tests have not been developed primarily as Efficiency Tests either, but as general educational graded programs including tests for promotion from one grade to another, or as athletic or aquatic contests. The graded tests challenge the interest and ambition of the boys and girls to greater knowledge and personal improvement.

The Boy Scout Movement appeals strongly to boys between twelve and sixteen years of age. The program deals with the physical, mental and moral sides of boys' life.

The Girl Scout program corresponds in principle and in general method to the Boy Scout plan.

The Standard Efficiency Training Program of Canada and The Christian Citizenship Training Program of the United States are being promoted by the churches and Young Men's Christian Associations. Both of these programs are fourfold tests—physical, mental, social and devotional—and are so arranged as to not only serve as tests along the lines stated, but also to stimulate the all-round ambitions of the boys who participate. They are particularly planned to interest older boys.

The Outdoor Athletic Test for Boys is an athletic contest originated and conducted so that rural schools and small organizations in rather isolated places can compete with one another without the necessity of travel. Participants are required to be sixty pounds or more in weight, pass a satisfactory examination as to physical fitness, and maintain a required scholarship standard. Every boy's score counts and the eligible boys who fail to participate lower the final score, which is determined on the percentage basis.

The two Hexathlon events (one for men and one for boys) are primarily intended to be athletic competitions between the Physical Department members of the Young Men's Christian Associations throughout North America. Each Association conducts the events in its own gymnasium, thus eliminating the necessity of travel and making it possible for 25,000 individuals to participate. Events were selected that could be conducted in the average Association gymnasium. It is not intended to be an efficiency test, as it is not necessary for anyone to participate in all six events. Only the scores of a certain number of the best participants count in the total report. For instance, Associations are grouped according to the total number of members as follows:

<i>Men.</i>	<i>Boys.</i>
Class A      2,000 members or over.	Class A      500 members or more.
Class B    Over 750 and under 2,000.	Class B              250 and over.
Class C              750 or under.	Class C              Under 250.
Class A report scores of best 10 men.	Class A report scores of best 8 boys.
Class B report scores of best 8 men.	Class B report scores of best 5 boys.
Class C report scores of best 6 men.	Class C report scores of best 3 boys.

In reality the Hexathlon is a group contest but nevertheless there are many features in the Hexathlon that are basic in any efficiency tests that may be developed.

The Swimming Pentathlons are fundamentally the same as the Hexathlon contests, the only difference being in the list of events and that they are conducted in the swimming pool.

The North American Gymnastic Union events have been developed as an all-round gymnastic competition for the purpose of stimulating interest in the general gymnasium program and in order to decide the champion in each of several groups.

The Young Men's Christian Association Swimming Tests are proficiency tests of swimming and life saving ability. They have been promoted entirely for the purpose of creating a greater interest in swimming and life saving. The tests are graded in difficulty. The element of competition with others is minimized as each individual simply seeks to reach a certain standard and qualify for a higher grade. No time limit is placed on any of the events.

The Amateur Athletic Union Decathlon is a genuine test of athletic proficiency. This event is conducted annually and is participated in by a comparatively small number of men each year. The Decathlon is the National all-round athletic competition and has for its purpose ascertaining who is the best all-round amateur athlete in the United States.

## TEST EVENTS.

### BOY SCOUTS.

There are three classes of Boy Scouts—Tenderfoot, Second Class and First Class.

No physical test or qualification of any kind, except being twelve years of age, is required for admission as a Tenderfoot.

To qualify as a *Second Class Scout* a boy must pass a test in:

1. Elementary First Aid.
2. Track— $\frac{1}{2}$  mile in 35 minutes.
3. Go 1 mile in 12 minutes.
4. Use knife or hatchet properly.
5. Build fire in the open.
6. Cook  $\frac{1}{4}$  lb. meat, 2 potatoes.

With four other tests not related to physical matters at all.

To become a *First Class Scout* he must pass the following tests:

1. Swim 50 yards.
2. Make 14-mile trip alone (write about it).
3. Pass Advanced First Aid.
4. Prepare and cook a meal.
5. Properly use an axe.

And seven other tests not physical.

As soon as he qualifies as a Second or First Class Scout he is eligible to try for merit badges. A merit badge is given for each one of fifty-eight different subjects.

A boy may become a *Life Scout* by securing the merit badges for First Aid, Physical Development or Athletics, Personal Health, Public Health, and Life Saving or Pioneering.

He may become a *Star Scout* by securing the same five badges as for Life Scout and any other five merit badges.

He may become an *Eagle Scout* after having become a Life Scout by securing sixteen other merit badges. In other words, the five physical merit badge tests for becoming a Life Scout are basic for the higher grades.

The Physical Tests for merit badges cover the following eight subjects:

#### I. *First Aid.*

To obtain a merit badge for First Aid, a scout must:

1. Be able to tell what to do with an apparently drowned person, and demonstrate the Sylvester and Shafer methods of artificial respiration.
2. Show how to apply bandages to the head, ankle and hand.
3. Show how to apply a tourniquet to stop arterial hemorrhage at any point (a) on the upper extremity below armpit,  
(b) on lower extremity below hip joint.
4. Demonstrate how to arrest venous hemorrhage on any part of the body.
5. Show how to apply a gauze dressing to a wound so that it will not be contaminated, that is, do it in an aseptic manner.
6. Show how to support by splints, etc., a broken arm or a broken leg so that the patient can bear transportation.
7. Be able to explain what to do for the bite of a mad dog, a venomous snake, a mosquito, and a scorpion sting.

8. Show how to rescue an individual from contact with an electric wire.
9. Produce satisfactory evidence that he has taken advantage of every opportunity to put into actual practice his knowledge of first aid work during a period of at least six months since becoming a First Class Scout.

## II. *First Aid to Animals.*

To obtain a merit badge for First Aid to Animals, a scout must:

1. Have a general knowledge of domestic and farm animals.
2. Be able to treat a horse for colic.
3. Describe symptoms and give treatment for the following: wounds, fractures and sprains, exhaustion, choking, and lameness.
4. Know what to do for horses in harness when they fall on the street.
5. Know what to do when animals are being cruelly mistreated.

## III. *Physical Development.*

To obtain a merit badge for Physical Development, a scout must:

1. Produce satisfactory evidence of habitual good posture.
2. Have no remediable physical defects uncorrected.
3. Produce satisfactory evidence of daily practice of hygienic habits and a thorough knowledge of a standard book on hygiene.
4. Pass three of the tests, according to his weight, in the Athletic Schedule. See Athletics.
5. Demonstrate proper form in running, high jump, hurdle, and shot-put.
6. Make up a daily drill of ten exercises for scouts, giving proper exercise for whole body; present evidence of having practiced this daily for six months and having taught the same to two or more boys for a period of three months. (See chapter on Health and Endurance.)
7. Demonstrate reasonable efficiency in two outdoor games requiring physical development; give evidence of having taught at least ten scout games to a group of boys, and know ten more. See Chapter IX.

## IV. *Athletics.*

To obtain a merit badge for Athletics, a scout must:

1. Write an acceptable article of not less than 500 words, on how to train for an athletic event.
2. Give the rules for two track and two field events, and define an amateur.
3. Prepare plans for the holding of an athletic meet, specifying duties of each required official.
4. Produce evidence of having satisfactorily served as an official in an athletic meet, or in a major athletic sport, such as football, baseball, or basket ball.
5. Qualify in one event, according to his weight, in each of the following groups:

*Group 1.*  
 Running broad jump.  
 Running high jump.  
 Standing broad jump.  
 Standing high jump.

*Group 2.*  
 50-yard dash.  
 100-yard dash.  
 6 potato race.

*Group 3.*  
20-yard swim.  
40-yard swim.

*Group 4.*  
Pull up.  
8-lb. shot-put.  
Push up from floor.  
Rope climb 18 ft.

#### V. *Personal Health.*

To obtain a merit badge for Personal Health, a scout must:

1. Write a statement on the care of the teeth, and show that his teeth are in good condition as a result of proper care.
2. State a principle to govern in eating; and state in the order of their importance five rules to govern the care of his health.
3. Present satisfactory evidence that he has not been absent from school or work for a period of at least six months as a result of his failure to observe these rules.
4. Tell the difference in effect of a cold bath and a hot bath.
5. Describe the effects of alcohol and tobacco on the growing boy.
6. Tell how to care for the feet on a march.
7. Describe a good healthful game and state its merits.
8. Describe the effects of walking as an exercise.
9. Tell the dangers of specialization and overtraining in the various forms of athletics, and the advantages of an all-round development.

#### VI. *Public Health.*

To obtain a merit badge for Public Health, a scout must:

1. State the chief causes and modes of transmission of each of the following diseases: tuberculosis, typhoid, malaria.
2. Draw a diagram showing how the house fly carries disease.
3. Tell what should be done to a house which has been occupied by a person who has had a contagious disease.
4. Describe the method used in his community in disposing of garbage.
5. Tell how a city should protect its milk, meat and exposed foods. State what are the laws in his community covering this subject, and to what extent they are being enforced.
6. Tell how to plan the sanitary care of a camp.
7. State the reason why school children should undergo a medical examination.
8. Tell how he may cooperate with the health authorities in preventing disease.
9. Produce satisfactory evidence that he has rendered service in some effort recommended by the public health authorities in the interest of Public Health.

#### VII. *Life Saving.*

To obtain a merit badge for Life Saving, a scout must:

1. Go down from the surface of the water at least 7 ft. deep and bring up an object 12 in. or more in diameter, weighing not less than 10 lbs.
2. Swim 30 yds., carrying a person of his own weight:
  - (a) By a two-hand carry, using feet only for propulsion.
  - (b) By a one-arm carry, using side stroke.
3. Dressed in trousers, coat and shoes swim fifty yards, then undress before touching shore.
4. In deep water, demonstrate three approved methods of releasing death grip.
5. Demonstrate Shafer (prone pressure) method of resuscitation.



## VIII. *Pioneering.*

To obtain a merit badge for Pioneering, a scout must:

1. Tie twelve kinds of knots quickly.
2. Lash spars properly together for scaffolding.
3. Build a bridge or derrick (each) capable of supporting 200 pounds in weight.
4. Make a camp kitchen.
5. Build a shack of one kind or another, suitable for three occupants.

## TEST EVENTS.

### GIRL SCOUTS.

The Girl Scouts also have three classes—Tenderfoot, Second Class and First Class Scouts.

Here again there are no physical requirements for the grade of Tenderfoot, except to be ten years of age.

As a Second Class Scout a girl is required to know how:

1. To cook one simple dish.
2. To make a fire in stove or oven.
3. To make a bed.
4. To know her own measurements.
5. What to do in case of fire, poison or frostbite.
6. Must know health habits:
  - (a) Fresh air and sunlight.
  - (b) Dressing.
  - (c) Eating and drinking.
  - (d) Regular life habits.

The physical test events for a First Class Scout are:

1. Walk one mile in twenty minutes.
  2. Pass in three chapters of First Aid.
  3. Know laws of sanitation and health.
  4. Swim fifty yards with clothing on.
- And eleven general tests.

Second or First Class Scouts are permitted to qualify for the five following physical merit badges.

### 1. *Athletics.*

To obtain this badge a Scout must:

1. Write a 500-word article on "The Value of Athletics to Girls," giving proper method of dressing and naming activities most beneficial.
2. Be a member of a gymnasium class of supervised athletics or a member of an active team for field work.
3. Understand the rules of basket ball, volley ball, long ball, tether ball, tennis and captain ball.
4. Must be able to float, swim, dive and undress in water.
5. Know and be able to teach twenty popular games.

## II. *Personal Health.*

To obtain a badge for Personal Health, a Scout must:

1. Eat no sweets, candy or cake between meals for three months.
2. Drink nothing but water, chocolate, or cocoa for a year.
3. Walk a mile daily for three months.
4. Sleep with open window.
5. Take a bath daily for a year, or sponge bath.
6. Write a statement of the care of the teeth, and show that her teeth are in good condition as a result of proper care.
7. Tell the difference in effect of a cold bath and a hot bath.
8. Describe the effect of lack of sleep and improper nourishment on the growing girl.
9. Tell how to care for the feet on a march.
10. Describe a good healthful game and state its merits.
11. Tell the dangers of specialization and overtraining in the various forms of athletics, and the advantages of an all-round development.
12. Give five rules of health which if followed will keep a girl healthy.

## III. *Public Health.*

1. Write an article, not over 500 words, about the country-wide campaign against the house fly and why, giving the diseases it transmits and make a diagram showing how the fly carries diseases—typhoid, tuberculosis and malaria.
2. Tell how to cleanse and purify a house after the presence of contagious disease.
3. State the laws of her community for reporting contagious disease.
4. Tell how a city should protect its supplies of milk, meat and exposed foods.
5. Tell how these articles should be cared for in the home.
6. Tell how her community cares for its garbage.
7. State rules for keeping Girl Scout Camp sanitary—disposal of garbage, rubbish, etc.

## IV. *Horsemanship.*

1. Demonstrate riding at a walk, trot and gallop.
2. Know how to saddle and bridle a horse correctly, and how to groom a horse properly.
3. Know how to harness correctly in a single or double harness, and how to drive.
4. Know how to tether and hobble and when to give feed and drink.
5. State lighting-up time, city law.
6. How to stop runaway horse.

## V. *Swimming.*

1. Swim fifty yards in clothes, skirt and boots.
2. Demonstrate diving.
3. Artificial respiration.
4. Flinging a life line.
5. Flinging a life buoy.
6. Saving the drowning.

Requirements for examination must be sent to parents of candidates for approval. Approval must also be obtained from the family physician or some other doctor.

# CHRISTIAN CITIZENSHIP TRAINING PROGRAM.

## Three-Year Program (Pioneers—Comrades).

### PIONEERS.

#### I. Health Habits.

1. Fixed hour for retiring and rising, taking nine hours' sleep.
2. Drink one glass water daily.
3. Clean teeth.
4. Regular exercise.
5. Bathe twice a week.
6. Regular bowel movement.
7. Temperate in sweets.
8. Care in personal appearance.

#### II. Camp Craft.

1. Attend an educational talk on Camping.
2. Sleep in open air.
3. Build fires.
4. Build camp latrine.
5. Build shack.

#### III. Team Games.

1. Be proficient in two team games.
2. Participate in eight contests.
3. Show sportsmanship.

#### IV. Group Games.

1. Know and play at least ten different group games.

#### V. Aquatics.

1. Dive properly.
2. Swim 15 yds.
3. Scull on back.
4. Three methods of release and resuscitation.

#### VI. Physical Examination.

1. Have thorough physical examination.

#### VII. Athletics.

This test consists of a total of ten events, six of which are definitely required and four may be selected from five other events suggested.

##### Required.

80 lbs.	3 Potato	75 yds.	Pull up 4	Running High Jump	1 Day Hike	8 mi.	Cent Hike 1 yr.
95 lbs.	4 Potato	100 yds.	Pull up 5	Running High Jump	1 Day Hike	10 mi.	Cent Hike 1 yr.
110 lbs.		100 yds.	Pull up 6	Running High Jump	1 Day Hike	12 mi.	Cent Hike 6 mo.
125 lbs.	6 Potato	220 yds.	Pull up 7	Running High Jump	1 Day Hike	14 mi.	Cent Hike 6 mo.
Unlimited	8 Potato	220 yds.	Pull up 8	Running High Jump	1 Day Hike	18 mi.	Cent Hike 6 mo.

##### Optional.

80 lbs.	1 Potato	50 yds.	Standing Broad Jump	Running Broad Jump	Baseball Throw	
95 lbs.	1 Potato	75 yds.	Standing Broad Jump	Running Broad Jump	Baseball Throw	
110 lbs.	2 Potato	75 yds.	Standing Broad Jump	Running Broad Jump	Baseball Throw and Shot	
125 lbs.	2 Potato	100 yds.	Standing Broad Jump	Running Broad Jump	Baseball Throw and Shot	
Unlimited	3 Potato	100 yds.	Standing Broad Jump	Running Broad Jump	Baseball Throw and Shot	

Elective tests are provided in every division.

I. *Health Habits.*

Give evidence that daily habits are as follows:

1. Fixed hour for rising and retiring.
2. Drink one glass of water.
3. Clean teeth.
4. Regular physical exercise.
5. Bathing twice a week.
6. Daily bowel movement.
7. Proper posture standing and sitting.
8. Personal appearance.
9. Temperate in use of sweets.
10. Abstain from tobacco.

And a number of elective tests.

II. *Camp Craft.*

1. One week-end hike into country, staying all night, cooking three foods.
2. First, Second and Third year elective tests.

III. *Team Games.*

1. Reasonable proficiency in four team games.
2. Participate in twelve games.
3. Show good sportsmanship.
4. Read two rule books.

IV. *Group Games.*

1. Know and participate in ten group or mass games.

V. *Aquatics.*

1. Dive into and swim 15 yds.
2. Three methods of resuscitation and release.
3. Shafer method of resuscitation.

VI. *Athletics.*

The same events as for Pioneers.

VII. *Physical Examination.*

The same as for Pioneers.

VIII. *Personality Analysis.*

1. Right attitude toward securing an adequate physical development.
2. Receive fifty credits for following analysis:
  - (a) Proper posture.
  - (b) Coördination and control of motions.
  - (c) Strength.
  - (d) Skill in directing the body.
  - (e) Physical influence upon others (inspiring, depressing).

# CANADIAN STANDARD EFFICIENCY TRAINING PROGRAM

(Rangers—Tuxis.)

## RANGERS.

### I. *Health Habits.*

1. Window open—Fixed hours for sleep.
2. Setting-up exercise.
3. Morning bath.
4. Regular bowel movement—Drink one glass water.
5. Clean teeth.

### II. *Health Tests.*

1. Six months' clean bill of health.
2. Chin bar five times (endurance).
3. Understand chapter on "Health and Endurance."
4. Physical Examination.
5. Attend two health talks.

### III. *Camp Craft.*

1. Two camp trips (Six miles' hike, prepare two meals).
2. Sleep outdoors—bed of own making.
3. Build shack.
4. Build fire and cook three dishes.

### IV. *Team Games.*

1. Reasonable proficiency in two games.
2. Play ten games—show sportsmanship.

### V. *Group Games.*

1. Twenty different group games.

### VI. *Swimming.*

#### Grade 1.

1. 50 yds. free style.
2. 25 yds. on back.
3. Five methods of resuscitation and release on land.

#### Grade 2.

1. 65 yds. free style.
2. 35 yds. on back.
3. Shafer method of resuscitation.
4. Dive into 5 ft. and bring up 3 lbs.

#### Grade 3.

1. 50 yds. breast stroke.
2. 25 yds. on back.
3. Resuscitation, release and rescue drill on land.
4. Rescue, release and resuscitation drill in water.
5. Dive from surface and bring up object.

### VII. *Athletics.*

#### Age and Weight Groupings.

- All boys 12-13 yrs. under 81 lbs.  
All boys 13 yrs. over 80 lbs.—14-15 yrs. under 96 lbs.  
All boys 14-15 yrs. over 95 lbs.—16-17 yrs. under 111 lbs.
1. Two running tests.
  2. Three jumping tests.
  3. Two throwing tests.

I. *Health Habits.*

1. Fixed hour for retiring and rising.
2. Drink water—one glass frequently.
3. Clean teeth twice.
4. Daily physical exercise.
5. Daily bath.
6. Bowels open.

II. *Health Knowledge.*

1. Attend one health talk.
2. Know book on health hygiene.
3. Understand effects of alcohol and tobacco.
4. Understand value of different foods.

III. *Health Tests.*

1. Pass endurance test.
2. Pull up—Relay message.
3. 18 rope climb.
4. One-mile walk.
5. Cross-country or paper chase.
6. Good posture.
7. Physical Examination.
8. Number uncorrected remediable defects.
9. Follow Health hobby.

IV. *Camp Craft.*

1. Sleep outdoors.
2. Build fire in the open.
3. Overnight camp trip.
4. Put up tent:
  - Trench it.
  - Comfortable bed.
  - Light 15 fires (1 wet).
  - Make fire and boil water in fifteen minutes.
  - Make a tent.
  - Make friction fire.
  - Make device for holding pans over fire.
  - How pitch tent—rock or sand.

V. *Team Games.*

1. Reasonable proficiency in two team games.
2. Play ten games, show sportsmanship.

VI. *Group Games.*

1. Take part in fifty games.
2. Name and describe them.

VII. *Aquatics.*

Grade 1.

1. Swim 100 yds. breast stroke.
2. Swim 50 yds. on back.
3. Rescue and release drills on land.
4. Shafer method of resuscitation.
5. Four methods of release in water.

## Grade 2.

1. Swim 150 yds., three styles.
2. Swim 75 yds. on back.
3. Dive from surface bringing up 5 lbs.
4. Five methods of rescue, three methods of release.
5. Shafer method of resuscitation.
6. First and second method of rescue and release combined in water.
7. Tow person 60 ft.

## VIII. Athletics.

1. Two running:  
60-yd. Potato.  
100 yds.
2. Three Jumping:  
Standing Broad Jump.  
Running High Jump.  
Standing Hop, Skip and Jump.
3. Three Throwing:  
Distance.  
Target.  
8-lb. Shot.

## Grouping.

- Under 13 yrs. irrespective of weight.  
Under 13 yrs. if under 81 lbs. in No. 1, if 81 lbs. or over in No. 2.  
14 yrs. and under 16 yrs.:  
Under 96 lbs. in No. 2.  
96 lbs. or over in No. 3.
- 16 yrs. and under 18 yrs.:  
Under 111 lbs. in No. 3.  
111 lbs. or over in No. 4.
- 18 yrs. and over irrespective of weight.

## BOYS' OUTDOOR ATHLETIC TEST.

### 50-lb. class.

30 yds. Std. Broad Jump Run. Broad Jump Run. High Jump Baseball Throw (Dist)

### 96-lb. class.

75 yds. Std. Broad Jump Run. Broad Jump Run. High Jump Baseball Throw (Dist)

### 111-lb. class.

100 yds. Std. Broad Jump Run. Broad Jump Run. High Jump Baseball Throw (Dist)

### 125-lb. class.

100 yds. Std. Broad Jump Run. Broad Jump Run. High Jump Baseball Throw (Dist) 8-lb. Shot

### Unlimited class.

100 yds. Std. Broad Jump Run. Broad Jump Run. High Jump Baseball Throw (Dist) 8-lb. Shot

An "Honor Standard" is placed at the fifty-point mark in each event.

## BOYS' HEXATHLON.

In the 80-lb., 95-lb. and 110-lb. classes the same events are used throughout, namely:

- |                                      |                         |
|--------------------------------------|-------------------------|
| 1. Short Potato race (around boxes). | 4. Long Potato race.    |
| 2. Running High Jump.                | 5. Standing Broad Jump. |
| 3. Target Throw.                     | 6. Snap for Distance.   |

In the 125-lb. and Unlimited classes the 8-lb. Shot and Fence Vault are substituted for Target Throw and Snap for distance.

## MEN'S HEXATHLON.

The men's Hexathlon test events are as follows:

- |                       |                         |
|-----------------------|-------------------------|
| 1. 60-yd. Potato.     | 4. Standing Broad Jump. |
| 2. 160-yd. Potato.    | 5. 12-lb. Shot.         |
| 3. Running High Jump. | 6. Fence Vault.         |

## BOYS' PENTATHLON.

The boys' Pentathlon test events are:

- |                     |                     |
|---------------------|---------------------|
| 1. 25 yds. on back. | 4. Underwater swim. |
| 2. 20 yds. Towing.  | 5. 200 yds.         |
| 3. 40 yds.          |                     |

## MEN'S PENTATHLON.

The men's Pentathlon test events are:

- |                        |                     |
|------------------------|---------------------|
| 1. 50 yds. on back.    | 4. Full dress Swim. |
| 2. 75 yds. free style. | 5. 220 yds.         |
| 3. 25 yds. Towing.     |                     |

## DECATHLON.

The Decathlon test events are:

- |                       |                        |
|-----------------------|------------------------|
| 1. 100 yds.           | 6. Pole Vault.         |
| 2. 16-lb. Shot.       | 7. 120-yd. Hurdles.    |
| 3. Running High Jump. | 8. 56 Weight.          |
| 4. 880 yds.           | 9. Running Broad Jump. |
| 5. 16-lb. Hammer.     | 10. 1 Mile.            |

Decathlon events classified:

### 3 Running:

- 100 yds.
- 880 yds.
- 1 mile.

### 3 Jumping:

- 120 Hurdles.
- Running High Jump.
- Running Broad Jump.

### 3 Throwing:

- 56 Weight.
- 16-lb. Shot.
- 16-lb. Hammer.

### 1 Vaulting:

- Pole.

## SWIMMING TESTS.

### *Beginners' Test.*

Swim at least 50 ft. any stroke, with or without turning.



### *Swimmers' Test.*

Swim 50 yds. any stroke.  
Dive properly from duck, side of pool, float or springboard.  
Swim 50 ft. on back.

### *Leaders' Test.*

Teach one person to swim 50 ft.  
Swim 200 yds.  
Dive from surface of water and bring up objects from bottom (opening eyes).  
Swim on back 50 yds.

### *Life Savers' Test.*

Dive in from 7 to 10 ft. of water and bring from the bottom to the surface a loose bag of sand weighing 10 lbs.

Swim 200 yds. i.e., 100 yds. on back not using arms or hands, and 100 yds. any other stroke.

Demonstrate:

- (a) On land, five methods of release.
- (b) In water, two methods of release.
- (c) Rescue and tow person of own weight 20 yds., using two different strokes (10 yds. each).
- (d) Shafer method of resuscitation.

### *Swimming Teachers' Test.*

Teach ten non-swimmers to swim at least 50 ft., and demonstrate the following strokes by swimming each stroke the length of pool (not less than 40 ft.):

Swim on back using hands only.  
Side underarm with scissors kick.  
Side overarm with scissors kick.  
Trudgeon with scissors kick.  
Crawl with flutter kick.  
Breast with frog kick.  
Back double overarm and frog kick.  
Single overarm with flutter kick.  
Back dive from springboard.  
Front Jackknife from springboard.  
Back Jackknife from springboard.  
Swan dive from springboard.  
Pass Life Saving Test.

### *Life Saving Instructors' Test.*

Teach ten persons to pass the Life Saving Test and secure the award.

Pass Swimming Teachers' Test.

Demonstrate five methods of release in the water.

Tow a person of own weight 50 ft. each of the following methods:

- (a) Breast stroke.
- (b) On back, using double arm body grasp and frog kick.
- (c) On back, head hold and frog kick.
- (d) One hand, hair or collar grasp, any kick.
- (e) One arm, neck and armpit grasp, scissors kick.

## AMERICAN GYMNASTIC UNION.

### *Gymnastics.*

Exercises on the Horizontal Bar, Parallels, Horse.

*Athletics.*

Running High Jump.  
Running Broad Jump.  
Standing Broad Jump.  
Three Standing Broad Jump.  
Running Hop, Step, Jump.

Pole.  
16-lb. Shot.  
100 yds.  
Rope Climbing.

WOMEN'S TEST.

The same events as for men and boys but modified, also Dancing for women and girls.

The events used in these tests vary widely and appear to be related to the purpose of the originators in establishing the tests. They also appear to be related to whether the tests were to be taken indoors or outdoors, and whether gymnastics or athletics are a part of the general program of the group.

SCORING.

*Boy Scouts.*

The Boy Scouts have no credits or point system of scoring. The boys qualify by passing the subject to the satisfaction of the Scout Master or Court of Honor.

*Girl Scouts.*

No particular number of credits or points are required but each Scout is required to show proficiency in the subject of the test.

*Christian Citizenship Training Program.*

*Health Habits*—150 credits.  
Required test, 90 credits.  
Elective, 20 credits each up to 60.

*Camp Craft*—100 credits.  
Required test, 50 credits.  
Elective, 25 each up to 50.

*Team Games*—150 credits.  
Required test, 75 credits.  
Elective, 25 each up to 75.

*Group Games*—150 credits.  
Required test, 90 credits.  
Elective, 30 each up to 60.

*Aquatics*—150 credits.  
Required test, 50 credits.  
Elective, 20 each up to 100.

*Athletics*—200 credits.  
Each event (100) = 20.  
Ten events = 200.

*Physical Examination*—100 credits.  
Physical Total—1,000 credits.

*Standard Efficiency Training Program.*

*Health Habits*—300 credits.  
Deduct two credits for each day a habit is broken.

<i>Health Tests—200 credits.</i>	
Good health for six months,	40
Pass Endurance Test,	40
Pass test "Health and Endurance,"	40
Physical Examination,	40
Two talks on Disease,	40
	200

*Health Total—500 credits.*

<i>Camp Craft,</i>	100
<i>Team Games,</i>	100
<i>Group Games,</i>	100
<i>Swimming,</i>	100
<i>Athletics,</i>	100
	500

Total Physical—1,000 credits.

*Boys' Hexathlon.*

In the Boys' Hexathlon test scoring tables are used. From zero to 100 points are required for each event in each weight class. Each unit of one-fifth second or one-half inch has a fixed value. Boys doing better than 100 points receive corresponding credit for the performance.

*Men's Hexathlon, and Outdoor Athletic Tests for Boys, etc.*

The same general scoring method is used in the Men's Hexathlon and in the Outdoor Athletic Tests for boys, and also for the Athletic events in the S. E. T. P. and the C. C. T. P.

*Swimming Pentathlon.*

The scoring plan known as the Progressive Increment method is used, each event scoring from zero to 1,000. The units of one-fifth second or one-fourth inch increase in point value as the performance improves. This increase in unit value is based on the fact that a much higher grade of ability is required to improve in any event as the record is approached.

*V. M. C. A. Swimming and Life Saving Tests.*

Beginner.	Swimming Teacher.
Swimmer.	Life Saver.
Leader.	Life Saving Instructor.

The person who passes any test is qualified for that grade.

*American Gymnastic Union.*

Gymnastic events are marked on a basis of ten points for a perfect exercise performance, personal judgment being used to determine deductions. For the athletic events one point is given for a minimum performance and one additional point for a given improvement, like 3 ft. in the Running High Jump.

*All-round Athletic Championship.*

Same general principle as for Hexathlons, except that the tables run from zero to 1,000 for each event, the total possible score being 10,000. The maximum performance is much higher (being the American Amateur Record).

There are five different methods of scoring used in these twelve tests:

1. and 2. The Progressive Increment and fixed unit methods are the most accurate but they involve the publication and use of extensive tables.
3. The personal judgment method is faulty in that the standards may vary widely at different times or places.
4. The Standard Grade method is the simplest reliable procedure.
5. The combination, personal judgment and fixed unit method, is confusing.

#### AWARDS.

All awards are of small intrinsic value.

##### *Boy Scout Merit Badges.*

- |                     |  |
|---------------------|--|
| 1. Athletics.       | 8. Personal Health.                                      |
| 2. Cycling.         | 9. Physical Development — Cooking, Camping, Pathfinding. |
| 3. Hiking.          | 10. Public Health.                                       |
| 4. Horsemanship.    | 11. Swimming.  |
| 5. Life Saving.     | 12. First Aid to humans and First Aid to animals.        |
| 6. Archery—Angling. |  |
| 7. Marksmanship.    |  |

These merit badges are cloth emblems and are worn on the uniforms, and are intended to stimulate the Scout's interest in the life about him, being given for general knowledge.

##### *Girl Scout Merit Badges.*

Merit badges are issued to those who show proficiency in the various subjects. These badges are registered at headquarters and are issued from no other source. Badges are provided for the following Physical Tests:

1. Athletics.
2. Gardening.
3. Personal Health.
4. Public Health.
5. Horsemanship.
6. Swimming.

##### *Christian Citizenship Training Program.*

Pins, watch fobs and sweater emblems are provided. These insignia are used to show that the wearer is identified with the Christian Citizenship Training Program, and indicate which particular phase of the program is being taken. The use of the insignia is entirely optional. There are slight variations in the design for Pioneers and Comrades and Leaders. The sweater emblem is larger and has much more suggestive detail upon it.

##### *Standard Efficiency Training Program.*

Special silk badges for Rangers who qualify.

Taxis Honor Badges for a wide variety of different subjects.

Small diamond-shaped cloth emblems are used as merit badges and are placed on a sweater or pennant as preferred.

##### *Boys' Outdoor Athletic Test.*

Honor Roll, inexpensive buttons, badges, certificates, pennants, shields, banners or wall plaques as desired, and provided by the local groups.

##### *Hexathlons.*

Trophy shield for the Association winning in each group. This year buttons will be given every boy who scores 400 or better in the six events.

#### *Pentathlons.*

Trophy shield for the Association winning in each group. Medal to young man making best individual score.

#### *Decathlon.*

Championship—Gold, silver and bronze medals for first, second and third in the contest.

#### *Swimming Tests.*

Bronze and silver plate buttons for Beginners, Swimmers and Leaders.

Sterling silver watch fob for Life Savers.

Gold button for Swimming Teacher.

Gold pocket piece for Life Saving Instructor.

These awards are paid for locally but distributed nationally.

#### *American Gymnastic Union.*

Different colored ribbons for each of two lower grades; also ribbons or bronze, silver and gold buttons for higher grades.

The awarding of emblems in order to indicate the individual or group standards of proficiency, appear to be a necessarily valuable adjunct to all such tests.

## PRINCIPLES AND STANDARDS FOR UNIVERSAL PHYSICAL EFFICIENCY TESTS.

In the judgment of this Committee, Physical Efficiency is more than athletic proficiency, it involves physical condition as well.

A well-balanced test of efficiency should be both subjective and objective.

Owing to the limits of both time and information at the Committee's disposal, we have not attempted to deal with the subject of physical condition but have confined our attention to the proficiency phase. We would suggest, however, that the matter of condition is of the utmost importance and should be referred to another committee for most careful study and future report.

We present for your consideration the following Principles and Standards for Universal Physical Efficiency Tests:

1. Physical Efficiency is a fundamental essential of human life.
2. Standard tests of Physical Efficiency may be made of large value by enabling people to make just comparisons with themselves and others.
3. A National or International series of Standard Physical Efficiency Tests for men and women, boys and girls, are desirable.
4. The objective of a Physical Efficiency Test is to determine the physical qualities (both condition and ability) of an individual or group.
5. Physical fitness is fundamental in any test of physical efficiency and should include a health examination covering health (condition, knowledge, habits).
6. Physical ability is also fundamental in any test of physical efficiency and should include:
  - (a) The fundamental physical qualities of strength, speed, endurance and neuro-muscular control.
  - (b) The fundamental physical activities, i.e., walking, running, jumping, throwing, climbing and swimming. Such a test should also cover the fighting and team spirit.

7. Tests should be comprehensive and include all of the fundamental physical qualities.
8. The test events should be inherently interesting and stimulate interest in greater efficiency.
9. Tests should be simple so that they can be easily understood and readily administered.
10. The tests should be developed with due regard to the widely differing conditions that exist throughout the country, such as climate, equipment and leadership.
11. Tests should be worked out on a progressive basis in order to test varying grades of condition and ability.
12. The tests should be such as not to interfere with, but to promote, the highest possible intellectual, moral, spiritual and social development of the participants.
13. Standards of Physical Efficiency should be based upon modern human requirements rather than upon those of earlier generations.
14. That five grades and tests be developed
 

}	5. E.	Names Suggestive Tests.
	4. D.	
	3. C.	
	2. B.	
	1. A.	
15. That a different series of tests be used for men and women.
16. That awards such as pins, buttons and sweater emblems are desirable features of such tests.

## SUGGESTIVE TESTS (to illustrate No. 14).

### FIVE GRADES OF WALKING TEST.

A. 25 miles,	carry 60-lb. pack,	10 hours.
B. 20 miles,		8 hours.
C. 10 miles,		3 hours.
D. 4 miles,		1 hour.
E. 1 mile,		15 minutes.

### RUNNING TEST.

A. 440 yds.	55 seconds.
B. 220 yds.	24 seconds.
C. 100 yds.	11 seconds.
D. 75 yds.	9 seconds.
E. 50 yds.	7 seconds.

### JUMPING TESTS.

#### Running Broad Jump.

A. 5 ft. 6 in.	20 ft.
B. 5 ft.	18 ft.
C. 4 ft. 6 in.	15 ft.
D. 4 ft.	12 ft.
E. 3 ft. 6 in.	10 ft.

### CLIMBING.

- A. 18-ft. rope, using hands only.
- B. 18-ft. rope, using hands and legs.
- C. 12-ft. rope, using hands and legs.
- D. Pull-up seven times.
- E. Pull-up four times.

### THROWING BASEBALL FOR DISTANCE AND ACCURACY.

- A. 300 ft.
- B. 50 ft.
- C. 200 ft. Within a 20 ft. lane.
- D. 150 ft.
- E. 100 ft.

### SWIMMING TEST:

- A. Swim  $\frac{1}{2}$  mile. Tow person of own weight 50 ft., using Crawl, Single, Overarm, Breast.
- B. Swim 440 yds. Surface dive. Bring up 10 lbs. Float 30 seconds.
- C. Swim 220 yds. Surface dive. Back swim. 25 yds. Tread water 1 minute.
- D. Dive into water. Swim 100 ft. Scull on back 15 yds.
- E. Swim 50 ft.

All participants to pass the lower tests before taking the higher ones.

#### *Grade A.*

- Walk 25 miles with 60-lb. pack, within 10 hours.
- Run 440 yds. within 55 seconds.
- Broad Jump 20 ft.
- High Jump 5 ft. 6 in.
- Throwing Baseball 300 ft.
- Climbing 18-ft. rope, only using hands.
- Swimming  $\frac{1}{2}$  mile. Tow person of own weight 50 ft.
- Team Game—varsity, football or baseball team.



The Value and Benefit of  
Walking as an Exercise.

COMPLIMENTS OF

**HARRY SCULL.**

AMATEUR,

Chicago Board of Trade.

*Apple*

Record: Thirty-Six Miles in One Day.

and

1,040 Miles in Ninety Consecutive Days.



**GOOD EXERCISE.**

Dr. Evans of the Chicago Tribune under the caption of Good Exercise quotes Weber as saying that other things being equal a man who walks five miles a day should live to be a hundred years old; he follows that policy and he is now in his ninety-sixth year.



## HOW TO BE REGULAR IN YOUR EXERCISE.

BY BOYD KITHCART,

PHYSICAL CULTURE, November Issue.

Be regular and persistent in your exercise. Do it every day at your most convenient time. Do not be disappointed because your improvement is not very great at first. Give Nature time enough. Big results always come gradually. Exercise to-day, to-morrow, and every day after that. If you engage in athletics, do not stop just as soon as you finish training. If not healthy, do not stop when you become so. If very busy, do not stop because of that. Always do just a little exercise, anyhow. When once you form this habit, never break it for any excuse whatever. It is easy to keep right on doing the same thing over and over. But, it is mighty difficult to renew your interest in exercise and start again when once you stop. A little exercise every day is just as absolutely necessary as rest and sleep. If you leave out exercise, you are just as sure to grow weaker as if you failed to secure the latter. Neglect of exercise causes ugly bodies, weakness and disease. It kills ambition and makes bright minds dull. But a little attention to exercise every day, year in and year out, just as regular as the seasons come and go, keeps your body on the upward track, and leads to perfect health, physical perfection and great success. It helps to make life really worth living.

## WALKING AND RUNNING AS WEIGHT-REDUCING MEASURES.

BY JOHN J. HAYES,

PHYSICAL CULTURE, November Issue.

To the man or woman burdened with excessive flesh, the question is—How will I be able to lose ten to twenty pounds in a natural, normal way without injury to myself and loss of time to my business?

The answer is simple—walk or run or do both.

Walking—the best exercise in the world—is at the same time the cheapest, easiest acquired and brings more muscles into play than many exercises of a more violent nature.

Running—if one is unused to it—should not be taken up without some preparatory work which will serve to prepare the muscles and the heart for the more strenuous work and I don't know of any better method of doing so than to take up walking first.

If you find that walking alone is hard or distasteful, try and get some of your friends in your club, lodge or sewing circle to accom-

pany you on these walks. It is remarkable how many people would be glad to embrace this method of reducing, and you have only to inform them of your intention to have them glad to join you.

The surplus tissues of the body are composed of a large proportion of water, and when the water comes through the open pores, during the exercise, it causes a decrease in weight, and for this reason there can be no material reduction in weight unless profuse perspiration is produced.

In walking or running to reduce weight, everything worn should be loose, except the garment that is next to the body, which should be close-fitting to induce perspiration. Old garments, with a heavy sweater and cap in the case of men, supplemented by wide, broad-toed shoes with strong soles and rubber heels should be worn. Underneath should be worn underwear, and a wide strip of red flannel, two and a half yards long, about a foot wide, wrapped around the abdomen and fastened.

An objective point may be picked out at a distance of perhaps two miles, and one should make this the turning point, walking four miles for a starter. This distance can be gradually increased until ten-mile distances are covered, which will be long enough to induce a good sweat.

The best time to walk is early in the morning or during the afternoon when the sun is the warmest, for it is then easy to sweat, but any time, even if it is at night will get results. Forget the night-air bugaboo—the men who make up the bulk of the Olympic teams that win Olympic victories for the United States work during the day and train at night and the fact that they are the best in the world is proof positive that the night air is beneficial.

After the walk come the bath, which serves to wash away the poisons that have been forced through the pores by the exercise, and refreshes the tired muscles. Hot tub baths, as hot as you can stand them, are the proper kind to take after walking or running to reduce, to be followed, after a five minute soak, by a cold shower in which the temperature has been gradually reduced from hot to cold. The cold water serves to close the pores of the skin and prevents one taking cold.

Massage helps in the reduction process as it serves to take out the kinks that appear in the muscles for the first few times out. If possible, rub yourself, for nothing benefits the stomach muscles more than the exercise that being your own masseur gives you.

The feet need special care when one is reducing, for the feet get fat as well as the rest of the body, and unlike the rest of the body are under a continual strain, especially when one is taking long walks.

A bag of sea salt can be procured at the drug store for ten cents. Into a pail of water throw a cupful of this salt and pour onto it enough boiling water to dissolve same, adding cold water enough to bring the water in the pail or pan over the ankles, to a body heat. Let the feet soak in this for five or eight minutes and it will serve to refresh and harden them. After drying the feet alcohol may be rubbed over them and allowed to dry in, and when you awake in the morning all the fatigue and tired feeling will be gone. Don't fail to cool the water off well, as hot water has a tendency to make the feet tender.

After several weeks of the walking, if you find that this exercise is not taking down the flesh, try alternating the walking with some running.

If you take up running, the first care should be for the feet, for the arches will cave in if you do not take all precautions in caring for the pedal extremities that bear the brunt of the work.

It is always safer to get shoes constructed especially for running, that are made of light leather, fitting snugly around the arches, with heels of light rubber. Shoes made to order are always better if one can afford them. As in walking, make the first runs short and gradually increase them. Try running for a mile the first time and select a course that has a hill on it, for this will induce perspiration. If you have a carriage or an auto, get your wife or husband to drive the vehicle and you hold onto the back and allow yourself to be pulled along. The costume should be the same as that worn while walking with the exception of the shoes, as the chief intent is to promote circulation.

Tired business men or women should remember that walking or running are recreations as well as means of flesh reduction, and they should approach these exercises with pleasure, and not try to crowd all the exercise they are going to take in the first week. These exercises are a good cure for the tired, worn-out business man, for they take the mind off his or her work, and serve to stimulate the brain as well as reduce surplus flesh.

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## WESTON, 75, READY FOR 1,446-MILE HIKE.

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### VETERAN PEDESTRIAN SAYS HE FEELS BETTER THAN 35 YEARS AGO—DUE IN CHICAGO JULY 9.

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Special Dispatch to the Inter Ocean.

NEW YORK, June 1.—“Though I am in my seventy-fifth year, I feel younger than I did thirty-five years ago,” said Edward Payson Weston to-day. He is the white-haired pedestrian who at noon to-morrow will start from the plaza of the College of the City of New York on a 1,446 mile walk to Minneapolis, Minn., which he purposes to make in sixty days. Mr. Weston has been staying in the home of his daughter in Harlem.

“Away back in 1876, when I was lunching with Sir John Astley and Edward Lawson in London, Mr. Lawson said to Sir John that if he kept me going in the tremendous walks I was then making he would ‘kill the Yankee.’ I said that more men were killed by the lack of exercise than by it, and that I hoped in my seventy-fifth year to accomplish a task, either in America or England, that would convince the greatest skeptic that the person who walked, ate moderately and lived a simple life could accomplish a greater task in his seventy-fifth year than the ordinary man at 50.

“I am not trying to make time. I shall leave the College of the City of New York at 12 o'clock. Crossing the river to Jersey City, I shall follow the line of the Erie railroad to Chicago, where I arrive by July 9, the distance being 999 miles. From Chicago I shall follow the line of the Chicago and Northwestern.”

# Something NEW in Electricity.

SOMETHING new is always developing in the practical application of this wonderfully versatile physical agent. Since the introduction of the milliamperemeter as a means of exact therapeutic dosage, there has been nothing especially new in electro-therapeutics until d'Arsonval, of Paris, called the attention of the profession to the wonderful properties

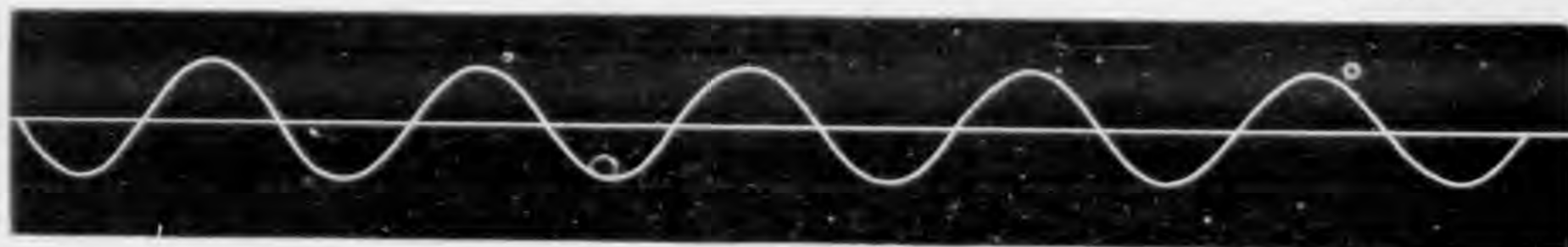


Fig. 1.

of the sinusoidal magneto-electric current. This current was discovered independently by Dr. J. H. Kellogg, of Battle Creek, Mich., in 1883, and by Prof. d'Arsonval, of Paris, in 1892. Dr. J. H. Kellogg described the current in a paper read before the American Medical Association at its annual meeting in May, 1888, and has given a fuller description in several subsequent papers.

Prof. d'Arsonval first made a study of the physical properties of the current, and found that its peculiar action was due to the characteristic form of the curve, which is that of a sinuous line (Fig. 1), hence the name *sinusoidal*. The difference between this current and the ordinary



Fig. 2.

magneto-electric current will be seen by referring to Fig. 2. The irregular curves of an ordinary faradic current are shown in Fig. 3, and of Dr. Piffard's fluctuating galvanic current in Fig. 4.

For further information concerning the characteristics of this current, see a paper read by Dr. J. H. Kellogg, of Battle Creek, Mich., before the Electro-Therapeutic Association at its meeting held in Chicago, in October, 1893. This paper was published with the proceedings in the *Journal of the American Medical Association*. A reprint will be sent on application to the undersigned.

Dr. Kellogg's extensive use of this machine, which he has employed in making more than 50,000 applications, has enabled him to make modifications and improvements in his original apparatus. The manufacture of these improved machines is now being undertaken by the undersigned for the purpose of supplying the demand which has arisen for the means of utilizing this important therapeutic agent. The advantages



Fig. 3

offered by these machines, which are the only apparatus of the kind manufactured in this country, or, so far as we know, the only machines existing in this country, are chiefly the following —

1. This apparatus produces physiological and therapeutic effects of a most decided and important character, which are not obtainable from any other form of electrical apparatus.

2. Aside from the galvanic current, it is the only form of electrical apparatus which affords a means of exact and accurate dosage, or the only apparatus with which accurate dosage, variable within large limits, is possible.

3. Its therapeutic applications are painless.

4. It affords the most efficient means possible for exercise of the muscles, producing the most marked muscular contractions without pain. It may even be applied in such a way as to throw all the muscles of both extremities into violent muscular movement, without other sensation than that of motion. The muscular effect may be localized to the nicest degree,

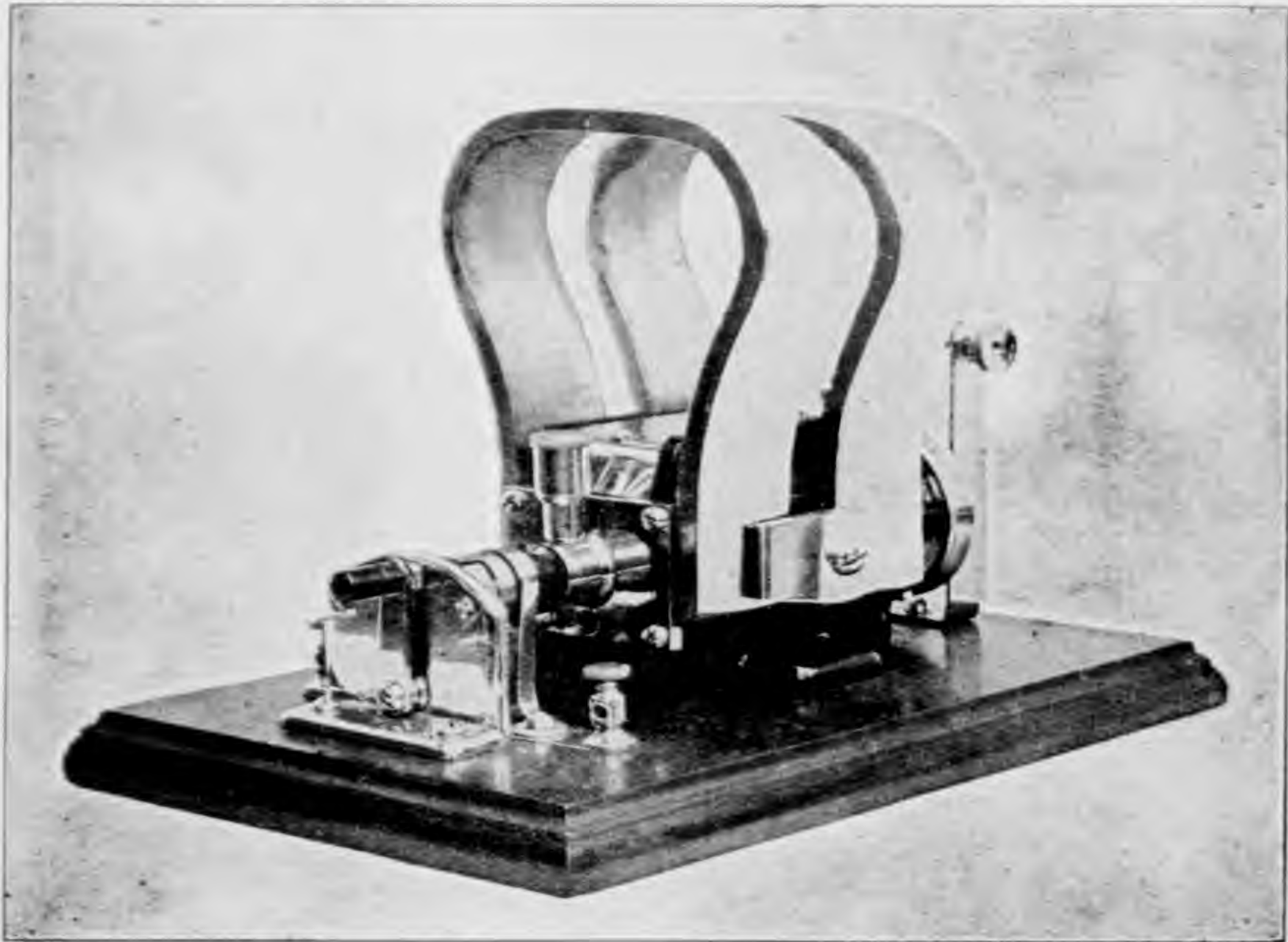


Fig. 4

confined to a single set of muscles in the face, or to a thumb or finger, bringing all the muscles into efficient action without affecting others. When the machine is rotating slowly, a current is produced which gives a vigorous muscular contraction at each change in the direction of the current. When the machine runs at a sufficiently high rate of speed, the muscular contraction becomes tonic and continuous.

5. It is unexcelled as a means of relieving pain, or exciting the nerves of special sense. When applied to the region of the eyes, it produces a

most remarkable light phenomenon without pain, pricking, or any of the other disagreeable sensations induced by the galvanic and faradic currents. Applied to the ear of a person who is totally deaf from disease of the middle ear, strong impressions of sound are made without the production of pain, or any other sensation than that of sound. This current succeeds in relieving pain in a large proportion of cases in which the galvanic faradic and static currents fail.



NEW SINUSOIDAL APPARATUS.

6. This current has a larger range of adaptability than any other current.

7. The first cost of the entire apparatus is less than that of other first-class electrical outfits, while the effects obtainable are much more varied, and of a character not approached by any other apparatus.

8. The apparatus may be maintained without any expense whatever, as when the machine is used with a permanent magnet and runs with photo spring power, there are no battery plates or fluid to be consumed, and nothing whatever to get out of order. It is always ready to give its maximum current, and any lesser current desired.

9. The apparatus is provided with a commutator, by which the alternating current is converted into a direct current capable of producing all the effects of an ordinary direct or galvanic current, such as electrolysis, cataphoresis, and other popular effects. It is much more agreeable in its application than the ordinary direct current for the reason that the construction is such that a gentle sinusoidal current is superadded to the direct or galvanic current, thus producing a very desirable combined effect, the advantages of which, especially in electrolysis or fibroid tumors of the uterus, as pointed out by Dr. Kellogg in his paper in the "International System of Electro-Therapeutics," and elsewhere.

The sinusoidal apparatus is extremely convenient in use. It is always ready for business, and the several different currents can be obtained by simply moving a switch and without adjustment of the conducting cords.

It is provided with a perfect speed regulator, and the current is controlled by a simple rheostat, as any other electrical current.

Any physician who has once used this apparatus in his office, will be unwilling to dispense with it, as it furnishes all the desirable effects to be obtained from both the galvanic and faradic batteries, together with a large number of other effects which are not approached by any other apparatus. It requires no cleaning of cells and brightening of contacts, gives no unpleasant fumes, does not get upset, destroying carpets and other office furniture, and never produces disagreeable or undesirable effects.

This apparatus, which is now for the first time made available to the members of the profession, is furnished in the following styles and combinations:—

Sinusoidal apparatus with permanent magnets .....	\$25.00
Hand motor .....	5.00
Electric motor to be run with two Edison or storage cells .....	15.00
Electric motor, to be operated by ordinary incandescent current 100 to 110 volts or with 50 volt current from transformer or an electric street-car system,	25.00
Water motor .....	15.00
Sponge rheostat, convenient and indestructible .....	2.00

Some sort of motor is of course required to operate this apparatus. Any of the above motors will be found satisfactory, but the most satisfactory arrangement of all is, of course, the electric motor, operated by an electric light system, which is constant and always ready for use.

The sinusoidal machine can now be promptly furnished without motor, or with any of the different motors named above, at the prices named, carefully boxed and delivered at the express office. A full set of directions is sent with each apparatus.

Further particulars may be obtained by addressing,

**THE SANITARY AND ELECTRICAL SUPPLY CO.,**

Battle Creek, Mich.; or 28 College Place, Chicago, Ill.

## THE TEETH.

The following is a summary of the conclusions reached by the writer respecting the significance of dental decay as presented in a paper read before the Michigan Dental Association, July, 1899:

1. Dental caries is almost universal in cases of chronic indigestion; only two persons in one hundred were found to have sound teeth.
2. The largest number of sound teeth were found in simple dyspepsia, the smallest number in hypopepsia.
3. In hypopepsia with gastric catarrh the number of sound teeth averaged about twelve, whereas in simple dyspepsia without gastric catarrh the average number was twenty-four.
4. The highest degree of dental caries was found in cases in which the amount of free hydrochloric acid present was less than ten milligrams per 100 c. c. of stomach fluid.
5. The average number of sound teeth in persons whose stomach fluid contained twenty-five thousand or more microbes per cubic centimeter was but eleven and one third. Complete loss of teeth was found to be four times as frequent in this class of patients as in dyspeptics as a class, showing that bacterial infection of the stomach is closely associated with dental caries.
6. A study of the physiological characters of the germs present in the stomach in these cases showed them to be both acid-forming and gelatin-liquefying; that is, capable of producing both acid fermentation and putrefaction.
7. Bacterial infection of the mouth is an abnormal condition, and may lead to infection of the stomach and alimentary canal in general. Bacterial infection of the stomach leads to infection of the mouth.
8. The study of ~~the~~ <sup>five</sup> one hundred cases ~~considered in this paper~~ shows that the beginning of decay of the teeth is, as a rule, either coincident with gastric indigestion or subsequent to it; hence it is evident that the hygiene of the mouth and teeth necessarily includes the hygiene of the stomach and careful attention to dietetics, and will lead to the exclusion of all substances which impair the digestive functions, and especially those substances which encourage bacterial infection of the mouth and stomach.



decay of the teeth is not a purely local disorder, but is an expression of a general disorder involving the whole body, and as such is a symptom of a depreciation of the vital resistance and the physical powers of the individual.

As corroborative of this thought I want to call attention to the greater and more important consideration: namely, that the rapid and almost universal existence of dental decay among civilized people is an indisputable evidence of the race deterioration which is going on at the present time with most alarming rapidity.

The human body is naturally proof against germs. There are no parasitic bacteria which are capable of colonizing upon a thoroughly healthy organism. The tissues are all capable of resisting the attacks of bacteria when themselves wholly intact.

Decay of the teeth is not simply the result of some accident, an unusual exposure of some kind, but speaking in general terms, it is, in my opinion, an indication that there is a general deterioration of the body, whereby the tissues have lost their power to resist the encroachments of parasitic organisms. The relation of decay of the teeth to disorder of the stomach is not more absolute than that between decay of the teeth and disorder of the liver or deterioration of other bodily organs, except that disordered conditions of the stomach are primary to a great share of the ailments to which the body is subject, both local and general. Speaking in general terms, a disordered stomach is not the result of decay of the teeth, although decay of the teeth undoubtedly contributes to the development of indigestion in many cases, and likewise decay of the teeth is not directly the result of disordered digestion, but is only one expression of the general vital deterioration which results from the depreciation or vitiation of the body's mutative processes which are the infallible result of indigestion.

The healthy savage as well as the healthy dog has a clean mouth, although he never resorts to the use of the toothbrush. Many ladies might well envy the

ivory-white, regular incisor teeth which every dog exhibits when he growls. The dog's mouth, tongue, and teeth are clean, not because of antiseptic care, but because his vitality is at so high a level that his tissues are unfriendly to microbes; they can not thrive in contact with them.

I have had the opportunity of observing primitive people in many different countries. I have studied members of the Yuma, Apache, Sioux, and other tribes of American Indians, and the natives of Mexico, many scores of whom I have had the opportunity of examining carefully in connection with the dispensaries associated with the Sanitarium at Guadalajara, Old Mexico. I have watched the Arabs of Egypt eating their brown bread and cucumbers ~~and~~ a handful of dates, and the Bedouins of the Assyrian deserts making a meal of dried figs, wheat cakes, and a little dried cheese. I have observed the peasants of Italy and Greece breaking their fast with a meal of boiled chestnuts and polenta. I have studied the peasants of Turkey and Bulgaria and other European countries. In all these cases I have almost invariably noticed the soundness of the teeth of these people of simple habits, and the absence of the foul breath and the coated tongue which are so common among the people of countries more advanced in civilization. I was particularly struck with the soundness and beauty of the teeth of some of the most ancient mummies which I had the opportunity of examining recently in the museum at Cairo, Egypt. ~~In~~ once talking to an audience of several hundred persons upon this subject, I raised the question, "How many persons present are able to testify to the possession of a complete set of sound teeth?" Only two persons responded, one of whom was a boy of ten years, and the other a Greek, a man who had been but three or four years in this country, and who had been reared in the simple conditions which surround the life of the Greek peasant.

I wish to be clearly understood as maintaining not only that decay of the teeth is not the primary cause of indigestion, but the reverse of it; that disorder of the stomach is the result of the violation of laws relating to diet and other matters pertaining to the regimen, while decay of the teeth results from the general vital deterioration which renders the body vulnerable to germs and microbic diseases.

The teeth of men and animals fed upon an insufficient, impure, or unnatural diet undergo decay in sympathy with the deterioration of the whole organism, and often afford the first evidence of general tissue degeneration; hence the state of the teeth may be regarded as an index to the state of the entire body.

with

once

The Battle Creek System  
Change & Additions

## Fifty Years Ago and Now

JUST fifty years ago, the writer began work as editor of GOOD HEALTH, and during this half century, thanks to the personal application of the principles of biologic living of which GOOD HEALTH has been a consistent exponent, he has been able to contribute his quota of editorial matter and other articles to every number published, 600 issues in all.

Although the present editor's connection with the magazine began in the spring of 1873, the journal itself began its existence seven years before, in the summer of 1866. At that time, *The Health Reformer*, as the magazine was then known, was one of half a dozen popular journals devoted to the cause of "health reform," as the movement was at that time termed. With the exception of GOOD HEALTH, every one of these journals passed into oblivion many years ago. GOOD HEALTH remains today the oldest health journal in existence.

It is exceedingly interesting in looking back over this half century, to note the mar-

velous progress which has been made in the field to which this journal is devoted.

Fifty years ago, the subject of health received very little attention by anybody except a few who were generally looked upon as faddists or fanatics. The water-cure movement which began in this country about the beginning of the last century as the result of the achievements of Priessnitz, the peasant doctor of Gräfenberg in Austrian Silesia, had practically died out. Most of the numerous water-cures started in different parts of the country had been closed, or were nearly extinct. The Graham movement, inaugurated by Sylvester Graham in the forties of the last century, had failed to strike the popular imagination, but had left good seed here and there. Dr. Stephen Smith, with the foresight of genius, had organized a board of health for the State of New York and formed a code of health laws which later became the model for legislation in every State in the Union; but scarcely a half dozen States had estab-



1873

JOHN HARVEY KELLOGG



1923

lished boards of health, and real *efficiency* was unknown in public health administration in any part of the United States, even in New York City, where more progress had been made than anywhere else under the stimulus of Dr. Smith's leadership. The health officers were political appointees, and knew much less about the duties required of a guardian of the public health than of the qualities of chewing tobacco and the gossip of the corner grocery. Doctor White, president of Cornell University, illustrated the ignorance of these pseudo-health officers by relating a conversation which he had with one of them when serving on a commission of investigation. The official had made use of the word "hyginnicks." The Professor asked him for a definition of the term, to which the officer replied, "'Hyginnicks' is a bad smell rising from dirty water."

Very few cities, with the exception of the very largest centers, made any organized effort to protect the health of the citizens. Vaccination was practically the only health measure in general use, and was performed in such a gross and filthy manner that it was a serious question with many whether more good than harm was done by the so-called "arm-to-arm" method of producing immunity.

In those days, cooking schools were unknown. The science of household economics now taught in every public school, had not yet been evolved. The culinary art was conducted by the rule of thumb. The science of dietetics was yet unborn. A few centers of diet reform started by Graham and Alcott at Boston, Northampton and a few other points in New England, and by their followers, Shipherd, Finney and Jenner at Oberlin, Ohio, and Olivet, Michigan, had passed out of existence, along with David Campbell's vegetarian boarding-house in Boston. The Fowlers and their brother-in-law, S. R. Wells, were conducting a Phrenological Institute in New York City, at which students were instructed how to read character by the "bumps" on the head,

and joined with their propaganda were more or less wholesome ideas about "health reform." A Dr. Trall was conducting at Florence Heights, New Jersey, a fake medical college, the course at which consisted almost exclusively of a series of harangues against drugs and drug doctors, with very little information of a practical sort in relation to hygienic living or the healing art.

As the result of contact with these various influences, and especially through the publications of Cole (*Philosophy of Health*), Fitch and Sylvester Graham, a group of "come-outers," led by James White, had ten or twelve years before started in Battle Creek a health movement and, later, the health journal known as *The Health Reformer*. While the real origin of this movement was such as we have indicated, an unusual degree of picturesqueness was given to it through the announcement by its leader that the new light was of supernatural origin, having been communicated through a "vision" to the wife of the leader, Mrs. E. G. White. A book entitled "How to Live," setting forth the new doctrines was issued and quite widely circulated. Unfortunately for its claims to divine authority, a critical examination shows the book to be merely a re-hash, in many instances, a verbatim copy, of books by the writers named and others. It was also unfortunate for this movement that its pioneers advocated strenuously some "reforms" which not only were not calculated to reform the health but were positively and very decidedly harmful and dangerous. One of these was the disuse of butter, the importance of which as a source of an essential vitamin is now so well known that it is not remarkable that under the butterless regime many persons suffered great injury to health, and not a few succumbed to tuberculosis and other maladies due to malnutrition.

The natural result was a rapid backsliding after the first burst of enthusiasm was over and a return to the flesh-pots on the part of the great majority of the early adherents—a movement which doubtless re-

sulted in saving the lives of many who otherwise would have succumbed to malnutrition.

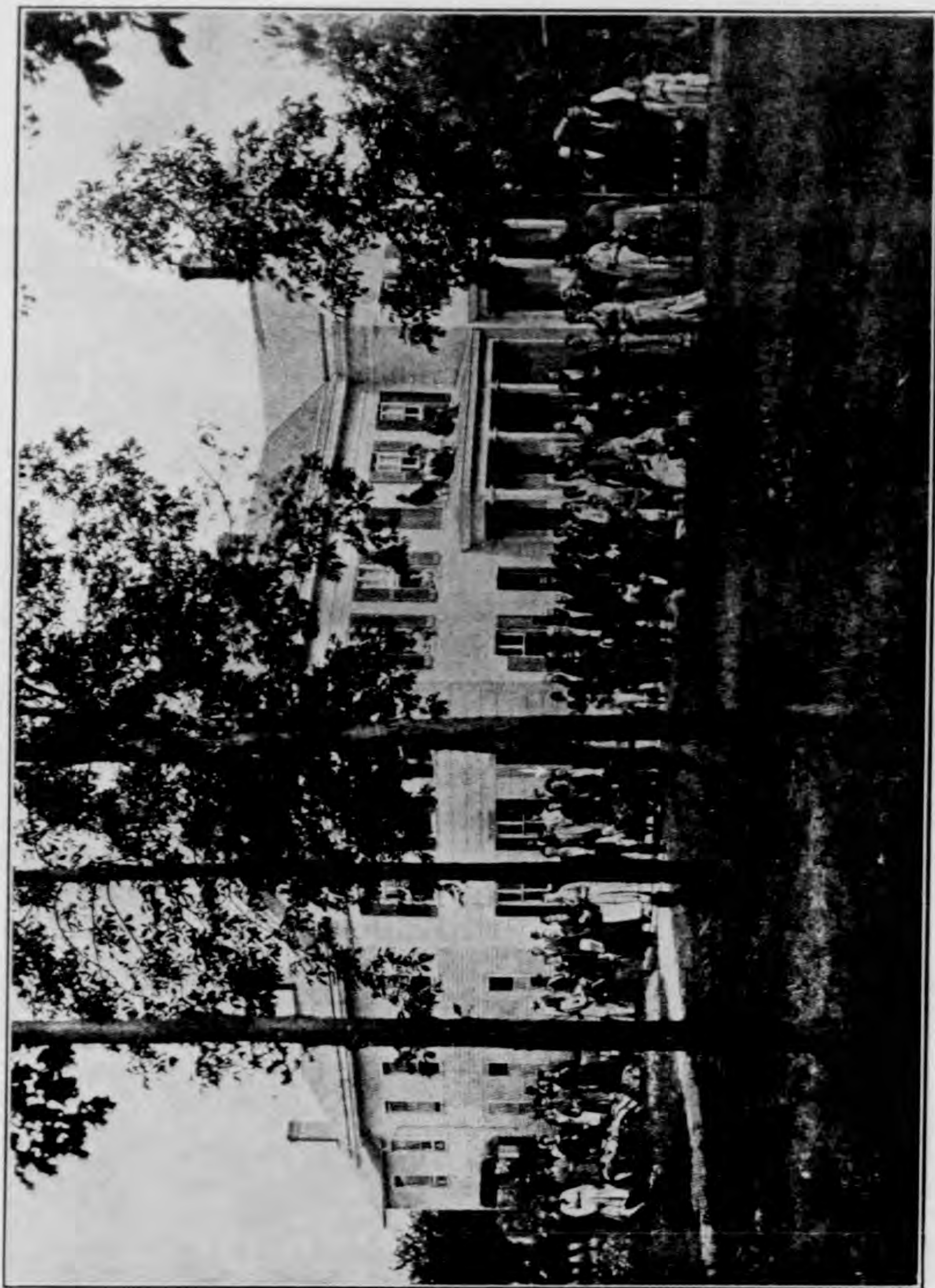
It is a curious fact that the same new light about "health reform" had been revealed to the world some thirty years before by Joseph Smith, founder of the Mormon Church, who also claimed his information to be of "divine origin." The Shakers, likewise, about the same time started a similar health movement in essentially the same way. Those were days in which new "cults" and "isms" were born over night. Unfortunately, the fantastic features of these movements and the lack of scientific foundation for many of the doctrines taught, hampered them to such a degree that little progress was made and little good accomplished. Nevertheless, many of the teachings were sound and the "reforms" insisted upon wholesome and physiologic. Flesh meats were discarded, together with tea, coffee, condiments, alcohol and tobacco.

Fifty years ago, the early Battle Creek health movement had reached the height of its prosperity and was beginning to decline. In taking charge of the journal at that time, the writer resolved to undertake a thorough study of the different health reform movements under their various phases, and to endeavor to find out how to live as indicated by the teachings of science, of physiology and biology divested of fads and visionary whimsicalities. The name of the journal was changed from *The Health Reformer* to *GOOD HEALTH*. The name of the health institution, which was taken in



THE ORIGINAL HEALTH REFORM INSTITUTE, 1866

charge soon after, was changed from The Health Reform Institute to The Battle Creek Sanitarium. The sectarian features were eliminated as far and as fast as possible, and for fifty years the continuous effort has been by research, experiment and observation, to find the way of right living, and to disseminate the knowledge gained as widely as possible. An earnest effort has been made to keep in touch with the great laboratories of the world, in which new discoveries in bacteriology, biology and physiology, are constantly being made, and to make a practical application of every new fact as far as possible. Enormous help has been received from the experiments in animal feeding conducted by Agricultural Experiment Stations and, in more recent years, in the laboratories of a few of our largest universities, by the aid of white rats. A laboratory of this sort, under the general supervision of the writer, has been carried on for a considerable number of years at the Battle Creek Sanitarium, and with interesting results. The application by scientific agriculturists of the principles of bi-



VIEW OF THE HEALTH REFORM INSTITUTE, TAKEN IN THE SUMMER OF 1875  
DR. KELLOGG IS STANDING BY ONE OF THE TREES (ARROW)



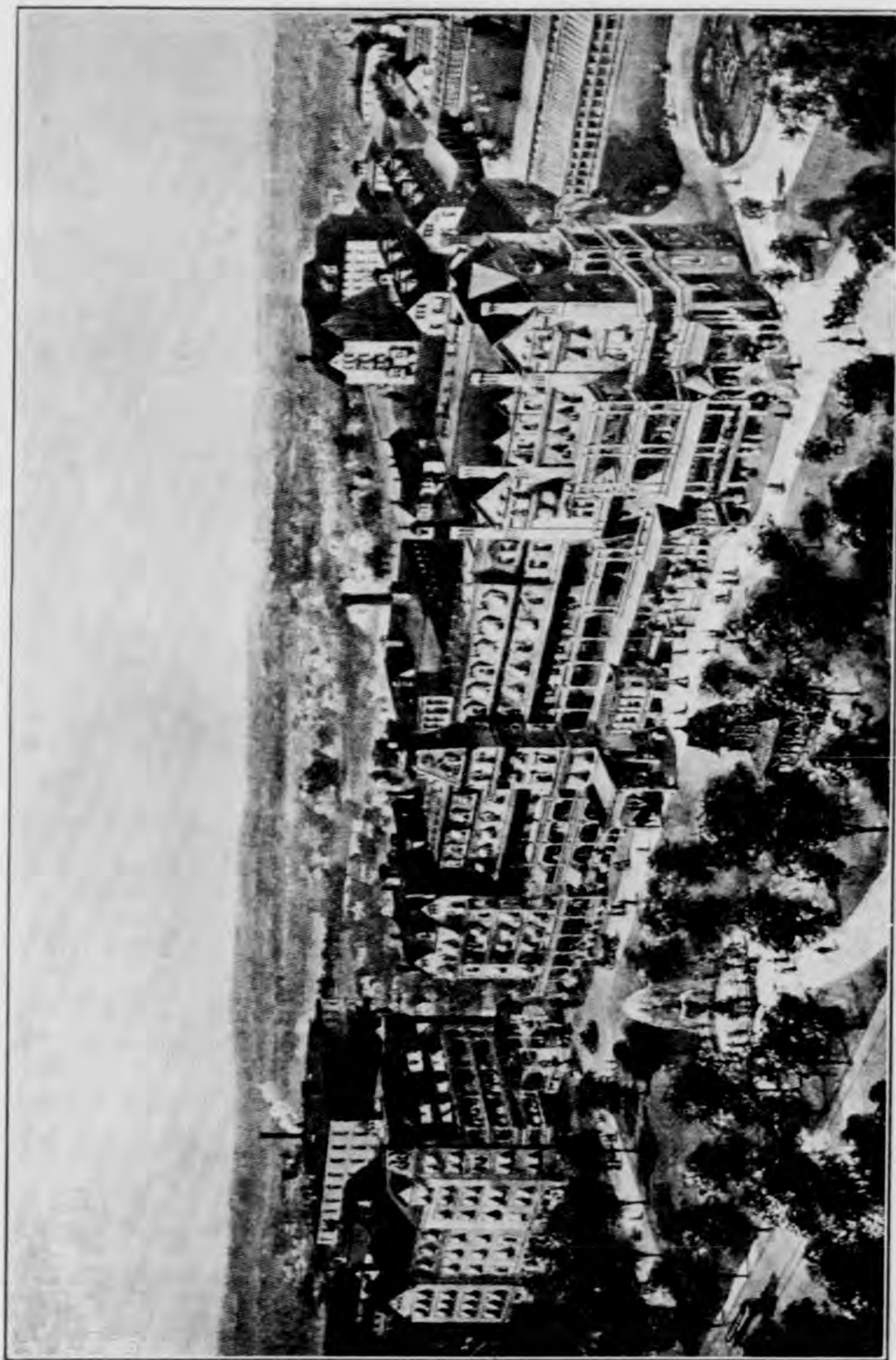
THE FIRST MAIN BUILDING, 1878

ology and physiology and the feeding and rearing of domestic animals, has produced marvelous results. We now have cows which give more milk than cows were ever known to give before. During the last summer, in the large registered herd of Holstein cattle which furnish milk to the Battle Creek Sanitarium, probably the finest dairy herd in the State of Michigan, there were at one time seven cows giving more than one hundred pounds of milk each, daily. Nearly three barrels of milk produced daily by seven cows! We now have hens that lay more eggs in a year than hens ever laid before; larger, and more speedy horses than were ever before known. All our domestic animals are marvelously improved by the application of the principles of physiology.

The application of these same principles to human life may be made to produce even more remarkable results. Through eugenics and euthenics, that is, race hygiene and personal hygiene, human beings may be so

greatly improved as to produce a veritable new human species. Mr. Burbank, the plant wizard, believes this might be accomplished within six generations. To promote progress in this direction has been the mission of GOOD HEALTH, and it is most encouraging to note that the importance of this mission is coming to be more appreciated than in former years. When the writer first began to call attention to the facts which indicate that the human race is degenerating, some forty years ago, he was called a "calamity howler;" but at the present time, all economists and scientists who have made a study of this subject not only admit that the human race is deteriorating, but the majority have abandoned hope for the race and predict its decadence until race extinction ends the career of man upon earth. The writer is not such a pessimist. It is our hope and belief that through biologic living, the human race may not only be saved but as greatly improved as have been the various creatures which man has





BIRD'S EYE VIEW OF THE MAIN BUILDING AND HOSPITAL, WHICH WERE  
DESTROYED BY FIRE, FEBRUARY, 1902

rescued from the forests and the plain and domesticated, to share with himself the toils and labors of civilized life.

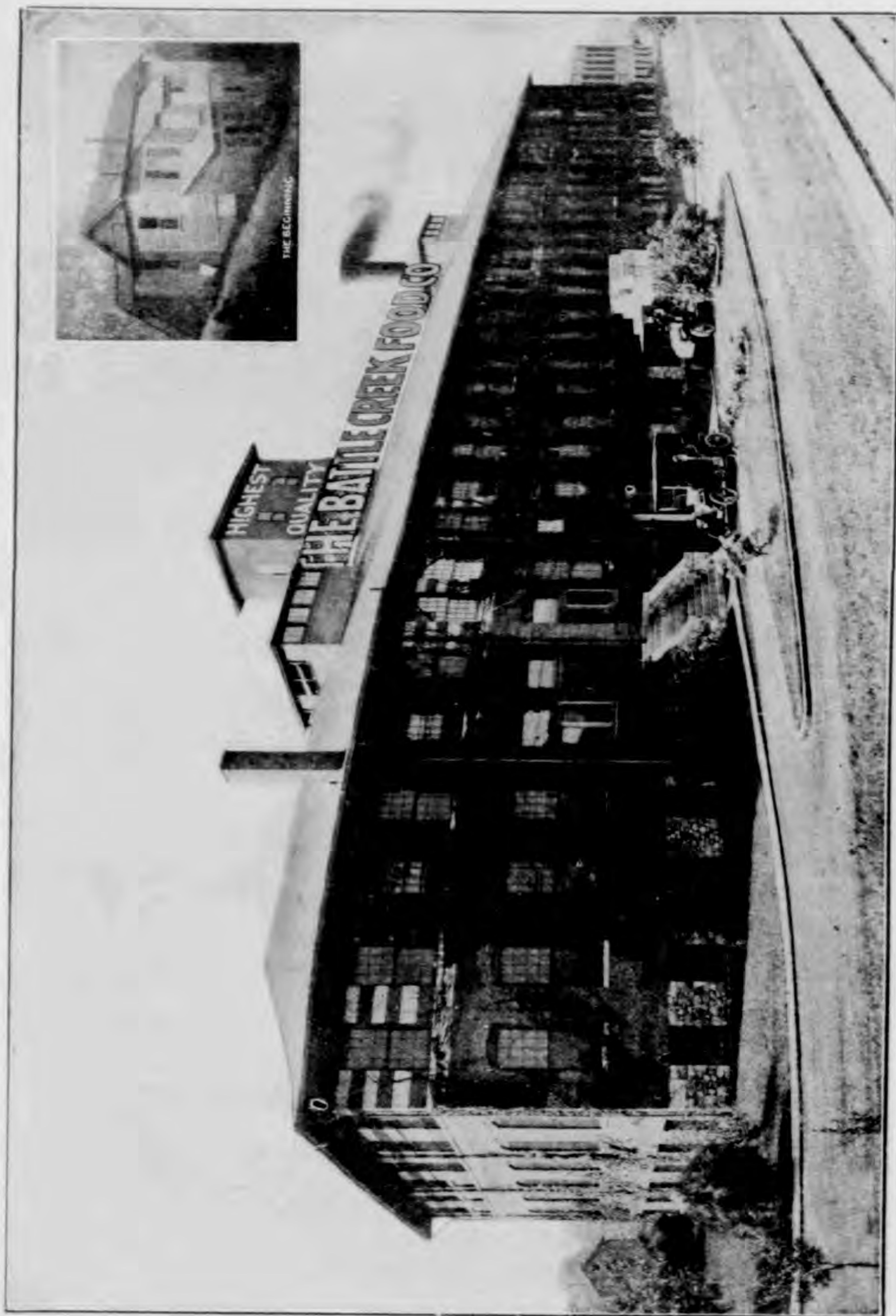
In harmony with this hope, the writer and his colleagues of the Battle Creek Sanitarium, a few years ago incorporated a Race Betterment movement, the initiative of which was the Race Betterment Conference held at the Battle Creek Sanitarium in January, 1914. Hundreds of scientific men and women from all parts of the United States, attended this Conference, and other cities sent representatives and published, daily, several columns of reports of the papers and addresses presented at the Conference. A second Conference was held in connection with the Panama-Pacific Exhibition. An exhibit conducted in connection with the exhibition, attracted more attention than any other exhibit in the educational building.

Beginning fifty years ago, the pre-ent writer began experiments for the purpose of developing an acceptable biologic dietary and in the summer of 1873 wrote his first little volume, "The Proper Diet of Man," and almost continuously since that time experimental work has been carried on, the result of which has been the production of scores of food preparations and the invention of machinery and methods for the production of ready-to-eat breakfast foods and other products having for their purpose the

improvement of dietaries for both the sick and the well. It is, perhaps, not too much to say that every household in the United States has been more or less influenced by these researches. The methods and prin-



THE NEW MAIN BUILDING, 1902



THE BATTLE CREEK FOOD COMPANY'S LABORATORIES, WHERE SANITARIUM FOODS ARE MADE



LAKEWOOD DAIRY—A PART OF THE SANI-TARIUM HOLSTEIN HERD

ciples developed have led to such a growth in the production of prepared foods in Battle Creek that the city has become known as the "breakfast food" center of the world. During certain seasons of the year, nearly one hundred carloads of foods are daily sent out to all parts of the United States and other countries by the various food concerns operating here, and it may truly be said that Battle Creek has changed the American breakfast from a meal made up chiefly of coffee, fried bacon and griddle cakes, to a more rational repast of ready-to-eat cereals and dairy products.

On the occasion of the third visit to Europe in 1899, the writer found Battle Creek and its food products quite widely known, not only in England, but in France, Switzerland, Germany, and even in Scandinavia. Factories for the manufacture of the foods were starting in all these countries, and soon factories were also opened in half a dozen other places. Not long after, doctors and nurses trained at Battle Creek began to make their appearance in numerous countries on both continents, and at the present time Battle Creek is known as a health center in all parts of the civilized world, and has been heard of in many heathen lands as well.

There is evidence everywhere that great progress has been, and is being, made in everything pertaining to health. The fluctuating fashions in women's dress have brought considerable relief from some of the distortions rife a half century ago. Out-of-door sleeping and out-of-door exercise are receiving much more attention than formerly. Tens of thousands of new homes that have been built within the last ten years have been provided with fresh air sleeping porches.

Of the various activities other than the editing of *GOOD HEALTH*, which have occupied the writer for the past fifty years, the most important has been the organization and development of the Battle Creek Sanitarium. The crude methods of the primitive water-cure system of Priessnitz, if it could be called a system, were illy adapted to the class



THE ANNEX, NEAR THE MAIN BUILDING

of sick people who claimed attention and the many failures and disasters had brought discredit upon these empirical methods. There was an evident need of a refinement and amplification of hydropathic measures. A long series of studies, researches, experiments and observations was begun which, after twenty-five years, was crystallized in a volume of more than 1,000 pages, "Rational Hydrotherapy." Massage and medical gymnastics, electricity, sunlight and the electric light were taken up in succession in like manner and the results presented in "Massage," "Light Therapeutics," and other works. The electric light bath and numerous mechanical and electrical appliances for application of exercise and "movements" were also among the results of the earlier years of work. The general aim of all these efforts was the development of a scientific and practical system of institutional treatment for the sick and methods of "bio-

logic living" for both sick and well. It has been gratifying and encouraging to see the ideas and methods evolved very widely copied and utilized in institutions and by physicians and others not only in this country but, to quite an extent, throughout the civilized world and recognized as "the Battle Creek System."

The hygienic and therapeutic value of water is coming to be more and more appreciated. The modern house is not considered at all complete without the stationary bath tub. None but the poorest hovels are found without proper facilities for bathing. This is certainly a great change from the situation so short a time ago as the forties of the last century, when the bath tub was pronounced "a danger to health," and the newspapers denounced this innovation brought over from England as "an extravagance," and called upon the government to suppress it by licenses and special taxes.



THE HOSPITAL

The State of Virginia, in fact, in 1843, made a law taxing each bath tub \$30 per annum, and a year or two later the city of Boston passed an order which rendered bathing unlawful except under the advice of a physician. So late as forty years ago, there was not a free public bath in the United States.

Thirty years ago, the writer, assisted by interested friends, established in Chicago its first free bath which for some time remained the only place where an indigent citizen could find an opportunity to free himself from the grime and soot of that dirty city. In connection with the free bath, a free laundry and dispensary were maintained, a visiting nurses' service, and at one time a settlement, a Good Samaritan lodging house and a day nursery. This work was continued for twenty years, for seven of which the writer spent one day each week in Chicago.

At the present time, many of our cities

provide public baths ample for the accommodation of all comers, while Young Men's and Young Women's Christian Associations, and many public schools, provide swimming baths and shower baths, with all up-to-date conveniences. Certainly, we are making progress.

Child welfare and other welfare organizations and health-promoting agencies are active in every part of the United States. Nearly every State Board of Health has a Welfare Department and sends out a monthly sheet devoted to health, together with leaflets dealing with every phase of public and personal hygiene. Recently, several new and excellent health publications have made their appearance, the last of which, *Hygeia*, is published by that most conservative of organizations, the American Medical Association.

The practice of medicine no longer con-



East West Hall—Nurses' Home

sists so largely as in former days of purveying pills and drugs of different sorts, but physicians are everywhere giving more and more attention to the application of hygiene, physiological medicine and instruction in methods of avoiding disease, many of which were ridiculed fifty years ago when advocated in this journal.

Within this fifty years, also, the new profession of nursing has developed in this country. Public health nurses, school nurses and visiting nurses are everywhere scattering the good seed of better habits and more biologic methods of living.

As the result of these various health activities, the death rate in the United States has been reduced to half the former mortality rate, and the average length of life has been increased from forty years to more than fifty years. The infant mortality, especially, has been wonderfully lessened. In many cities, the death rate of infants less than one year old has been reduced to con-

siderably less than half the former rate, as the result of improved conditions of living among the poor and the house-to-house instruction given by public health nurses.

GOOD HEALTH does not claim credit for this great progress, but it is a satisfaction to know that for fifty years or more, GOOD HEALTH has been a consistent advocate of these and other needed reforms, one of the greatest of all of which, the enactment of the Prohibition Amendment of the Constitution, was the greatest step forward ever made in so brief a time by any nation. Doubtless the World War hastened the achievement of prohibition, but it never could have been accomplished without the nation-wide educational work which had been carried on for half a century before in which GOOD HEALTH did its part.

The work of hygienic reform in its broader aspects is only just begun, and it is not at all likely that the great masses of the



EAST HALL—NURSES' DORMITORY, ERICETEN, 1893.

people will ever share in the benefits of biologic living; but an "aristocracy of health" may in time be developed. From year to year, new progress will be made, and Good Health will always be found in the front line of advance.

In order that the work of the Sanitarium should have influence and command respect, it was necessary that all its work should be conducted in a thoroughly scientific manner. To this end, extensive and thoroughly equipped laboratories were developed, with skilled experts in charge. To accomplish this, as well as to develop the surgical department, visits to the great European medical centers, six in all, were made, the first just forty years ago, when a very profitable time was spent in attending the clinics of the great surgeon, Billroth, and receiving special training from the chief assistant, the since famous Doctor Wölfler. Later, sev-

eral months were spent with the noted Doctor Lawson Tait, of Birmingham, England, the father of modern abdominal surgery. As the result of these opportunities, it was found possible to develop in connection with the Sanitarium system of diet and treatment, methods of dealing with serious surgical cases which greatly lowered the death rate. One of the early results of this work was the publication more than twenty-five years ago, of a series of one hundred and sixty-five successive recoveries after serious abdominal operations, and a total mortality after operations of this sort far lower than had ever before been attained. Although studiously avoiding repute as a specializing surgeon, having no enthusiasm for the surgical branch of the profession, the development of this branch of the work was so rapid that the writer was compelled to devote considerable attention to it, and

1889

1889

1889





THE "COLLEGE" BUILDING—CLASS-ROOMS AND LABORATORIES

in connection with other professional duties, he has performed something more than twelve thousand surgical operations, including several hundred involving the stomach, and abdominal and pelvic organs.

Another line of work undertaken was the establishment of a health mission in Mexico, with a Sanitarium located at Guadalajara, a work which was active and widely useful for several years.

During some fifteen years, from about 1893 onward, fully half the writer's time was expended in travel in an endeavor by lectures and other means to create an interest in biologic living and the rational care of the sick. During this time, also, a medical school was organized and carried on in connection with the Battle Creek Sanitarium where more than three hundred students were trained, and two hundred grad-

uated as fully qualified physicians. This work was begun because of the inadequacy of the training in the medical schools of thirty years ago, and was discontinued when found to be no longer needed.

A great step just being made is the establishment at Battle Creek, in affiliation with the Battle Creek Sanitarium and the work carried on by this journal, of a college, the work of which will be conducted in co-ordination with, and subordinate to, the principles of biologic living; that is, culture and training of the body to the highest state of vigor and fitness through right living, will be made as much a part of the work as mental training and character-building. Physical health will, indeed, be the basis of the educational scheme. This the writer has long regarded as the one step necessary to round out and complete the Battle Creek

*recently taken*

*other*

scheme for health betterment for the individual and *the race*, and he considers himself most fortunate in having lived long enough to see at least the beginning of what it is hoped will be made a model educational institution. This educational work will be only the extension of a work which has been steadily developed during the last forty-six years. The beginning was the School of Health, organized in the fall of 1877, the next year after the writer became superintendent of the Sanitarium. A few years later, a School of Nursing was organized and has been in continuous operation since, and has sent out into the world over two thousand nurses, who have been trained not only in the methods employed in ordinary hospitals, but in the special methods of treatment and the principles of biologic living which are in vogue at the Battle Creek Sanitarium.

Nineteen years ago, a School of Home Economics was organized, and thirteen years ago a School of Physical Education was opened. Hundreds of graduates have been sent out from both of these schools and are to be found successfully pursuing their professions in all parts of the United States. The grade of work done in these schools is equal to that of the best university schools, so that the completion of a college curriculum requires only the addition of a few academic studies.

Within this fifty years, along with other developments, the Battle Creek Sanitarium, of which *GOOD HEALTH* is a sort of bulletin, although in no sense a house organ for the institution, has made a phenomenal growth. Forty-seven years ago, the little water-cure, after having during ten years passed through many vicissitudes, was in such a state that the board of trustees had about determined to close its doors. Patronage had dwindled to less than a score of patients and debts were fast accumulating. A thorough re-organization, the introduction of new methods and the elimination of objectionable features, and especially a determined and continuous effort to put the work upon a sound scientific basis which

would command the respect of intelligent members of the medical profession, soon started a new development. The little handful of patients, scarcely a dozen, soon doubled in numbers, and during the years there has been a steady growth until at the present time the writer, after forty-seven years' continuous service as superintendent, surgeon and physician, finds himself associated with a faculty of fifty physicians, a corps of nurses, attendants, and other workers numbering fifteen hundred, with guests and patients reaching an annual aggregate of nearly twelve thousand; the buildings and equipment—all devoted to the care and treatment of the sick, aggregate in value nearly \$4,000,000, with affiliated properties devoted to the same interests which may be conservatively valued at a million more, all devoted unreservedly to the cause of biologic living.

In looking back over fifty years of continuous effort on one foundation and reviewing some of the evidences of growth and development, the writer is impressed by the fact that he has been peculiarly fortunate in always finding a considerable number of able associates willing to co-operate. For the most part, it is true, these have been persons who entered the work young and grew up with it, thus acquiring an experience and adaptability to the work that has proved invaluable. What has been accomplished has been the result of good team work. The writer feels no little pride in the fact that during the many years of his association with the work of the Battle Creek Sanitarium and the *GOOD HEALTH* Magazine, there has never been a serious internal ruction of any sort and very few desertions. There are today at least half a hundred persons holding responsible positions in the work who have been constantly at their posts except for short vacations for 25 or 30 years or more. Of the large board of trustees, ten in number, not one has been associated with the work so short a time as twenty years. For forty-seven years the management has remained the same. This continuity and stability of effort has been a

most important factor in what has been achieved by permitting an accumulation of experience and a summation of results.

The writer is happy to be able to report thus much of progress during his half century of continuous work in building on this foundation; and it is his sincere hope and wish that whoever has the pleasure of sum-

ming up the work of the next half century in this connection, will be able to report not only as much but more and better work accomplished for the great work of race betterment which is only just begun. In this field is the greatest opportunity for essential usefulness which the world affords.

## EFFECTS OF EXERCISE UPON DIGESTION.

Exercise aids digestion.

1. By increasing appetite.
2. By stimulating the stomach to produce a better quality of digestive fluid.
3. By increasing respiration.
4. By creating thirst.
5. By quickening intestinal activity.
6. By developing the abdominal muscles.

The effect of exercise upon the excretory organs.

Increase of Carbon dioxide,  $\text{CO}_2$ , during exercise.

2

## THE EXERCISE CURE FOR DYSPEPSIA.

Many dyspeptics complain of cold hands and feet.

The exercise of breathing is important for the dyspeptic.

1. Hyperpeptics should avoid violent exercise.
2. Hypopeptics and those suffering from aepsia take moderate exercise, after meals.
3. In cases of simple dyspepsia moderate exercise is recommended after meals.
4. In cases of ulceration of stomach, absolute rest after meals.
5. If pain in abdominal region, only moderate exercise.

## THE EFFECT OF EXERCISE UPON DIGESTION.

J. H. KELLOGG, M. D.

EXERCISE aids digestion in a great variety of ways, some of which are here enumerated:—

1. Exercise aids digestion by increasing the appetite. It creates an appetite by the removal of waste substances from the tissues, and by the consumption of the reserve tissues of the body, so that there is room for new material. Oxygen is the best of all appetizers, and as exercise increases the amount of oxygen taken into the system, it can be readily seen how it is an aid to digestion in this way.

2. Exercise aids digestion by stimulating the stomach to the production of a better quality and a greater quantity of digestive fluid. Oxygen itself is one of the most necessary elements of digestion; it is also required in the production of the digestive fluids.

3. Exercise very materially aids digestion through the healthful influence of the increased respiratory movements acting directly upon the digestive organs. By respiration, an expansion of the chest is produced, which creates a partial vacuum within the chest, or rather a diminished pressure, and this diminished pressure created within the chest-cavity is communicated to the large bloodvessels in the chest, and thus produces a suctional force acting in the direction of the heart. So with every act of inspiration, the blood is drawn into the chest. The liver and the stomach lie just below the diaphragm, so that the respiratory movement has the effect of drawing the blood into the stomach and liver, and thence into the portal circulation. Thus the portal circulation is promoted. Respiratory activity not only aids the stomach and liver, but it aids absorption by drawing the blood away from the

liver, and prepares the way for the fluids which are absorbed in the alimentary canal. And so digestion, you see, is aided in a variety of ways,—by the creation of appetite; by making room for new material; by supplying oxygen, the element essential to the production of digestive fluids; by stimulating the circulation so as to supply more blood; by stimulating the venous circulation by which effete elements are removed; and by emptying the bloodvessels and thereby aiding absorption. Thus the respiratory apparatus is a sort of pump by which the digested food is pumped into the bloodvessels of the stomach, from which it is drawn through the liver, and thus the whole digestive process depends upon the movements of the chest. There is another way in which the circulation through the abdominal organs is aided by the respiratory movements. As the diaphragm contracts, it compresses the stomach and the liver between the diaphragm and the abdominal walls; the tense abdominal walls hold the organs in place, while the diaphragm contracts and presses the blood out, as you would squeeze water out of a sponge.

4. Exercise aids digestion by creating a thirst for fluids. After a person has been exercising, if he then drinks as much as he pleases, the amount of fluid absorbed is so great that the weight that had been lost through perspiration will be more than balanced by the fluids taken in; so that a person's weight will be greater after exercise than before.

The advantage of exercise has not been fully recognized. A quaint old doctor has said that sawdust pills were the best remedy for dyspepsia that he knew of, provided the patient made them himself. Dr. Boerhaave, an old Dutch physician living some

two hundred years ago, says that for a dyspeptic, climbing a bitterwood tree is better than taking a decoction of its leaves. There is no doubt but that exercise is one of the best remedies for disease.

5. Another way in which digestion is specially aided, is by the quickening of intestinal activity, which is accomplished by exercise. The food circulates through about twenty-five feet of the small intestine, and it is very likely to become stagnant in some part of the alimentary canal; hence by inducing intestinal activity, exercise stimulates the intestines to action, and by that means promotes digestion.

6. Exercise also aids digestion by increasing the development of the abdominal muscles. When the abdominal muscles become weak and relaxed, so much so that they allow the stomach, bowels, liver, kidneys, spleen, and pancreas to drop down out of place, they very quickly become diseased. Prolapsed stomach, liver, and bowels are the result of this relaxation of the abdominal muscles, and this is certain to produce serious trouble in a variety of ways; sometimes the liver is so distorted that it folds upon itself.

In this state of general prolapse there is a continual strain upon the nerves which connect the organs with the abdominal walls; the roots of the nerves remain fixed, so when the organs drop down out of position, the nerves are continually upon a stretch. This is the same as if your arm or any other part of the body were constantly kept on a stretch by a heavy weight; the result is pain in various parts of the body. These pains are often attributed to a wrong cause, but they are due to a prolapse of some of these internal viscera, as the result of weakness of the abdominal muscles.

A knowledge of the effect of exercise upon the excretory organs, particularly of the skin and the kidneys, is very important. It is found that exercise always increases perspiration. There is a constant relation between the fluid that is thrown off through the kidneys and that thrown off through the skin,—the ordinary relation is about as 2 to 1; that is, the amount of fluid removed from the body in twenty-four hours by the kidneys, is about twice as great as that removed by the skin; but, as the result of active exercise, this relation may be reversed, so that the amount of fluid thrown off by the skin may be two and one half times as great as that thrown off by the kidneys. The amount of fluid thrown off by the skin does not necessarily indicate the amount of poisonous matter removed; for the poisonous matter could scarcely be two and one half times as great as that removed by the kidneys.

*Hydrogen = 100 parts  
100 5 parts and 100 parts*

Only the more important poisons in the secretions of the skin have been recognized by chemists, but that these poisons are of a very deadly character, is known.

It is found by experiment that when an animal is varnished, its temperature gradually falls, the elimination through the skin is destroyed, and it soon dies. It was formerly supposed that death in these cases was due to a too rapid radiation of heat from the body; but recent discoveries have shown that the real cause of the fall of temperature is the interference with the action of the skin, causing an accumulation of poisons in the body. It is found that when a particular poison which has been separated from the perspiration is injected into the skin of an animal, the temperature is lowered. So the accumulation of this poison in the body checks heat production and lowers the temperature.

The purpose of the action of the skin, is to regulate the temperature of the body, as well as to dispose of poisons produced in the body. With the skin in a normal condition, when the temperature of the body becomes too high, exercise will cause the skin to perspire freely, and throw off a large quantity of water, which evaporates and cools the skin, and by this means the temperature is lowered; so the skin is a regulator of heat. When exercising violently, the temperature of the body would rise to a dangerously high degree in a short time, if nature did not obviate the danger by increasing the amount of perspiration.

The chief purpose, as I have said, of the increased elimination of water by the skin, is to lower the temperature. This effect continues after a person ceases to exercise. During exercise, there is little danger of taking cold, because there is an increased production of heat; but after the exercise is discontinued, and there is no activity of the muscles, the increased production of heat ceases; but the increased heat-elimination through the cooling of the body still goes on, and there is great danger that the body will become abnormally cool. That is why there is so much danger of taking cold after exercise.

It is found by careful study and experimentation, as regards the action of the kidneys, that the amount of uric acid and other poisonous substances thrown off by the kidneys is not increased by exercise in one who is accustomed to exercise. Suppose a person has been accustomed to rowing several miles an hour: if he is in good training, the exercise does not increase the amount of uric acid or of waste matters thrown off by the kidneys, probably because the increased amount of oxygen taken into the system.



37

completely burns up the poisons and carries them off as carbon dioxide. There is a great increase of carbon dioxide, or  $\text{CO}_2$ , during exercise, but there is not an increase of nitrogenous waste. However, if a person takes exercise to which he is not accustomed, and becomes greatly fatigued in consequence of the urates and other poisonous substances produced, the amount of these substances thrown off may be greatly increased, especially under diseased conditions. It is because of diseased conditions that persons who take severe exercise find themselves suffering the next day from stiffness of the joints and muscles. The poisons which have been produced have been precipitated into the tissues, and an inflammation has been set up there.

Prof. Bouchard has shown by experimentation the interesting fact that the quantity of poisonous properties secreted by the kidneys is very much less during exercise than during idleness. It was found, for example, that when a man was made to exercise vigorously in the open air, it required twice as much urinary secretion to kill a rabbit, when it was injected into its veins, as of the urinary secretion produced during idleness. That is, the urinary secretion produced during idleness was twice as poisonous as that produced during exercise; and the probable reason of this was, that during exercise the great quantity of oxygen taken in consumed the most deadly poisons, because these are oxidized by the oxygen; so that the amount of poisonous matters thrown off through this channel during exercise is lessened.



# HYDROPATHIC AND HYGIENIC INSTITUTE.

...  
R. T. TRALL, M.D., PROPRIETOR.  
...

THIS commodious Establishment, 15 Laight street, New York, (the oldest and most extensive City Water-Cure in the United States,) has accommodations for one hundred or more persons. Its business arrangements comprehend:

1. GENERAL PRACTICE, in which Drs. Christie and Hambleton, and Miss A. S. Cogswell assist.
2. OFFICE CONSULTATIONS, personally or by letter, by Dr. Trall.
3. DEPARTMENT FOR FEMALE DISEASES—Prolapsus and other displacements, Ulcerations, &c., requiring mechanical and surgical management; also for lying-in women.
4. SCHOOL DEPARTMENT, for the Education of Physiological Teachers, Health-Reform Lecturers, and Hydropathic Physicians. Regular terms commence November 1st and May 1st of each year. Ample facilities are provided for a thorough general and medical course of study. Teachers—Dr. Trall, Dr. Taylor, Dr. Hambleton, Dr. Snodgrass, Dr. Briggs, Dr. Christie, L. N. Fowler, and Miss A. S. Cogswell.
5. LYCEUM, for Lectures, Debates, Calisthenic Exercises, Evening Entertainments, &c.
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7. PROVISION DEPOT, for the manufacture of pure and proper articles of wheaten grits, hominy, oatmeal, farina, crackers, Graham bread, &c. Orders for all kinds of farinaceous preparations, dried and preserved fruits, &c., will be supplied.

CHARGES.—Examination or entrance fee, \$5. Full treatment, with board, \$7 to \$10.50 per week. Day-patients, \$5 per week. Board, \$4 to \$7. Fires and lights for private rooms, \$1 to \$2 extra. Advice for self-treatment, verbal or by letter, \$5; subsequent advice or letter, \$1. Medical students are charged \$75 tuition for Winter Term; Tuition, with board, \$150. Tuition for Summer Term, \$50; do., with board, \$100, payable in advance. A liberal discount to those who attend two or more terms.

NECESSARIES.—Each patient must provide a pair of flannel blankets, two comfortables, one linen sheet, two cotton sheets, and half a dozen crash towels; or these may be hired at the Establishment for \$1 per week.

## Water-Cure Processes applicable to Home-Treatment.

1. WET-SHEET PACKING.—On a bed or mattress two or three comfortables or bed-quilts are spread; over them a pair of flannel blankets; and, lastly, a wet sheet, (rather coarse linen is best,) wrung out lightly. The patient, undressed, lies down flat on the back, and is quickly enveloped in the sheet, blanket and other bedding. The head must be well raised with pillows, and care must be taken to have the feet well wrapped. If the feet do not warm with the rest

of the body, a jug of hot water should be applied; and if there is tendency to headache, several folds of a cold wet cloth should be laid over the forehead. The usual time for remaining in the pack is from 40 to 60 minutes. It may be followed by the plunge, half-bath, rubbing wet-sheet, or towel-wash, according to circumstances.

2. HALF-PACK.—This is the same as the preceding, with the exception that the neck and extremities are not covered by the wet

sheet, which is applied merely to the trunk of the body, from the armpits to the hips.

3. **HAIR-BATH.**—An oval or oblong tub is most convenient, though any vessel allowing the patient to sit down with the legs extended will answer. The water should cover the lower extremities and about half of the abdomen. While in the bath, the patient, if able, should rub the lower extremities, while the attendant rubs the chest, back and abdomen.

4. **HIP OR SITZ-BATH.**—Any small-sized wash-tub will do for this; although tubs constructed with a straight back, and raised four or five inches from the floor, are much the most agreeable. The water should just cover the hips and lower part of the abdomen. A blanket should be thrown around the patient, who will find it also useful to rub or knead the abdomen with the hand or fingers during the bath.

5. **FOOT-BATH.**—Any small vessel, as a pail, will answer. Usually the water should be about ankle-deep; but very delicate invalids, or extremely susceptible persons, should not have the water more than half an inch to one inch in depth. During the bath, the feet should be kept in gentle motion. Walking foot-baths are excellent in warm weather, where a cool stream can be found.

6. **RUBBING WET-SHEET.**—If the sheet is used *drippingly* wet, the patient stands in the tub; if wrung so as not to drip, it may be used on a carpet or in any place. The sheet is thrown around the body, which it completely envelops below the neck; the attendant rubs the body over the sheet, (not with it,) the patient exercising himself at the same time by rubbing in front.

7. **PAIL-DOUCHE.**—This means simply pouring water over the chest and shoulders from a pail.

8. **STREAM-DOUCHE.**—A stream of water may be applied to the part or parts affected, by pouring from a pitcher or other convenient vessel, held as high as possible; or a barrel or keg may be elevated for the purpose, having a tub of any desired size. The power will be proportioned to the amount of water in the reservoir.

9. **TOWEL OR SPONGE-BATH.**—Rubbing the whole surface with a coarse wet towel or sponge, followed by a dry sheet or towels, constitutes this process.

10. **THE WET-GIRDLE.**—Three or four yards of crash towelling make a good one. One-half of it is wet and applied around the abdomen, followed by the dry half to cover it. It should be wetted as often as it becomes dry.

11. **THE CHEST-WRAPPER.**—This is made of crash, to fit the trunk like an under-shirt, from the neck to the lower ribs; it is applied as wet as possible without dripping, and covered by a similar dry wrapper, made of cotton or light woollen flannel. It requires renewing two or three times a day.

12. **THE SWEATING-PACK.**—To produce perspiration, the patient is packed in the flannel blanket and other bedding, as mentioned in No. 1, omitting the wet sheet. Some persons will perspire in less than an hour; others require several hours. This is the severest of the water-cure processes, and, in fact, is very seldom called for.

13. **THE PLUNGE-BATH.**—This is employed but little, except at the Establishments. Those who have conveniences will often find it one of the best processes. Any tub or box holding water enough to allow the whole body to be immersed, with the limbs extended, answers the purpose. A very good plunge can be made of a large cask cut in two near the middle. It is a useful precaution to wet the head before taking this bath.

14. **THE SNOW-BATH.**—This needs no description. It is not frequently used in water-cure, but is often very convenient. Those liable to a "rush of blood to the head," should not allow much of

the shock of the stream upon the head. Feeble persons should never use this bath until prepared by other treatment.

15. **FUMENTATIONS.**—These are employed for relaxing muscles, relieving spasms, griping, nervous headache, &c. Any cloths wet in hot water and applied as warm as can be borne, generally answer the purpose; but flannel cloths dipped in hot water, and wrung nearly dry in another cloth or handkerchief, so as to steam the part moderately, are the most efficient sedatives.

16. **INJECTIONS.**—These are warm or tepid, cool or cold. The former are used to quiet pain and produce free discharges; the latter to check excessive evacuations and strengthen the bowels. For the former purpose a large quantity should be used; and for the latter purpose only a small quantity.

**GENERAL BATHING RULES.**—Never bathe soon after eating. The most powerful baths should be taken when the stomach is most empty. No full bath should be taken less than three hours after a full meal. Great heat or profuse perspiration are no objections to going into cold water, provided the respiration is not disturbed, and the patient is not greatly fatigued or exhausted. The body should always be comfortably warm at the time of taking any cold bath. Exercise, friction, dry wrapping or fire may be restored to, according to circumstances. Very feeble persons should commence treatment with warm or tepid water, gradually lowering the temperature.

**GENERAL DIETETIC RULES.**—The food should always contain such relative proportions of bulk and nutriment as will keep the motions of the bowels at all times free, easy and natural. Graham bread, wheaten grits, hominy, wheat-meal biscuits, with plenty of good fruits, constitute the essentials of the best dietary system. Other farinaceous preparations and vegetables may be used for variety. Those who use animal food should eat fresh meat, but never more than once a day. All gravies, greasy meats, swine-flesh, shell-fish and old cheese should be religiously abstained from. Fresh butter may be tolerated if used very moderately, but is not to be recommended. Salt, sugar, milk and sweet cream are the only admissible seasonings, and all of them should be employed in moderation. Light puddings may be made of Graham crackers, cracked wheat, hominy, coarse Indian meal and rice, with milk and sugar. Comparatively healthful pastry may be made of Graham flour, shortened with sweet cream and mealy potatoes, with green or dried fruits, seasoned with sugar or molasses. Those who cannot make good fermented or loaf brown bread, may find a good substitute in wheat-meal cakes, made as follows: Wet the meal (Graham flour) with water, into a rather soft dough, then roll it into very thin biscuits, and bake in a range, oven, stove, or before the fire. They should be made fresh every day; whereas fermented bread should never be eaten till one day old.

**CRISIS.**—Those general disturbances of the system, transfers of morbid action, or aggravations of symptoms, constituting crises, do not occur as frequently nor with as much severity in home practice as under the more thorough and systematic course at a Water-Cure. Nevertheless, they do occasionally occur; and then all the patient has to do is to moderate the treatment in precise ratio to the violence of the crisis. Keep quiet and cool, taking no more exercise than is agreeable to the feelings, and *let Nature have her course*. After it is over, if the patient is not cured, the treatment may be resumed as before.

**NOTE.**—In some few cases, as in mercurial diseases, gout and rheumatism, the crises may be so violent as to render some part of the body excessively sore or painful; or the whole body feverish, tender and inflammatory. In these cases, one or two full hot baths, ten to twenty minutes, should be employed.

New York Dec 1, 1855

Dear General

I have your favor of 23rd.

You speak encouragingly of the probability  
of attending our school this winter.

Should you conclude your course  
to be such as would be well for you to

come a little before about 1st of your  
course here by Oct 1. The lecture of that

month will be a good preparation for  
you in relation to the material of our

lectures. We have most of the  
States represented in our list of students

for the next term, but I have not yet  
the names of more than from Georgia

except yours. Do we have medical  
or your bearing the first grade between

and physics for the most progressive  
of the Southern States.

Yours very truly

A. S. Davis

On a level with 2/4 1/2

Dear Madam

I have your letter that you are tired of my company  
with you. I have of 13<sup>th</sup> just can with what the  
I am very glad to hear how you are. I am  
sure at this time - however to C. G. I am doing well  
if at all, you are doing it. I will only let you  
to be here but a few weeks. I should like to  
give up my room, but if you go away what has  
cost me so much - and then why they had suspicious  
one and about home. My school has suspended this  
semester 30. I have to be with you by the  
you to 75. But they tell you to go immediately

to C. G. I. I can do it or leave just with  
it at all. I will write you if I can. I  
hope. Mrs. C. I have, I cannot understand  
but no time to finish it. Glad to hear as you  
bring home. My wife will be home to morrow.

I can pay my own expenses to C. G. I. I  
expended for. But I was going to write to  
you at all, if my health had not been out  
of order.

Excuse your very anxious letters  
I will be glad to see you any  
time. Love to all.  
Benjamin S. 4/11/18



FIG. 1

A culture of the *Lactobacillus acidophilus*  
grown in cow's milk.

Length of individual bacilli 8 microns.



FIG. 2

A culture of the *Lactobacillus acidophilus*  
grown in milk prepared from the soy bean.

Length of the individual bacilli 16 microns.



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FIG. 3

A roentgenogram of the colon of a patient who had suffered for many years from colitis. The descending and pelvic colon are in a highly spastic condition. There had been no natural evacuations for more than a year.



FIG. 4

A roentgenogram of the same colon shown in Fig. 3 after six weeks' use of Soy acidophilus milk by mouth and by enema. Within four weeks after beginning the use of soy acidophilus milk, natural evacuations occurred daily.



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A roentgenogram of the colon of a patient who had suffered for many years from colitis. The descending and pelvic colon are in a highly spastic condition. There had been no natural evacuations for more than a year.



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# TESTIMONIALS.

From Dr. JOHN M. KITCHEN.

INDIANAPOLIS,

A vast number of subjects, briefly and intelligently discussed, are presented in the work entitled "Home Hand-Book of Hygiene and Medicine."

There are no mysteries in true science, and this work can safely be consulted, not necessarily to supplant the physician, but rather as an aid to a just estimate of the treatment of disease on rational and common-sense principles.

JOHN M. KITCHEN, M. D.

From Dr. THAD. M. STEVENS, Secretary State Board of Health of Indiana,

INDIANAPOLIS, IND.,

Having examined the "Home Hand-Book of Domestic Hygiene and Rational Medicine" by J. H. Kellerg, M. D., Battle Creek, Mich., I find it a good practical treatise upon the subjects embraced within its scope. As a means of awakening the interest of non-professional persons in relation to such subjects, it can be recommended.

THAD. M. STEVENS,

Sec. State Board of Health.



# TESTIMONIALS.

**From Prof. James L. Denton, State Supt. Pub. Instruction of Arkansas.**  
LITTLE ROCK, ARK., June 22, 1881.

"After examining the *Home Hand-Book of Hygiene and Medicine*, I do not hesitate to pronounce it a work of genuine merit. It is written in a plain and vigorous style, and sheds much light on the preservation of health, as well as the causes and cure of disease. It deserves a national perusal, and should have a place in every family library."  
JAMES L. DENTON.

**W. J. Beal, M. S., Ph. D., Professor of Botany and Horticulture in the Michigan State Agricultural College, says:—**

"I am pleased with the work, and think it will do much good in giving valuable information in plain terms."

**From Rev. J. Morgan Smith, Pastor Congregationalist Church, Grand Rapids, Mich:—**

"I am struck with the lucidity of its style and explanations, with the naturalness of arrangement in the several parts—and with the sound common sense which is applied to many intricate subjects, so as to give an average reader a fair idea of them. The work is by far the best for its purpose of anything I have met, and there is a large place for it."  
CORUNNA, MICH., Jan. 25, 1881.

From an examination of Dr. Kellogg's *Hand-Book*, I am satisfied that it is a work which is well adapted to family use, and that it meets a long-felt want.

GEO. D. WRIGHT, M. D.  
JOSIA, MICH., April 7, 1881.

I have thoroughly examined the *Hand-Book of Domestic Hygiene and Rational Medicine*, and for unprofessional people and families I find it the best of the kind I have seen.

S. M. BAYARD, M. D.

**From Gen. J. D. Hoyer, of San Bernardino, Cal.:**—

"I have examined Kellogg's *Home Hand-Book*, and compared it with the latest edition of Gunn's. I consider it decidedly superior to Dr. Gunn's work, and the best of the many medical works that have been written for families that I have examined."

Having examined Dr. J. H. Kellogg's *Hand-Book of Medicine*, I can cheerfully recommend it, believing it to be all it claims, and conducive to a thorough and practical information on medical subjects.

A. G. BROWN, M. D., Corunna.

Corunna, Mich., Feb. 15, 1881.

I have made a hasty examination of the *Home Hand-Book*, and can recommend it as far superior to any work of its kind now in the hands of the people.

J. L. SMITH, M. D.

**From E. W. Jenks, M. D., L. L. D., Professor of Gynecology in the Chicago Medical College:—**

"I have no hesitancy in saying that the *HOME HAND-BOOK* far surpasses anything of the kind I have examined."

**From Prof. C. F. R. Bellows, of the Michigan State Normal School:—**

"I can appreciate the value of a work, developed as is this from the rational side of medical treatment. I am able to bear testimony in my own experience to the correctness of common-sense views in matters of cure, and care of health. I feel that a work such as the one you have prepared, must prove a source of incalculable benefit to all among whom it may go."

We have received the *Home Hand-Book of Domestic Hygiene and Rational Medicine*, the latest work of Dr. J. H. Kellogg, Battle Creek. Dr. Kellogg has a happy knack of expressing what he thinks in the simplest manner and language, so that any person can comprehend his meaning. Not only does he give the causes and means of curing the various diseases, but he devotes considerable space to the means of preventing them, and he appears to be a firm believer in the maxim that "an ounce of prevention is better than a pound of cure." The work should be placed in every household, as it is invaluable.

From H. B. Baker, M. D., Secretary of the State Board of Health of Michigan:—

"I am much pleased with your valuable *HAND-BOOK OF HYGIENE AND RATIONAL MEDICINE*. It seems to me to be very far in advance of anything of the sort heretofore published."

Of course I cannot speak very dogmatically as to the merits a work on medicine, but I can emphasize the need of a better knowledge of the human body and how to take care of it. It's not enough for the doctors to know this. Their skill is often called into requisition *after the mischief is done*. "An ounce of prevention is worth a pound of cure." The chapters on the adulteration of food are especially valuable and timely. The names of some of our best physicians among the subscribers attest the value of this particular work. We not only subscribe for it but recommend it.

Owosso, Mich., Dec. 17, 1880.

REV. W. M. FARNUM,  
*Pastor Baptist Church.*

*Jackson, Mich., Sept. 1, 1881.*

Having secured Dr. J. H. Kellogg's "*Home Hand Book*," I consider it superior to all other works of the kind published; and believe it will supply a long-felt want, and be a source of valuable information to thousands of families needing it, and if the contents be studied and practiced a great amount of unnecessary suffering will be prevented.

W. L. SEATON, P. M.

Having examined the work of Dr. Kellogg, I think it one of the finest works of the kind I have seen.

O. H. LAMOREUX, M. D., *Linden, Mich.*

From Rev. N. I. Benson, Rabbi Congregation Bnai Israel, Little Rock, Ark.  
LITTLE ROCK, ARK., May 19, 1881.

"This is to certify that I heartily recommend "*Home Hand Book of Hygiene and Medicine*," by Dr. Kellogg of Battle Creek, Mich. Dr. Kellogg being a distinguished medical scholar and his reputation as such being personally known to me."

N. I. BENSON.

*Ionia, Mich., April 5, 1881.*

I hereby \_\_\_\_\_ have examined Dr. Kellogg's work on "*Domestic Hygiene and* \_\_\_\_\_ *and* \_\_\_\_\_ *most complete work of its kind I have* \_\_\_\_\_ *ever seen for the public. If such works as this were more frequently read in place of the* \_\_\_\_\_ *miserable and pernicious trash that forms so large a portion of the literature of the day,* \_\_\_\_\_ *it would add very much to the intelligence and healthfulness of the general public.*

DR. F. G. GUNDRINER.

MO. VALLEY, Iowa, Nov. 18, 1880.

Dr. Kellogg's late work is certainly the product of deep thought, extensive research, and very much labor, and is deserving of hearty support and patronage.

R. W. DOUGLASS,  
*Pastor of M. E. Church.*

*Ionia, Mich., April 6, 1881.*

I have examined with some care Dr. J. H. Kellogg's "*Home Hand-Book of Hygiene and Rational Medicine*," and recommend the work for every family.

DR. C. H. HAMMOND. -

*Goshen, Ind., March 15, 1881.*

There is no question but that Dr. Kellogg's "*Home Hand-Book of Hygiene and Rational Medicine*" is destined to become the people's favorite, and do great service in carrying valuable information concerning health to thousands of families needing it.

W. O. PICKRE, D. D.,

*Pastor M. E. Church, Goshen, Ind.*

**From DR. WENGER.**

I think that it is one of the best works of the kind, especially for domestic use.

CUMBER, WHITBY CO., IND.

N. R. WENGER, M. D.

**From Dr. F. M. MAGERS.**

I have examined the prospectus of the "Home Book of Hygiene," and think it valuable for domestic reference. For its simplicity of language it is unequalled.

CHURBURSCO, IND., Sept. 21, 1881.

F. M. MAGERS.

**From Drs. P. H. JAMESON, HENRY JAMESON, and I. C. WALKER.**

Having examined Dr. J. H. Kellogg's "Home Book of Medicine," I think I can justly say it is a good and useful book in which there is much to approve and little that is censurable. If it were in the hands of every intelligent household in the land, it would serve as a reliable guide in relation to hygiene and the treatment of many of the milder and incipient forms of disease, and thus, in all probability, prevent much suffering and sickness. The style is peculiarly happy.

INDIANAPOLIS, IND., Jan. 31, 1882.

P. H. JAMESON, M. D.

**From Dr. G. O. WOOLEN, President Marion Co. Medical Society, late Secretary Indiana State Medical Society.**

To WHOM IT MAY CONCERN:—I herewith certify that I have somewhat carefully examined the "Home Hand-Book of Domestic Hygiene and Medical Medicine," by J. H. Kellogg, M. D., and that, under a strong prejudice against works of somewhat a similar title. However, upon reading the preface, (which I think we should do before reading any book,) I learned that an attempt was made to correct the very evils propagated in such very objectionable works. That the author has very greatly succeeded, I am convinced by the subsequent examination of the book. The character of the authors so fully quoted guarantees safe teaching, if followed. This, together with the great interest shown by the author, and the unexceptional manner of arrangement, make it a very attractive and instructive treatise of the kind. Especially would I recommend the first half of the work to the general public. Whatever may be said of the latter part, I have no objection to the claim of the author in his preface, and believe he has quite satisfactorily accomplished the difficult task, so far as it is possible, in the existing state of medical science.

INDIANAPOLIS, Jan. 28th, 1882.

G. O. WOOLEN, M. D.

Pres. Marion Co. Medical Society, late Secretary Indiana State Medical Society.

**From J. A. COMINGOR, M. D.**

I have hastily examined the "Hand-Book of Domestic Medicine and Hygiene" by J. H. Kellogg, M. D., and think it an excellent compilation of the branches named. It is replete with practical suggestions with regard to every-day life; and if faithfully studied and appreciated, it may be the means of driving impostors from the professional field, thereby protecting the people from the imposition so successfully practiced by this class of medical sharks. If it does this, it will do a great work.

INDIANAPOLIS, 1882.

J. A. COMINGOR, M. D.

**From W. A. COCHRAN, M. D. and J. K. BIGELOW, M. D.**

Having examined Dr. Kellogg's "Home Hand-Book of Hygiene and Medicine," I take pleasure in expressing my belief that it is decidedly the best book of the kind that has come to my notice. So many books of this class are written by irresponsible, uneducated, and unscrupulous charlatans, that it is really refreshing to see a volume from the pen of a man standing so high in his profession as Dr. Kellogg does; and I take pleasure in recommending it to the public.

INDIANAPOLIS, IND., Feb. 4th, 1882.

W. A. COCHRAN, M. D.

I endorse Dr. Cochran's opinion.

J. K. BIGELOW, M. D.

Pres. U. S. Board of Examiners for Pensioners.

**From Dr. J. RICHARDS.**

I have carefully examined a prospectus of Dr. Kellogg's "Home Hand-Book of Domestic Hygiene." I regard it a scientific work. The facts are stated in such language that any person can understand them. In fact it is one of the most elaborate and practical Family Guides that I have ever seen.

FOREST, IND., July 22, 1881.

J. RICHARDS.

**From Dr. A. J. SALTS.**

I consider the "Home Hand-Book" the best of the kind ever published, and earnestly wish that the good volume was in the book-case of every man in this township.

REANOCK, IND., Aug. 9th, 1881.

A. J. SALTS, M. D.

Late House Physician to City Hospital of Ft. Wayne, Ind.

**From D. W. GRUBBS, Mayor of Indianapolis.**

I have examined Dr. Kellogg's "Home B...

INDIANAPOLIS, IND., Jan. 10, 1882.

**From I. N. PATTISON, City Treasurer.**

INDIANAPOLIS, IND., JUN. 14, 1882.

I have examined Dr. J. H. Kellogg's "Home Hand-Book," and in my opinion it by far exceeds anything of the kind I have ever seen in print, being compact and containing nothing but useful information to all, and in language easy of comprehension to any one.

Respectfully,

I. N. PATTISON.

**From CAPT. W. D. WILES.**

INDIANAPOLIS, IND., JUN. 10, 1882.

I have examined Dr. Kellogg's "Home Hand-Book of Domestic Hygiene and Rational Medicine," and unhesitatingly pronounce it by far the most comprehensively, thoroughly, and systematically developed work of its character that I have seen. Throughout the entire work great stress is put upon the laws of health and the methods of preventing disease. The language used is such that any one can understand it. I think it is the best family medical work I have ever examined.

CAPT. W. D. WILES.

**From GEN. JOHN COBURN, of Indianapolis, Ind.**

INDIANAPOLIS, IND., JUN. 10th, 1882.

I have hastily examined "The Hand-Book of Hygiene and Medicine" by Dr. Kellogg, but enough to see that it is a carefully prepared compendium of scientific knowledge upon those subjects, written in a plain and common-sense style. The plates are valuable. The whole constitutes a very useful work to those of us who know too little of those vital matters of the preservation of health and the prevention and removal of disease.

JOHN COBURN.

**From HON. A. P. STANTON.**

INDIANAPOLIS, IND., JUN. 10th, 1882.

I have been much interested in Kellogg's "Home Hand-Book of Domestic Hygiene and Rational Medicine." I think it an improvement upon most medical books, in this, that it has much to say on hygiene, and for both the prevention and cure of disease. I have found there is more help in careful living than in drugs. Any dyspeptic can well afford to buy the book if he read only the chapters on foods and those that treat of disordered digestion. The book is a valuable one, and marks a step forward in the prevention and treatment of diseased conditions.

A. P. STANTON.

**From HON. M. B. WILLIAMS.**

INDIANAPOLIS, IND., 1882.

A careful but somewhat hasty examination of Dr. Kellogg's "Home Hand-Book of Hygiene and Rational Medicine," has impressed me most favorably. The arrangement and scope of the work are judicious; and while it will prove of practical value to the profession, its greatest value consists in its admirable adaptation to the home and family.

The direct statement of the causes of disease, the means by which they may be prevented, and the plain, practical directions given for their treatment, will, when carefully studied, enable the mother or nurse to usurp and successfully hold the position of Family Physician, in dealing with the numerous ailments to which infancy and childhood are subject.

M. B. WILLIAMS.

**From MRS. R. SWAIN, M. D.**

INDIANAPOLIS, IND.

The Book is one that I take pleasure in recommending. It should be in the house of every intelligent family, not only in Indianapolis, but in every city, and the country as well. The author, Dr. Kellogg, is doing a good work, and one that will bring with it success.

MRS. R. SWAIN, M. D.

I heartily endorse the above.

HENRY JAMESON, M. D.

Prof. of Chemistry, Toxicology, and Diseases of Children, Medical College of Indiana.

So do I.

L. C. WALKER, M. D.

Prof. of Diseases of the Mind and Nervous System, Medical College of Indiana.

**From Drs. W. C. THOMPSON and P. J. WATTERS.**

INDIANAPOLIS, JUN. 20, 1882.

We have examined the "Home Hand-Book of Domestic Hygiene and Rational Medicine" by Dr. J. H. Kellogg, and think it well adapted to the wants of the non-professional reader, and of special value to the farmer, and those distant from a physician. The truths of Physiology and Hygiene are clothed in a language at once plain, beautiful, and attractive, and the department of Treatment is sufficiently elaborate for emergencies and light ills not requiring the service of a trained mind. The work is especially valuable for the advice given and the thorough manner in which the evils of the society of to-day are pointed out. In a word, it is a work worthy of perusal by all, and will do much good in this country at this time.

W. CLINTON THOMPSON.

P. J. WATTERS.

OLIVET, Mich., July 9, 1880.

I have been deeply interested in examining your "Home Hand-Book of Hygiene and Medicine." It is, in my opinion, by far the best work for the people on Hygiene and Medicine which has been published. It is very comprehensive, pointing out not only causes of disease, but ample means for prevention. It is a splendid work, and will surely have a large sale throughout the country.

Yours, truly, PROF. GEORGE H. HOWARD, A. M.,  
*Director of the Michigan Conservatory of Music.*

The "Home Hand-Book of Rational Medicine" by Dr. J. H. Kellogg is undoubtedly a valuable book. Children and adults will read it by the hour with pleasure and advantage. Read with attention and administered with good common sense, I have no doubt its precepts will save the value of the book in a few months by making the physician's visits less frequent.

F. YOCUM,  
*Pres. of M. E. College, Fort Wayne, Ind.*

AFTON, IOWA,

After having examined Dr. Kellogg's Home Hand Book of Domestic Hygiene, I can say that I believe it to be the best of its class, and one worthy a perusal by every one.

W. D. CHRISTY, M. D.

From G. W. McCaskey, Ph. B., M. D., *Prof. of Physiology and Microscopy in Fort Wayne College of Medicine, and Editor of Fort Wayne College Journal of the Medical Sciences:*

"Having examined Dr. Kellogg's 'Home Hand-Book of Hygiene and Medicine,' I take pleasure in expressing my belief that it is decidedly the best book of the kind that has come to my notice. So many books of this class are written by irresponsible, uneducated and unscrupulous charlatans, that it is really refreshing to see a volume from the pen of a man standing so high in his profession as Dr. Kellogg does. It deserves a wide circulation."

It is seldom that a popular work of this kind appears that a regular physician can endorse; but I am cordially recommended Dr. Kellogg's "Home Hand-Book" of Hygiene, and am sure it will be a public service to recommend it to all families, as the Doctor has treated these important subjects in a plain, sincere, and earnest manner; and I would wish that every family in the land possessed a copy of it.

DR. W. A. NEAL, *Elkhart, Ind.*

Fort Wayne, Ind.,

After having been for many years disgusted with the usual literature which has been thrust upon an indiscriminating and too-confiding public, in the shape of popular treatises upon the subject of diseases and their treatment, most of which has been designed to advertise some charlatan or quack nostrum, it is really gratifying to find a meritorious work concisely written and methodically arranged and adapted to popular instruction, and that, too, written by a profound scholar and an indefatigable and conscientious laborer for the dissemination of useful knowledge among the people. Having recently examined the Home Hand-Book of Domestic Hygiene and Rational Medicine, and knowing as we do personally, the author, Dr. J. H. Kellogg, we are prepared to give it as our opinion that it is such a work as the above; and that placed in every family, it would prove of immense value in the promotion of health and morals, the prevention of disease, and in the protection of the people from the imposition of quacks and quack nostrums; and we take pleasure in recommending it to the public.

J. S. GREGG, M. D.,  
*Prof. of Surgery, Fort Wayne College of Medicine;*

C. B. STEMEN, M. D.,  
*Prof. of Anatomy, Physiology and Hygiene, Fort Wayne M. E. College.*

Having looked over the work of Dr. Kellogg, I believe it to be an excellent thing, and can heartily recommend it.

A. R. INGRAM, M. D., *Argentine, Mich.*

FLINT, Mich.,

From personal acquaintance with the author, I know this work [the Home Hand-Book] is one of rare excellence, and that it will fully meet the expectations of those who buy it.

HON. LEROY PARKER,  
*Member State Board of Health.*

I have perused, to some extent, Dr. J. H. Kellogg's "Hand-Book of Domestic Hygiene," and unhesitatingly pronounce it the best of the kind that ever came to my notice.

APP, M. D., *Bassett, Mich.*

Mich.,

"book" about one year  
that should be in  
BULLOCK.

Having purchased Dr. J. H. Kellogg's "Home Hand-Book of Domestic Hygiene and Rational Medicine," I consider it the best book of the kind published—a book for every family.

Jackson,  
R. D.  
Ann Arbor, Mich., April, 1881.

From an examination of Dr. Kellogg's "Home Hand-Book of Domestic Hygiene and Rational Medicine," and from a knowledge of the author, I heartily endorse the work, and would recommend it as a valuable addition to any library.

H. B. BARNES, M. D.  
North Manchester, Ind., May 13, 1881.

As a popular educator, we think Dr. Kellogg's work, "THE HOME HAND-BOOK OF HYGIENE AND RATIONAL MEDICINE," will prove of inestimable value in every home.

DR. CHARLES H. WINTON,  
DR. DAVID A. GOSHORN,  
DR. HORACE WINTON,  
DR. M. O. LOWER.

I have examined the work entitled, "the Home Hand-Book of Rational Medicine," and am satisfied that it is the book for everybody. It should be in every home to the hand. The advice it contains will, in a short time, save many times its cost, since it shows how to prevent as well as how to cure disease.

H. B. BROWN,  
Prin. Normal School, Education, Ind.  
REASON SAINSBARGER,  
Co. School Supt. for Porter Co., Ind.  
Goshen, Ind.

I cheerfully endorse the above.

The "Home Hand-Book," by Dr. J. H. Kellogg, is a work which, if thoroughly studied by the laity and put in practice, will be priceless as a guide to health and a protection against quacks.

DR. P. D. HARDING.

T. J. Kirkpatrick, Editor of the "Farm and Fireside," Springfield, Ohio.

"I think the 'Home Hand-Book' the grandest popular medical work ever published, and I have seen all of any repute. I have learned from it much that I have adopted, and which has benefited me."

ANNAPOLIS, Iowa, Oct. 15, 1880.

I believe the "Hand Book of Hygiene and Medicine," by J. H. Kellogg, M. D., to be an excellent work, well worthy a place in any household. It is full of practical instruction to old and young, and is a useful work.

REV. ED. B. COUSINS,  
Pastor Presbyterian Church.

From L. R. Fiske, President of Albion College:—

"I possess a copy of the 'Home Hand-Book of Domestic Hygiene and Rational Medicine' and prize it highly for the wide range of valuable information it contains. If thoroughly studied there will be but little need usually of calling for the services of a physician to cure disease. A knowledge of the functions of the several portions of the human body and the observance of the laws of Hygiene so plainly presented w<sup>ll</sup> in most cases serve to keep off disease and avoid much of suffering. Every home should contain a copy of the book."

From Prof. T. C. Abbot, A. M., D. D., President of the Michigan State Agricultural College:—

"The book has been in constant service since it came, and I feel sure we shall find it a HAND-BOOK of great value for daily use. It will take its place beside the English Dictionary."

HOLLY, Michigan, Nov. 18, 1880.

If the laity desire a work from which information can be obtained that will aid in preserving the health, and assist in discriminating between the educated and accomplished physician and the ignorant advertiser, Dr. Kellogg's is the only reliable one with which I am acquainted.

DR. D. W. C. WADE.

EXTRA, Iowa, Dec. 22, 1880.

I have examined the "Home Hand-Book of Domestic Hygiene and Rational Medicine," and would like to see it studied in every household. Success in treating the sick depends as much upon intelligent home treatment as upon the advice of the physician.

JOHN RILEY, M. D.

From Hon. H. Goodell, Supt. of Schools, San Bernardino Co., Cal.:—

"I pronounce it, so far as I am competent to judge, the best book of the kind I have ever seen, and superior to any of the various Family Practitioners, Family Physicians, etc."

From F. M. Taylor, A. M., Professor of History and English Literature in Albion College:—

"I have a copy of Dr. Kellogg's HOME HAND-BOOK OF DOMESTIC HYGIENE &c., and would warmly commend the work as, in my judgement, satisfactorily meeting a real and great want. Of it can be said with the truth of few other subscription books.— It is worth more than it costs."

The "Home Hand-Book of Domestic Hygiene and Rational Medicine," by J. H. Kellogg, ought to be in every family. The protection of the health of the body by carefully warding off the approach of disease by simple hygienic laws, and the treatment of the milder forms of disease with the easily obtained remedies, being a specialty, with the purely moral influence of the work, renders it such, that we wish, as an educator, it might not only be placed in every family, but in the hands of every young man and woman in the land.

REV. J. P. WOOLTON,

*Pastor of Friends' Church, Des Moines, Iowa.*

MICHIGAN STATE NORMAL SCHOOL, YPSILANTI, Mich.,

I regard Dr. Kellogg as one to whom we are becoming very much indebted for the service he is doing in the cause of rational medical treatment. The position he occupies is one of exceeding advantage for the usefulness to which he is so ardently devoting himself; and the high ability which he brings to the work is a most perfect assurance of his success.

C. F. R. BELLINGS, A. M.,

*Professor of Mathematics in Michigan State Normal School.*

From John B. Gough, the eminent temperance orator:—

"It is a wonderful book, the wealth of information is almost bewildering, and the research that has enabled the author to produce and collect such a mass of material, so fully adapted to the individual, the family and society is simply amazing. I have never seen any work, so comprehensive, of such varied information and belief, or rather more systematic, in its arrangements."

CHICAGO,

Dr. J. H. Kellogg is a graduate of Bellevue Medical College, New York City. He is well known as a physician of great skill and high attainments, having already a national reputation. It gives me great pleasure to say that in my acquaintance with him I have been deeply impressed with his energy and ability and the great amount of his skill in diagnosis and treatment of disease is

of his professional attainments. His style of writing is  
remarkable, and his acquirements in and out of the profession are simply marvellous.

R. MURRAY, M. D.,  
*Medical Director U. S. A.*

RED OAK, IOWA.

I have examined somewhat carefully Dr. Kellogg's new work, and take pleasure in recommending it as a valuable accession to the library of any family, not only the educated but the masses of the people who perhaps more than the more learned classes need the information contained in his work. It is desirable that the book should have a ready sale among the people throughout the whole country.

REV. B. F. CROZIER,  
*Pastor M. E. Church.*

**From Henry M. Hurd, M. D.,** Superintendent of the "Eastern Michigan Asylum for the Insane":—

"I have examined, somewhat hastily and imperfectly, Dr. Kellogg's "*Home Hand-Book of Domestic Hygiene and Rational Medicine.*" It seems to contain much valuable information, clearly and judiciously expressed, touching the topics mentioned. It is well illustrated and beautifully printed, and its general appearance is certainly creditable. I trust the industry and scientific ability which the author has so strikingly displayed, will meet with suitable recognition."

I certify that I have given Dr. J. H. Kellogg's "*Home Hand-Book of Domestic Hygiene*" an examination, and can cheerfully recommend it to the laity as a work of great merit for the prevention of disease and the preservation of health.

DR. C. HECTOR, *Litchester, Ind.*

After examining the "*Home Hand-Book of Hygiene and Medicine,*" I am fully satisfied that it is a valuable work, and all that it purports to be, and I firmly believe it should be in the hands of every family.

R. MCGAVEM, M. D.

FLINT, Mich.

Being personally acquainted with Dr. J. H. Kellogg and his works, I have no hesitancy in saying this work is worth its weight in coin to any one who will study its precepts and practice its teachings.

B. COUSHALL, M. D.,  
*Pres. Flint Academy of Medicine*

**From L. F. Andrews,** Secretary Iowa State Board of Health, Des Moines, Iowa,

"A careful examination of specimen pages of Dr. J. H. Kellogg's "*Home Hand-Book of Hygiene and Rational Medicine*" gives a favorable impression. The author has devoted years to the theory and practice of the subjects upon which he treats. His opinions are safe and reliable. It ought to have a place in every family library. A thorough knowledge of its contents would lead to more healthful living, and protection against the villainous practices of peddlers and quacks who prey upon the lives, bodies, and purses of the people, and would greatly facilitate the sanitary work upon which Iowa has just entered in the enactment of health laws. For these reasons, the book receives my hearty commendation."

MILLERSBURG, Ind., July 7, 1880.

The best book of the kind I ever examined.

J. W. JENNINGS, M. D.

From the examination which I have made of the "*Home Hand-Book,*" I deem it a valuable book for every family. In addition to the valuable information contained in the book on medical subjects, its moral influence must be good.

WM. TAYLOR, *Minister of the Gospel, Vernon, Feb. 10, 1881.*



I take great pleasure in saying that I believe that the "Home Hand-Book" is a highly valuable work, and the author has treated his subjects, which include all diseases, their causes, and remedies, with marked ability and skill. The moral tone which runs through the work, is of the highest order, and such as every clergyman must endorse. I cheerfully commend the work as practical and useful.

L. L. ROGERS, *Pastor of St. Jude's Church, Pontiac, Mich.*

RIVERSIDE, CAL., DEC. 31, 1880.

Such a work as the "Home Hand-Book" ought to be in every family. It treats the all-important subject of Domestic Hygiene in a superior way, with clearness, science, good sense, and excellent illustrations. Whenever physicians are out of hand it is invaluable; and where they are, it will prove an intelligent help to their efforts.

REV. DAY NOBLE,

*Ashtabun, Mich.*

I have partially examined Dr. Kellogg's "Home Hand-Book of Medicine and Hygiene," and I think for the purpose for which it is designed it is superior to any published.

CYRUS SMITH, M. D.

ATLANTIC, IOWA.

The high order of attainments possessed by Dr. Kellogg should commend to every family "Home Hand-Book of Hygiene and Medicine," to careful study by the head of every family. The work of the family physician would be much more effective were such things followed.

W. C. EGAN, M. D.

CHARITON, IOWA.

After a careful examination of a work by J. H. Kellogg, M. D., entitled Home Hand-Book of Hygiene and Medicine, I have no hesitation in recommending it to the favorable consideration of the public, believing it will throw much light on subjects of great interest not only to the profession but to the public at large.

A. P. McCULLOCK, M. D.

BATTLE CREEK, IOWA, Dec. 9, 1880.

I have partially examined the prospectus of Dr. J. H. Kellogg's Home Hand-Book of Hygiene and Medicine, and find it to contain many subjects of value which may be of lasting benefit to every family; and while it is not an elaborate treatise on Pathology, Therapeutics and kindred branches, it will undoubtedly not only save many dollars to the intelligent reader, by knowing when to send for a doctor, but enable him to use his knowledge as a safeguard against imposition from quacks.

B. GRAESER, M. D.

I have carefully examined the "Home Hand-Book of Hygiene," by Dr. Kellogg, and consider it an excellent book. The subject matter is interesting and instructive to any person who can read the English language. It will make a valuable addition to any library, and is a book that should be in every family.

F. B. SMITH, M. D.

*Warren, Mich.*

December 20, 1880.

*Rochester, Ind., March 23, 1881.*

This is to certify that I have examined the "Home Hand-Book of Domestic Hygiene," by Dr. J. H. Kellogg, and am persuaded that it is a scientific and thorough treatise on the subject of which it treats. I therefore recommend it as a valuable work for every family.

W. J. WILLIAMS, *Supt. of Public School.*

We approve of the above recommendation.

A. BROWN, M. D.

R. D. UTZIK, *Pastor of A. Church.*

*Ronald, Mich., April 26, 1881.*

I have examined to some extent "The Home Hand-Book of Domestic Hygiene and Rational Medicine," by Dr. J. H. Kellogg, of the Battle Creek Sanitarium, and consider it a very valuable one for any family to possess, giving, as it does in plain and concise language, directions not only for the diagnosis and domestic management of nearly all diseases, but what is of much greater importance, how to prevent disease.

GEORGE PRAY, M. D.

IDA GROVE, IOWA.

I have carefully examined a prospectus of Home Hand-Book of Domestic Hygiene, etc. I regard it as a scientific work. The facts are stated in such language that any person can comprehend them. The articles on "Food and Diet" and "Accidents and Emergencies" are well worth the price of the book. I am sure that nothing could be more conducive to the good health of a family than the possession of this book.

E. C. HEILMAN, M. D.

AUDUBON, IOWA, Oct. 15, 1880.

I take pleasure in commending to the public, Dr. Kellogg's Domestic Hygiene. The time spent in reading it will not be misspent. A careful perusal may help to that "eance of prevention which saves a pound of cure."

J. D. HOLMES, M. D.

*Rochester, March 23, 1881.*

Having carefully examined the "Home Hand-Book" by Dr. J. H. Kellogg, I cheerfully recommend it to all as a work of rare excellence, and the best domestic work now in print; and if its teachings are carefully studied and put in practice, a great amount of unnecessary suffering will be prevented. The chapters on the adulteration of foods are especially valuable and timely at present. No family desirous of preserving its health can afford to be without it.

WM. HILL, M. D.

EXIRA, IOWA.

I have examined the "Home Hand-Book of Domestic Hygiene and Rational Medicine," by Dr. J. H. Kellogg, and consider it a scientific work specially adapted to the wants of the people. It is really an aid to the scientific physician in that its doctrines are wholesome, and subversive of quackery.

J. M. RENDLEMAN, M. D.

Inclosed please find our check payment of "Kellogg's Home Hand-Book." It is estimated to do much good, and we hope you may sell it to every family. Yours, etc., E. M. CHAPLIN.

I fully endorse the above recommendation.

F. McALPINE, *Ex. Co. Supt.*

ODESBOLT, IOWA, Dec. 17, 1880.

I have examined the prospectus of Home Hand-Book of Hygiene and Medicine, and think that it is one of the best works of the kind, especially for domestic use.

H. GROMAUN, M. D.

*Jackson, Mich., Aug. 29, 1881.*

I have looked over the work somewhat—like its arrangement, and believe it to be far the best work of its kind that I have seen.

J. T. MAIN, M. D.

ACKWORTH, IOWA.

I have briefly examined the "Home Hand-Book of Hygiene and Medicine." I regard the plan of the work as excellent; the author, Dr. Kellogg, is one of the best of living teachers of subjects presented in his work. I can cordially recommend the work as the best of the kind now in print.

PROF. E. W. BEARD,

*Principal Academic School, Ackworth, Iowa.*

RIVERSIDE, CAL., Dec. 31, 1880.

Kellogg's "Home Hand-Book" is one of the most elaborate and practical family guides I have ever seen. Its close perusal and application must be followed by good results.

ANNA L. M. POTTS, M. D.

**From L. K. Fisk, President of Albion College:—**

"I possess a copy of the "Home Hand-Book of Domestic Hygiene and Rational Medicine" and prize it highly for the wide range of valuable information it contains. If thoroughly studied there will be but little need usually of calling for the services of a physician in acute disease. Every home should contain a copy of the book."

I am acquainted with Dr. Kellogg's book, and consider it the best of its kind I have ever seen.

H. H. CHASE, M. D., *Charlevoix, Mich.*

*Des Moines, Iowa,*

I have carefully examined the prospectus of the "Home Hand-Book of Domestic Hygiene and Rational Medicine," by J. H. Kellogg, M. D., and believe it to be a most valuable acquisition to the list of works on popular medicine, and greatly superior to most of those with which I am acquainted. The work bears marks of having been carefully and conscientiously prepared, and cannot help but exert a beneficial influence upon all who read it, and should be in the hands of all who desire reliable information upon the subjects of which it treats. Aside from its reliable professional teachings, its possession will exert a good moral influence.

J. C. KENNEDY, M. D.,

*Secretary Iowa State Medical Society.*

*ANN ARBOR, Mich.*

This is to certify that Dr. J. H. Kellogg, the resident physician of the Sanitarium at Battle Creek, in this State, is personally known to me, and that he is in good regular standing in the medical profession, being a member of the State Medical Society and of other organizations, and that, furthermore, he is a gentleman of superior attainments and of *unexceptionable* character.

PROF. E. S. DUNSTER, M. D.,

*Prof. of Obst. and Dis. Wom. and Ch., University of Michigan.*

*EXIRA, Iowa, Dec. 22, 1880.*

I have been shown a work entitled "Home Hand-Book of Hygiene and Medicine," by Dr. Kellogg. It appears to have merit in many ways over all its predecessors. The perusal and careful use of this work in families will be likely to save valuable lives, and heavy bills for sickness, and, what is more precious, may save moral constitutions and ruined characters.

J. A. HALLOCK,

*Pastor, Congregational Church*

## THE BODY TEMPLE

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**E**VERY man is conscious of the fact that there is something about him, within him, in addition to the mere anatomical structure which he can see with his eyes. There is an invisible force, an energy, an intelligence, of the operations of which he is continually conscious. A deeper study of the subject shows the presence of two distinct intelligences which exercise control of bodily movements and operations.

**The Two Wills.**—The study of the human body clearly sets before us the fact that there is in the body an intelligent power, ever at work, presiding at all the functions upon which life directly depends,—circulation, digestion, respiration,—carrying on these essential activities while we are asleep as well as while we are awake, repairing, cleansing, replacing, creating, pouring in a constant stream of energy and life, renewing, strengthening, building, rebuilding, all independent of the human will or personality. The regulation of the body heat, the function of perspiration, the acts of sneezing, coughing, and other defensive acts, are all indications of the working within the body of a personality, a will which is distinct from the human will or personality, a being which shows its superiority to that

## The Two Wills

of man by the fact that its vigilance is never relaxed, it "neither slumbers nor sleeps;" also in that it carries forward those bodily functions which are essential to the body's welfare, not only without the assistance of the human will, but often in spite of opposition therefrom.

A man may hold his breath for two or three minutes, but he is obliged at last to yield to the instinctive demand for air. The strongest effort to restrain the movements of the chest fails. The respiratory center, or rather the will behind it, seizes the reins of control, and compels the chest to expand.

One cannot by any effort of the will suppress the perspiration or produce a chill. One cannot awaken himself when he has fallen asleep, neither can he compel himself to sleep, though he may much desire to do so. Before we conclude that this will which operates within the body independent of the consciousness is of an order below that of the human will, let us recall further some of the wonderful things which it does,—the miracles of digestion and of heart action; the creation of millions of blood corpuscles every second to take the place of those which die, and the disposal of the millions of dead bodies of those which have perished; the wonderful miracles of sight, hearing, smell, taste, and feeling; and that greatest miracle of all, the building of the body itself from a minute speck of life to the adult man or woman.

This will, this power, outside of the human consciousness, by means of which all these marvelous miracles are performed, can be nothing less than the power which made the worlds, and which rules the

## Man the Masterpiece

universe, a fact which Job recognized when he said, "The Spirit of God hath made me, and the breath of the Almighty hath given me life." Job 33:4. Moses, in his wonderful song, complained of Israel that they had "forgotten God that formed them." The inspired Word thus teaches us not only that God formed the first man, but that it is by the same infinite power that every man has been formed, and this process of forming, creating or re-creating is continually going forward as long as life continues; for the body is continually renewed.

The human body, then, represents an instrument, a harp of a million strings, at which two players preside, the one human, the other divine; the one fallible, erring; the other, infallible, unerring. When these two players move in harmony, the song of life is sweet and melodious, a symphony; when the human player strikes even one discordant note, the harmony is broken, the melody is spoiled.

The one thing needful for success, for happiness in life, is to live in harmony with God, to keep in tune with the Infinite One, to make the human will conform in every purpose, in every voluntary thought or act, with God's order of life as revealed to us by the divine voices which speak to our hearts, by the teachings of experience, and by the instruction of Holy Writ.

To live in tune with the Infinite One is to walk with God; it is to be in harmony with all the laws of being, physical and mental; it is to live at peace with one's self, as well as with the world about him. "Her ways are ways of pleasantness, and all her paths are peace." Prov. 3:17.

## The Two Wills

The man whose stomach is the seat of fermentations, putrefactions, gaseous commotions, and chemical reactions, suffers burnings, pains, pangs, aches, twinges, depressions, and miseries of various sorts. He is out of tune. He is not in harmony with God. He is at war with him, either consciously or unconsciously. The man whose mind is full of forebodings, worries, doubts, and suspicions, is equally out of tune.

“Thou wilt keep him in perfect peace, whose mind is stayed on thee.” Isa. 26:3. To have one’s mind stayed on God is to be ever studying his will, and earnestly endeavoring to do his will as revealed to us in the Bible and the book of nature, and even in our own bodies. We are not competent to care for the temple of the body unless we study it, unless we seek earnestly to become acquainted with all its parts, and to know their several needs, and to find the divine method of satisfying them.

We are often out of tune with Heaven because we foolishly attempt to draw a line of distinction between physical duties and spiritual duties, forgetting that everything physical which has a relation to the well-being of the temple has a spiritual significance. Life is a unit, not a duality. It is impossible to divide life into a spiritual and a physical part. There is but one life, and that is the life of God. As manifested in man, this life presents various phases, which we call physical, mental, moral, or spiritual; but these all spring from one fountain, and are as necessarily related as the several branches of a tree. Nothing could be more absurd than to imagine that the highest welfare of one can be secured while neglecting the interests of the

## Man the Masterpiece

others. As well might two players at a single instrument expect to produce melody by taking care to harmonize a portion of their chords, while striking discordant notes in others. Every note must harmonize.

The whole human life, physical, mental, and moral, must conform to the great decalogue which is written upon the human constitution itself, and which is revealed to us through nature, the inspired Word of God, and in human experience. The highest of all attainments is to reach a state of absolute harmony with the Infinite One, to bring the truant human will into perfect accord with all the principles which govern mental, moral, and physical action, including eating, drinking, exercise, and every other physical relation of life, as well as those obligations which are commonly denominated "Christian duties," but which include but a very small part of our moral obligations.

Every intelligent human being who recognizes this great truth, the universal unity of being, the absolute and incessant dependence upon the infinite indwelling power, will no longer be able to call some things sacred, other things common. All things become sacred.

Eating and drinking are but the means by which the waning life of our bodies is reinvigorated and maintained, the vital fire rekindled by daily demands upon God's great storehouse of life and energy, the products of the vegetable kingdom, prepared for us by man and kindred beings endowed with life.

Man has no power of himself.

All the energy which he exhibits in his actions, good or bad, comes to him direct from the source of all energy, is loaned to him by God. That he is able

## The Infinite Personality

to direct it, thus making God to serve in his conduct, whether it be good or bad (Isa. 43:24), is due to the fact that the Creator of all the universe bows his neck to the yoke of labor, carries all the burdens, performs all the toil for all his creatures, in order that each may fulfill his mission in the world as representing some divine thought or purpose, and for man especially that he may be a fit representative of the God who made him, a true witness to the world and to the universe of the power that dwells within, a noble image of the personality which conceived him, and modeled him from clay, and animated him by making him the temple of his life and power.

**The Infinite Personality.**—All about us in the world and in the universe there are overwhelming evidences of an all-pervading, all-controlling personality. The regular rotation of day and night and of the seasons, the movements of the planets and the distant stars, the phenomena of plant life, all speak to us in unmistakable tones of a great Designer, a personal being, working constantly and everywhere in nature, of whom nature is the expression. Physicists tell us all about the transformations of energy, the change of force from one form to another, of the conversion of light into heat, of heat into electricity, of electricity into magnetism, of magnetism into mechanical work, as in the operation of the motors which run our electric cars; but ask the wisest physicist on earth whence comes the energy of the sun, the universal power of gravitation, or what is the original source of energy, and he will confess that these questions are beyond the limits of his science. He will admit that he can find no better expla-



## Man the Masterpiece

nation than that of the psalmist, who declared, "Power belongeth unto God."

That the power behind, in, or beneath all the operations of nature is not simply a blind, unintelligent force, is clearly enough manifested by the evidences of intelligence displayed in every object and operation of the natural world. A skeptic, walking one day across the plains of Texas, picked up a little flower known as the Texas star. He counted its five petals, its five stamens, its five green sepals, and then asked himself the question, "How did it happen that this little flower should have exactly the same number of stamens, petals, and sepals?" Applying the doctrine of chance, multiplying together the three fives, he found that there was but one chance in one hundred and twenty-five that such a combination would occur. But right about his feet he found a hundred such stars, and each one with five stamens, five petals, and five sepals. The probability that chance should have produced a hundred such flowers was but one in twelve thousand five hundred; but as he cast his eye over the plain, he saw that here were not only one hundred, but hundreds and thousands of millions of such stars, and that every year for ages, millions upon millions of these flowers had been produced, always the same. He recognized the overwhelming weight of the argument. That such a thing could come by chance was utterly beyond belief. The only consistent conclusion to which he could come was that the Texas star was the product of a designer, a personality, a power, capable of planning and executing on a scale beyond all human calculation. Then as he thought of the stars overhead,

## Intelligence in the Natural World

and the incalculable distances which separate them, the infinite number, the infinite space through which they are scattered, yet all bound together in one vast system by a force which every instant thrills and pulsates throughout the limitless bounds of infinite space, without an instant's loss of time, not overlooking a single grain of sand, the smallest atom, so that suns so far apart as to be invisible still keep time; when he reflected upon this majestic manifestation of infinite power beneath his feet and spread out in the blue universe over his head, he was compelled to exclaim aloud,

"There is indeed a God who knows all and rules all."

### **The Intelligence Displayed in the Natural World.**

—It is exceedingly interesting to note the manifestations of mind in nature, even in inanimate things. Observe the nice balance between the weight of the air and that of the smoke, by which the poisonous gases are carried upward in a gentle rising cloud, while the pure air clings to earth where it is needed for the support of animal life. Note the remarkable arrangement by which, in the freezing up of rivers and lakes in the fall, enormous quantities of heat are given off by the water in the formation of the ice, thus modifying the temperature of the chilly air, and so graduating the change from summer to winter; and again in the melting of the ice in the spring, the same quantities of heat are absorbed from the air, thus favorably modifying the oncoming summer's heat, which otherwise might become too intense. The minutest details of nature exhibit these wonderful adaptations and intelligent provisions in which are manifested a common sense, an adjustment of means to ends, which are entirely

## Man the Masterpiece

akin to the same faculties manifested in the operations of the human mind.

In other words, man recognizes that the great mind is in many respects like his own, only vastly transcending it.

**Man's Kinship with His Maker.**—The more one learns of nature, the more deeply one looks into the secrets of God's creative work, the more clearly does one recognize the kinship which exists between the human mind and the infinite, between the higher and nobler manifestations of human thought and the divine thoughts which are expressed in the sunlight, the clouds, the flowers, the trees, the fields of waving grain, the fragrant meadows, the rushing torrent, the heaving ocean, the whole moving, speaking universe about us.

In many of the operations of nature we find illustrated arithmetical and geometrical principles as clearly as in the scientific treatises upon these subjects. Indeed the science of mathematics is only a study of the principles which exist in nature, and which man has not created but has only discovered. Surely there is manifested a marvelous ingenuity, a common sense which transcends the human common sense, which is common in kind though far exceeding human qualities of the same sort.

And again, we are reminded of the remarkable declaration of the apostle in his impressive address to the Athenians, that "we are also God's offspring." Acts 17:29. While the whole human race has wandered far away from uprightness and naturalness, so that man has lost his high estate and become perverted, deformed, debased, and full of iniquity, the fact still

## Man's Kinship with His Maker

stands that he is a son of God; and the invitation is ever held out to him to recognize this sonship, and to avail himself of its privileges by accepting his Creator as his master and ruler, by placing his mind and all his intellectual powers, his emotions, and every faculty of his being which is under the control of his will, under absolute submission to the divine will; so that the same beneficent Intelligence which unerringly and unceasingly guides and guards his heart, his stomach, his liver, and other of his bodily organs, may preside with equal constancy over all the activities of his brain, directing all his conscious movements, actuating all his plans and motives, thus taking possession of the temple, and making him in the highest sense a member of God's family, a son fit to stand as a representative of his Father and his Maker. Sinning man is still a son, although an erring, wandering, prodigal son. A sincere Christian is a son returned to his father's house, recognized as a dutiful and obedient member of his father's family, and as a rightful heir. Luke 15:19; 1 John 3:2; Job 33:27-29.

Nature reveals to us an infinite personality, working constantly, harmoniously. The uniformity of law is due, not to the fact that the power behind is a blind, unintelligent, unreasoning force, but to the fact that the power at work in nature is possessed of such infinite intelligence that every act was perfect the first time it was done, and not being susceptible of improvement, can only be repeated. Apples are always observed to fall downward instead of upward or in varied directions. The very uniformity of nature is a striking evidence of the wisdom, intelligence, and power of the personality which presides at its heart.

## Man the Masterpiece

**Permanence in the Midst of Change.**— One of the most remarkable facts of human life, is the retention, notwithstanding the perpetual change of substance, of individual properties and features.

By what means are the symmetry and proportion of the different parts of the body maintained in the midst of the continual change which is taking place hour by hour and week by week? The forefinger is always a little shorter than the middle finger; the little finger is the smallest of all, and always remains the smallest, unless it becomes swollen or otherwise enlarged as the result of disease. What is said of the hand may be said of the various features of the face,— the two eyes, the ears, and all the corresponding portions of the two sides of the face and of the body. The preservation of the form and symmetry of the body in the midst of the perpetual change of matter which is constantly taking place, is truly a most remarkable fact, and should cause us to pause a moment, and consider by what means is maintained this wonderful stability in the midst of perpetual change.

In this permanence of form and feature we have a physiological proof of the existence within the body of some power superior to the material composition or substance of the body, which exercises a constant supervision and control whereby individual identity is maintained. This can be nothing less than the Power which builds, which creates. As Lord Herbert has well said, “Whoever considers the study of anatomy, I believe, will never be an atheist; the frame of man’s body and the coherence of its parts are so strange and paradoxical that I hold him as the greatest miracle of nature.”

## “Not Far from Every One of Us”

The apostle plainly says, “Because that which may be known of God is manifest in them; for God manifested it unto them. For the invisible things of him since the creation of the world are clearly seen, being perceived through the things that are made, even his everlasting power and divinity; that they may be without excuse.” Rom. 1: 19, 20. R. V. God gives us the proof of his existence, the evidence of his presence, in the marvelous phenomena of life which presents to us a perpetual miracle, a spectacle of creative power in actual operation.

We have not to look back many thousands of years to the beginning of the world's history to find evidence of divine creative skill and power. The Bible record of the creation of man out of dust is confirmed by the teaching of true science, especially the science of biology. We constantly behold the miracle of creation wrought out before our eyes in the growing of forests and fields of grain and all the products of the earth, which, as at first, are made of dust, in the development of a human being from infancy to adult age, and the maintenance of individual identity, from year to year.

# Discovery of the Therapeutic Value of Radiant Heat<sup>\*</sup>

by *John Harvey Kellogg, M.D.*

**M**Y OWN attention was accidentally called to the remarkable penetrating property of the red rays, many years ago (1891). In turning the switch of an incandescent lamp, I noticed, as my hand happened to pass between the lamp and my eyes, a red glow of the fingers, especially distinct at the nails and joints. In the case of the little finger, the entire finger glowed with a deep red light. This led me to experiment.

I found when, in a darkened room, a small incandescent lamp was placed in the mouth, the cheeks glowed; and when a similar lamp was placed in the vagina of a patient with little abdominal fat, a red glow appeared over a circular area extending nearly from the pubis to the umbilicus. I recognized at once that I was in the possession of a new, highly useful, therapeutic agent.

Previous experiments had shown me that the heat from heated bodies placed in contact with the skin, even very intense, could be made to penetrate only a very short distance, because the heat was carried away by the constantly moving blood and lymph as rapidly as it was transmitted by conduction to the

deeper layers of the skin and underlying tissues.

Here was a form of heat which, as radiant energy, would penetrate instantly into the depths of the tissues to the extent of at least two inches or more, as my experiments showed. I was considerably excited over the discovery of this new and precious resource which might prove of immense value as a therapeutic means for the relief of pain and as a means of applying thermic stimulation to the subdermic structures. I proceeded at once to construct cabinets and appliances of various sorts for utilizing radiant heat, and have since that time made continuous and extensive use of both the incandescent light and the arc light in thermic applications, both local and general.

I also began, with the aid of my students, a series of experiments for the purpose of determining the physiologic effects of the electric-light bath. Some of the observations made were detailed in a paper read by the writer before the American Electro-Therapeutic Association at its fourth annual meeting, New York, September 25, 1894. An account was given of the physiologic effects of the electric-light cabinet bath, the effects of which are essentially those of the infra-red rays.

## The Physiologic Effects of Visible and Infra-Red Heat Rays

Up to the present time, in their studies of the physiologic effects of light, physicists and physiologists have confined themselves almost exclusively to observations upon the influence of the ultra-violet rays. It is quite natural that this should be the case for the reason that the erythema, tanning and other effects of the ultra-violet rays, are highly unique and striking; while the effects of the visible rays, especially the red, and of the invisible infra-red rays, are much more subtle, and on superficial examination, appear to be not essentially different from the familiar heat effects produced by ordinary contacts with warm water, hot air and other heated objects.

But science has clearly demonstrated that there is a decided difference between the heat effects produced by mere contact with non-luminous, heated objects and those produced by irradiation from luminous bodies.

These effects differ both in kind and quantitatively. Radiant heat produces all the effects obtainable from non-radiant heat sources and important, additional effects; consequently, in the study of the physiologic

<sup>\*</sup>"Light Therapeutics" by John Harvey Kellogg, M.D., 1927, published by Modern Medicine Publishing Co., Battle Creek, Michigan.

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# GOOD HEALTH

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Discovery of the Therapeutic Value of Radiant Heat <i>by John Harvey Kellogg, M.D.</i>	230
Henry David Thoreau — "Higher Laws" in Relation to Diet <i>by E. E. Wagner</i>	233
The Aristocracy of Health	236
From the Editor's Pen	240
A Digest of Health Progress	244
The Health Question Box	248
Book Reviews	249
Nutrition	250
Why Not Eat Meat?	252

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effects of infra-red rays, it is necessary to study the effects of heat in general.

### Observations of Winternitz, of Vienna

"The electric-light bath presents an advantage over every other means of applying heat in the readiness with which the dosage may be regulated as regards time and intensity. The instant the switch controlling the circuit is closed, the whole force of the bath or that portion of it in use is brought to bear at once upon the body. The instant the circuit is opened the heat is wholly and absolutely withdrawn. By means of properly adjusted switches, whereby the number of lamps in use may be controlled, the amount of heat applied may be exactly regulated.

"Another advantage of the electric-light bath is that it does not interfere with heat elimination. It, in fact, encourages heat elimination by encouraging free perspiration. Many other forms of hot applications, particularly hot-water baths and sweating packs, cause retention of bodily heat. In the electric-light bath, the heat elimination and the excretion of effete matters which accompany vigorous perspiration, proceed with increased activity at the same time the rays of radiant heat are penetrating the tissues, elevating the temperature of the blood, and quickening vital processes.

"The importance of this property of the electric-light bath is clearly shown by the interesting experiments of Conrad Klar. This investigator showed by calorimetric experiment that with the body exposed in an atmosphere somewhat below the body temperature, heat elimination was during the first five minutes ten times the normal amount; while during the second five minutes the amount of heat eliminated was half as great. The diminished loss during the second five minutes was doubtless due to contraction of the blood vessels of the skin. In the electric-light bath the cu-

taneous vessels are thoroughly relaxed, and this condition is maintained by the action of the rays of light falling upon the skin while the air about the patient is but little above the ordinary atmospheric temperature, a condition which in the highest degree favors heat elimination.

"The electric-light bath is a new invention by Kellogg, Battle Creek, Mich., U. S. A. It is undoubtedly true that radiant heat penetrates the tissues much better than conducted heat, and it is very probable also that the inner life of the cell is influenced by the radiant heat, either qualitatively or quantitatively, and to a higher degree. All the effects of the vapor bath can be produced by the electric-light bath. The loss of carbonic acid gas is considerably greater in the electric-light bath than in the vapor bath, and what is especially remarkable, perspiration occurs very quickly and at a very low temperature, and is very profuse. [Indications of perspiration are sometimes noticed at 28° C. (95° F.). The author has observed perspiration at 85° F., and Professor Winternitz stated to him personally (1899) that he had seen moisture appear upon the skin in a single instance at 65° F. The patient was a somewhat excitable neurasthenic, and very susceptible to the stimulus of radiant energy.]

"Ordinarily a much higher temperature is necessary before symptoms of sweating occur in the vapor bath. The time required to produce sweating in the electric-light bath is commonly 3½ minutes, whereas about five minutes are required in the vapor bath. Finally, the quantity of perspiration is considerably greater in the electric-light bath. That the radiant heat is the main cause of this, and not the heated air, was evident from the observations made by us that the external part of the leg upon which the rays of light directly fell perspired very much more quickly and profusely than the internal part of the leg, which received only reflected rays. After 10 to 30

minutes the body temperature increased to 40° C. (104° F.), the pulse to 160, respiration to 42,—symptoms of the condition resembling fever. We have used the electric-light bath in ways analogous to the use of the vapor bath in a number of cases of sclerosis, rheumatism, and gout, and have been much gratified with the results. We have as yet made no further experiments. Kellogg reports very good results in sclerosis, arthritis, and many disorders of nutrition. Lehmann has been very successful in psoriasis. Since we have in the electric-light bath a thermal method by which the degree of heat applied can be exactly measured and regulated, and knowing the powerful influence of light upon the life of the cell and of the whole organism, we believe that this method will hold a prominent place among the forms of thermal applications, and that we shall be enabled by its use to influence a series of maladies more quickly, more effectively, and more satisfactorily than heretofore."

A striking proof of the superior penetrating power of the luminous red rays was given by Rubner many years ago (1894). This careful observer noted that for a given length of time and a given area, a far greater amount of heat may be introduced into the tissues through the skin in the employment of sunlight than when heat from such a source as an Argand burner is employed. He found, for example, that heat from an Argand burner allowed to fall upon the forehead was unendurable when the intensity of the heat reached 0.3 calory per minute, whereas an intensity of 1.0 calory per minute gave no inconvenience when the source of heat was the sun's rays.

The reason for this is to be found in the fact that in the case of sunlight the luminous heat rays constitute nearly one third of the total energy, whereas in the flame of an Argand burner the luminous rays constitute only about 3 per cent of the total energy, the balance consisting of infra-red rays. This experiment shows very clearly the very

pronounced difference in penetrating power between luminous heat rays and infra-red rays.

Heated bodies, metal for example, become incandescent, or red hot, at a temperature a little below 1,000° F. Below this temperature only invisible, or infra-red rays, are emitted. As the temperature rises, visible and ultra-violet rays are given off. At the same time, the volume of infra-red rays increases although the proportion of visible and ultra-violet rays to infra-red rays increases as the temperature rises.

Carl Sonne, of Copenhagen, the able physicist associated with the Finsen Institute, made a careful study of this question, the results of which he presented in a series of papers from which through his courtesy we are permitted to abstract as follows:

Although sunlight is very rich in luminous rays because of its high temperature, two-thirds of its energy still consists of infra-red rays. The infra-red rays of the carbon arc light constitute about four-fifths of its total radiant energy, the proportion of infra-red rays decreasing as the amperage is increased. For each additional ampere of current used, an arc light yields 300 to 400 additional candle power. Infra-red rays constitute about 58 per cent of the quartz light.

Sonne thinks it necessary to distinguish between the effects of the two kinds of infra-red rays, the inner and the outer rays. The outer infra-red rays are the rays of longer wave length at the far end of the spectrum, while the inner infra-red rays are the rays of shorter wave length which lie next to the visible spectrum just below the red, having wave lengths of 8,000 Å. or longer.

The rays thrown off by ordinary heated bodies, such as hot stoves and most terrestrial sources of light, are chiefly outer infra-red rays. In the case of the arc light, the temperature being higher, the chief output of energy is in the inner infra-red region, and in the case of sunlight in the luminous region of

the spectrum. Says Sonne, "It is only the sunlight and the carbon arc light which contain any large quantities of infra-red rays. The outer infra-red rays, that is, the longer rays, have a *very low power of penetration.*" It is for this reason that the finest screen of water or glass is sufficient protection from the radiant heat of a stove. The penetrating power of the inner infra-red rays is, however, much higher, a fact easily demonstrated with an open fire.

The figures found by Sonne are considerably higher than those of Rubner, which Sonne explains as being due to the fact that Rubner "did not go so far as to determine the extreme point at which destruction of the skin could just be avoided, but chiefly aimed at ascertaining when, for instance, the radiant heat from a reading lamp became unendurably troublesome, which is of course long before the radiant heat will cause combustion."

This experiment clearly demonstrates the superior penetrating power of the luminous heat rays and shows that even the inner infra-red rays have little more than half the penetrating power of the luminous heat rays and that their penetrating power diminishes as the wave length increases. The conclusion reached by Sonne was that the penetrating power of the visible heat rays is practically double that of the infra-red. On testing the temperature of the skin he found the surface temperature to be after radiation with visible rays 3.1° F. lower than after radiation with outer infra-red rays; but on taking the temperature of the skin 15 seconds after the conclusion of the radiation, the figures were reversed, the temperature of the skin after radiation with visible rays being 1.8° F. higher than after radiation with infra-red rays. The evident explanation is that the visible heat rays penetrated the tissues more deeply than did the infra-red rays so that the amount of heat accumulated was greater and a longer time was required for its dissipation.

## Richard Wagner Tried the Cold Water Cure

**R**ICHARD WAGNER was a lifelong invalid. Overwork, errors in diet, including the use of beer, and a sedentary life made him neurasthenic. After trying all other methods in vain, Wagner was induced by a friend, Uhlig, to try the water cure, which at his time consisted chiefly of applications of cold water. Wagner thus describes his experience at a water cure establishment:

"My daily program now: 1. From half past five to seven in the morning, cold pack; then cold tub (Wanne) and promenade; breakfast at eight,—dry bread and milk or water (no butter allowed, as he says in another letter). 2. Short promenade again; then a cold compress. 3. Toward twelve o'clock, a short rub-down; short promenade; another compress. Then dinner in my room to avoid disrelish. An hour of idling; brisk walk for two hours—alone. 4. About five o'clock another wet rub-down and a little promenade. 5. Hip-bath for a quarter of an hour; about six, followed by a promenade to warm me. Another compress. At seven, supper: dry bread and water. 6. Whist party till nine, followed by another compress; and about ten o'clock to bed."

As the result of this vigorous regimen, Wagner felt so greatly improved that he wrote, "I feel myself on the high road to recovery. . . . I am basking in a sense of well-being such as I had never conceived." It is quite possible that the treatment was somewhat too severe. Certainly there are few except the most robust patients who would at the present time endure such an amount of treatment without the development of untoward symptoms. On returning to his work the patient relapsed, and later wrote that he found warm or tepid baths better suited to his case than cold.

## CRYOAEROTHERAPY OR COLD AIR TREATMENT<sup>1</sup>

ALFRED B. OLSEN, M.D., D.P.H.

*Battle Creek, Mich.*

It is obvious that a sun or light bath is necessarily combined with an air bath, for exposure to sunlight or daylight includes exposure to the fresh air. Of course an air bath can be given on a cloudy day, but even then there is more or less skylight or filtered sunlight. Further, the healing effects of a sun bath are not due alone to the light, but also partly and possibly largely to the tonic influence of the fresh air, especially if it is cold. Thus we have the dual effects of both the solar rays and the cold air to take into account in evaluating the benefits of the exposure. Considering these facts it is permissible to use the terms air bath and sun bath interchangeably since a sun bath must always include an open air bath.

There is little reason to doubt that air baths and sun baths co-existed with water baths in ancient times, if they did not actually antedate them. About four hundred years before Christ the Greek physician, Hippocrates, known as the Father of Medicine, recognizing the value of sunlight in promoting health, prescribed air baths for patients suffering from various complaints and had them walk about naked in the open air. In those days there were numerous sanatoria in the eastern Mediterranean countries where these simple treatments were available. "The Romans used to lie or walk naked in the sun, after anointing their bodies with oil, which was esteemed as greatly contributing to health and therefore daily practiced by them." The elder Pliny<sup>2</sup> followed this custom and after exposing himself to the sun and air bathed in cold water, a practice that can be highly commended today. The athletes of both Greece and Rome exposed their naked bodies to the air and sun to obtain the pigmentation that would increase their strength.

For many hundreds of years air baths and sun baths were lost sight of until near the close of the past century, although we find occasional references to them. Boswell's "Life of Johnson," published in 1791, contains the following interesting item: "I remember that Lord Momboddo told me he awaked every morning at four and then for his health got up and walked in his room naked with the window open, which he called taking an air bath." Benjamin Franklin, one of the three greatest Americans, preferred a cold air to a cold water bath. From England he wrote "You know the cold bath has long been in vogue here as a tonic, but the shock of the cold water has always appeared to me as too violent. I have found it much more agreeable

<sup>1</sup> Read by invitation at the joint meeting of the American Electrotherapeutic Association and the Western Association of Physical Therapy, Indianapolis, September, 1925.

<sup>2</sup> Letter of the younger Pliny to Tacitus. *Harvard Classics* no. 9, p. 299.

to bathe in another element, I mean cold air." Dr. John Harvey Kellogg, superintendent of the Battle Creek Sanitarium for over half a century, is one of the modern pioneers in both aerotherapy and heliotherapy. In his early medical practice he recognized the healing virtues of fresh air and sunlight, and for many years he has been reviving the "cult of Apollo." He regards the open air and sunlight as powerful tonics and considers them superior to the so-called drug tonics which are still used too freely. His success in the treatment of chronic complaints and in creating a magnificent temple of health for the relief of human suffering has been phenomenal. Dr. Kellogg, like Benjamin Franklin, enjoys a cold air bath, which he takes with great regularity each morning on rising. It is his favorite stimulant.

The wonderful achievement of Drs. Bernhard and Rollier of Swit-

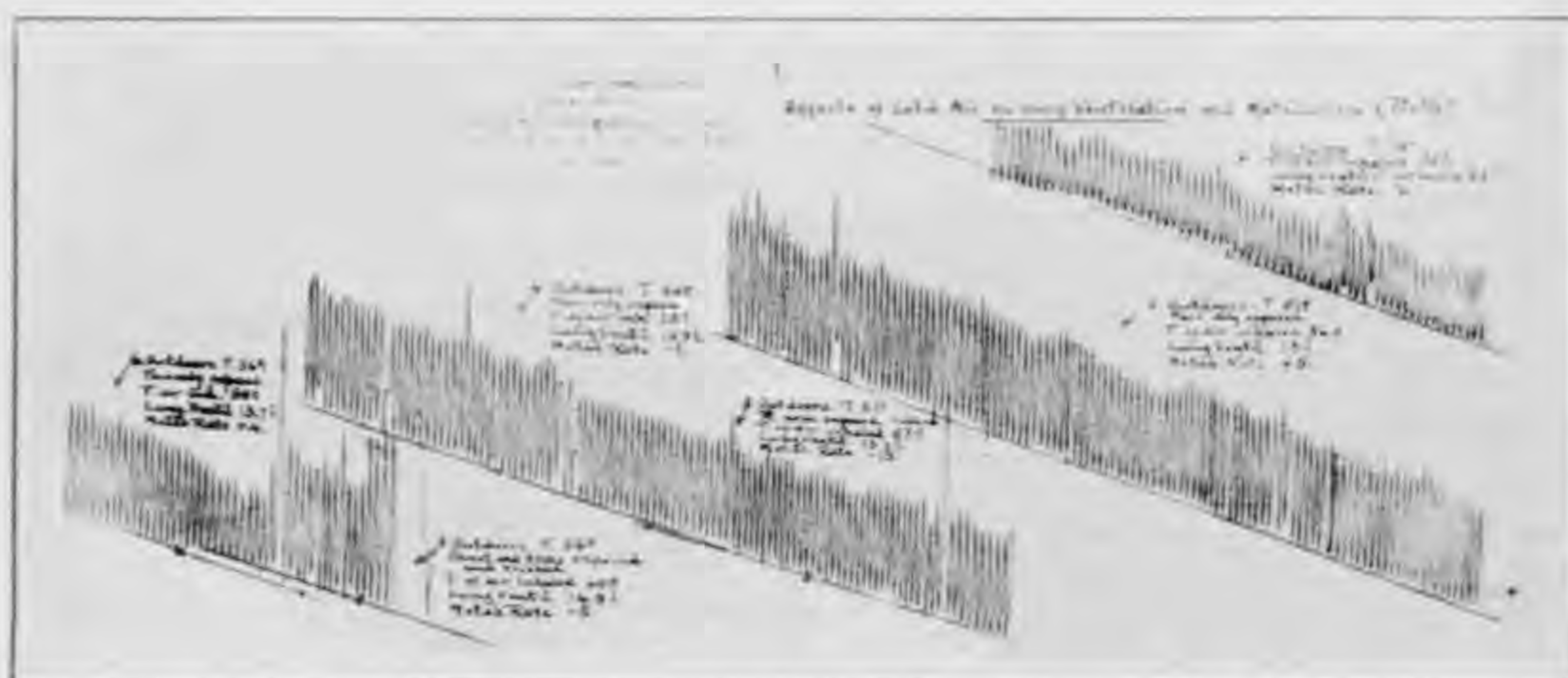


Figure 1.

zerland in the treatment of all forms of tuberculous disease by exposure to the open air and sunshine is well known. Sir Henry Gauvain in England, Dr. Carl Ottosen in Denmark, the late Dr. Trudeau of Saranac Lake, and many others have had equal success with heliotherapy and aerotherapy. For nearly thirty years the writer has been prescribing air and sun baths for debility, malnutrition, anemia, tuberculosis, and various other chronic disorders with uniform good results. There are few patients that do not benefit by a cold air friction bath, using a turkish towel, and most of them enjoy the refreshing effect of the cool air on the skin as well as the friction.

It is interesting to note in passing that the problem of maintaining warmth in a cold climate is comparatively simple. Housing, fuel, clothing, and exercise readily provide the necessary comfort. But keeping cool in a hot climate is an altogether different matter and for the majority is well nigh impossible. Further, good ventilation is easily ob-



The prevalence of "colds" and catarrhal diseases among civilized peoples is both appalling and disgraceful. That this condition has prevailed so many years and still continues is difficult to understand. More attention should be given to this matter in order to reduce the incidence to "colds" and conquer the respiratory diseases. The custom of modern life calling for so much clothing and the dwelling in winter in veritable hothouses has so weakened and enfeebled the skin that it has in a measure lost its heat regulating function and thus fails properly to adjust the body to the frequent and sometimes violent changes of temperature so common in these northern states. According to Dr. Leonard Hill<sup>3</sup>, "Men largely living open air lives are free from 'colds,' whatever exposure to extremes they undergo." "Men taken from shop or office, turned into soldiers and put under canvas, escape the catarrhal diseases from which they suffered in civil life." Polar explorers have a similar experience. Pallor of the skin means weakness, inactivity, inefficiency, and finally sickness. Pigmentation, which is produced by exposure of the skin to air and light, confers a progressive increase of resistance to both cold and heat, i.e. a more perfect adjustment to changes of temperature. Rollier<sup>4</sup> believes that the acquired pigment acts as a kind of dynamic accumulator, for he has observed that the resistance of the patient is nearly always in proportion to the degree of the pigmentation of his skin. He says "It is probable that the pigment receives, furnishes, and activates the elements essential to the metabolism of the hormones and vitamins." "Pigmented skin is particularly resistant to infection and is inflamed with difficulty." He also holds that the skin "plays the role of an immunizer." "The skin when placed in contact with the air and sun is toned up and pigmented; it regains its many physiological functions and becomes once more the real garment provided by nature."

#### CRYOPHOBIA OR FEAR OF THE COLD

Dread of cold appears to be a common fear among civilized people. Regarding cold as dangerous, they multiply clothing unnecessarily, close and seal their windows in winter, and overheat their homes. A nervous patient on receiving a prescription for cold air baths exclaimed "Holy smoke! That will kill me sure." But children, if not frightened and terrorized by their elders against cold, take to cold air and cold water baths as naturally as ducks take to water. A healthy little child will stand and laugh while being doused with cold water. Children prefer cool to warm baths, and if not prevented will climb out of the bath and run and play without drying and without taking cold, a practice to be encouraged. On a winter day they will run out and play in the snow and race about without the usual "bundling up," if they can

<sup>3</sup> Sunshine and Open Air. Leonard Hill.

<sup>4</sup> Heliotherapy in hipjoint tuberculosis. August Rollier. Surg. Gyn. Obst., January, 1928, vol. 46, page 95.

escape. Children that are allowed to enjoy direct contact with the fresh outdoor air and sunshine are usually free from colds because their skin is functioning in a normal way. But if a child goes near an open window or attempts to go out "unwrapped" in winter the mother or nurse calls it back in alarm saying "Come in or you will catch your 'death of cold.'" Children instinctively look for light and fresh air. They dread darkness but they love light.

This irrational fear of cold is a serious menace to health. How often is not "the margin of safety" of health gravely risked by this dread of cold air and the paralyzing effects upon the skin of the multiplication of clothing and wraps. Just in proportion as one adds clothing the skin loses its natural tone, becomes flabby and weak and less able to resist the natural changes of temperature. The writer has counted nine garments covering the body of a patient in addition to a woolen binder. Another man required no less than eight blankets on his bed in July to keep warm. Dr. Leonard Hill<sup>2</sup> cites the experience of a man who went to Australia in search of a warm climate. Living by himself on a banana plantation, he started air bathing by working naked to the waist. Later he cut the legs off his trousers near the fork. He found this new freedom very pleasant and enjoyable, and was sorry to put on clothing on leaving work. He further reported the most enjoyable part was not the sunlight but the feeling of the air in motion on his skin. In winter he sat perfectly naked writing in a cold draughty house on a bare wooden chair. He added "This time last year I could not sit without a cushion on the chair and an extra thick pair of woolen trousers, a thick flannel shirt, a woolen sweater, and a heavy overcoat, and even then I would have to go to bed for warmth." This was the result of two and one half months of near nakedness.

Clothes should be of loose material, light as possible, permeable to air, and allow free evaporation. Heavy clothing actually hinders and lowers heat production, and interferes with exercise. Dr. Hill<sup>2</sup> thinks "it is absurd to put on an overcoat when going out for a walk. It is good to go out and be braced by feeling cold and so be impelled to take vigorous exercise." This may seem a hard saying for many who live in modern hot houses and have formed the habit of over-clothing themselves. The time to make the change is in the summer and early autumn.

#### PHYSIOLOGICAL EFFECTS OF COLD AIR

Cold air, like cold water, is a dependable stimulant which used wisely leaves no depressing effects. It has an all round tonic influence upon the entire body. It stimulates every organ and improves its functions. The lungs benefit by the bracing effect of cold air, breathing is deepened, and there is also an increase of the rate, so that the tissues are

<sup>2</sup>Clothes. Leonard Hill. Pract., December, 1928, vol. 121, page 359.

more perfectly aerated. The rate of metabolism is increased and the blood circulates more readily. Cold air contains more oxygen by volume than warm air. In a cold atmosphere the heat production of the body is stimulated in a natural way, bringing a comforting glow of warmth, all of which has a distinct enlivening effect. Thus the fires of life burn brighter, the body wastes are more readily eliminated, and the organs function more perfectly. This brings not only a delightful sense of wellbeing and comfort, but also greater efficiency both physically and mentally. Dr. Kellogg is right in saying "there is wonderful health giving value in the fresh cold out-of-door air."

The cool air has a calming, soothing and relaxing effect upon the nerves. With the removal of clothing there is a fine feeling of freedom from restriction and an agreeable sense of rest and refreshing follows. Fresh air is one of the most valuable hygienic agents for maintaining health, improving vitality, and prolonging life. It is equally necessary in health and in sickness. But to obtain the full benefit it must be brought into direct contact with the skin as well as the lungs. The cold air bath is the ideal tonic to give new life to the invalid and to enliven the aged. Here is a genuine vitalizer for the old man who wants to renew his manhood. A course of cold air and sun baths is far superior to glandular implantations, not to mention the risk involved in the operation. The mutilation of monkeys for the benefit of decrepit men is as unnatural and unscientific as it is unsatisfactory and disappointing. The temporary flareup of lost function is soon exhausted, and then the victim is more senile than ever. The exceptions are rare. It requires the unsophistication of a child to believe that the gonads of a chimpanzee or a baboon will rejuvenate the exhausted energies of an ancient. The safest and surest means of carrying the spirit of youth into old age is to live biologically, i.e. in harmony with the laws of life, and avoid narcotics, including alcohol, tobacco, tea, and coffee. Today prevention is the slogan in medical practice, and one of the most efficient means of preventing sickness is living out of doors in contact with the fresh air and sunlight. Cold fresh air is the modern elixir of life and there is no better health promoter or health restorer. Health is not found in a bottle nor in a pill box, but rather in obedience to the principles of hygiene. According to Winslow<sup>1</sup>, "The common air is indeed the basic condition of our existence controlling it in more ways than are yet fully realized."

#### COLD AIR AND METABOLISM

It is a common observation that cold air stimulates metabolism as well as respiration. By request my colleague, Dr. Paul Roth, director of the laboratories of the Battle Creek Sanitarium, has given me the following interpretation of some respiratory tracings which he has taken:

<sup>1</sup> Fresh Air and Ventilation. C. E. A. Winslow.



The determination of the immediate effects upon metabolism of cold air presents numerous complicating factors which are not easily controlled. The physiological effects of any kind of application of cold or of heat may vary considerably in kind and intensity according to many factors too numerous to mention. The respiration tracings here represented are quite typical of many similar observations made. It is in the light of repeated tests that the following results obtained are conservatively claimed.

1. The metabolic rate as well as the lung ventilation is definitely increased, at least temporarily, when the subject, well covered, is transferred from a room at ordinary temperature to cold outdoor air.

2. There is a further marked and sudden increase of both ventilation and metabolic rate whenever covered body surfaces are suddenly exposed to cold air.

3. The effects obtained are generally mitigated by brisk friction. In fact, even when the area exposed is relatively small, the effect of friction is often so soothing as to induce a more or less reduction of the metabolic rate even in the presence of persistently increasing lung ventilation.

4. If, after several minutes' exposure of the entire anterior surface, the body is well covered, extremely soothing effects follow immediately. Both the metabolic rate and the lung ventilation fall below the normal basal rate, very soon however to return to a level higher than the normal, where it may remain for various lengths of time.

5. Other observations fully confirm the fact that this type of therapy can produce all the characteristic effects of cold according to the manner of application or exposure.

6. An increase in the metabolic rate, unless excessive, is not necessarily accompanied by a corresponding increase in the lung ventilation.

#### DIRECTIONS FOR GIVING THE AIR BATH

To begin with, the cold air bath is given in carefully graduated doses, according to the condition of the patient. It is necessary to remember that cold air, like cold water, can do harm as well as good. Consequently the patients should be selected with care and the treatment adjusted to the individual condition. If the weather is cold or the patient is frail or fearful, the early treatment at least should be given in a light well ventilated room where the temperature is under control. Otherwise it is given outdoors, which is the ideal way as a rule. The treatment room which we call the frigidarium at the Sanitarium, may have a temperature of fifty to sixty degrees or even higher in exceptional cases the first day. Adjoining it is a warm dressing room. The patient disrobes and receives a tepid sponge or dry towel rub, if in a state of perspiration, or a hot foot bath, if he is chilly or if the feet are cold. If convenient, it is a good practice to take a brief electric light bath just before going into the frigidarium to insure warmth and general comfort to begin with. On entering the cold air treatment room the attendant lays a hot sheet upon the mattress, and the patient immediately lies down and the warm sheet is quickly wrapped over him. Then he is covered with a blanket and a hot sand bag is applied to the feet. As soon as he is settled and comfortable a part of the body, such as an arm or both feet, is exposed to the air for five to ten minutes more or less according to circumstances. If the patient feels the slightest tendency to chilliness,

the exposed part is at once given vigorous friction or he is covered with the sheet and blanket for a few minutes or the treatment is concluded and he returns to the dressing room for some suitable exercise and a dry friction rub. At the conclusion of the treatment a few minutes may be spent in exercise, such as tossing a medicine ball before dressing. This is enjoyed by all who are strong enough to engage in the exercise.

On the following day the procedure is the same, except that the temperature is reduced two or three degrees and the legs are included with the feet or both arms are exposed as the case may be, and the time prolonged. Each day more of the skin surface is exposed to the cold air and at the same time the temperature is regularly



Figure 3. Cold air treatment at the Battle Creek Sanitarium, December 28.

lowered. For persons in ordinary health it requires from four to six days until the entire body is exposed, perhaps five or six days more to reach the freezing temperature and undergo an exposure of ten to fifteen minutes on each side of the body. At the end of a couple of weeks of indoor treatment or sooner it is often possible and even desirable to take the air baths out of doors.

In giving a cold air bath indoors or out of doors the comfort of the patient is insured by the use of hot sand bags as necessary or by suitable exercise. Deep breathing, arm and leg movements, dumbbell exercise, medicine ball, and even volley ball are valuable adjuncts taken in connection with aerotherapy. Taking the baths outside in winter will depend largely on the weather and whether the sun shines

or not. If the sky is clear a sun bath may be combined with the air bath, but in any case there is always skyshine. Cold air baths given indoors should be combined with radiation whenever possible. This adds much both to the comfort of the patient and the efficacy of the treatment. The mercury vapor, open arc, or incandescent lamp may be used according to choice. The incandescent lamp is safest and can be recommended for home use.

#### REACTIONS OF THE PATIENTS.

The experiences of a group of patients at the Battle Creek Sanitarium who started the cold air baths in December may be of interest. Rollier's method of beginning with the feet and moving upward was followed. The temperature of the frigidarium was sixty degrees to



Figure 4. Taking the cold air bath in the frigidarium.

begin with, and was lowered about three degrees each day. On the fifth day the entire body was exposed, first the ventral aspect and then the dorsal. On the tenth day the temperature of the room was thirty-two degrees Fahrenheit with windows open top and bottom and a good breeze blowing. The following day, December 28, the baths were taken on the roof of the Sanitarium in the sunshine with a shade temperature of about 30° Fahrenheit. Here follow some of the reactions of the patients:

"I feel very good."

"The pain in my chest is relieved." This patient was suffering from despondency.

"This is the best hour of the day."

"I am feeling fine."

"I could stay here for hours" reported the youngest patient under treatment.

"I feel better for having taken the baths." Completing his fifth exposure.

"I can sleep better." This patient was suffering from insomnia.

The women were less willing to try the baths, but those that did got well. There was no complaint of "catching cold" on account of the air baths. On the contrary, several reported an increased immunity against "colds," a natural result. After giving over five hundred cold air baths the attendant reported that the patients experienced a general feeling of "wellbeing" and invigoration, and practically all found the baths very agreeable as well as a physical and mental uplift.

Of 458 air baths given to men in January and February the temperature in the majority of cases was normal both before and after the bath. In 98 cases the average temperature was 97.4° to begin with and 98.2° at the end of the treatment, all of these showing a rise of temperature during the treatment. Twenty-seven had a slight rise of temperature to begin with and in the case of nineteen of these it was normal at the conclusion of the air bath. Of the 458 exposures eight showed a slight rise above the normal at the close of the bath. The pulse usually slowed down with the treatment anywhere from eight to fourteen beats. One patient who had a moderate tachycardia invariably showed a slowing of pulse from twenty to twenty-five beats per minute. As a rule the respiratory rate increased from two to four breaths per minute. The inspirations were also notably deeper.

Surely we Americans, blessed with the good things of life, even with luxuries as no other nation on earth, ought to become an "out-door people" noted for robust health as well as generous wealth; for, as Emerson has said, health is the greatest wealth. We are entering the golden age of health, and good health has actually become fashionable. People are beginning to realize that sickness and disease are unnatural. No intelligent man now believes that sickness is the result of a mysterious providence. Disease for the most part is the result directly or indirectly of disobedience to the laws of health with the consequent abuse of the body and its functions. Health is both a right and a privilege and is the result of obedience to physical law.

#### CONCLUSIONS

From this brief and sketchy discussion of the subject we may draw a few conclusions.

1. The sun bath is always accompanied by an air bath, i.e. heliotherapy includes arotherapy.

2. The benefits obtained from exposure of the bare skin must be credited to the tonic and healing virtues of both the light and the fresh air.

3. The skin is the chief regulator of the body temperature. It is also regarded as the "first line of defense" against infection.

4. Overclothing the skin prevents it from direct contact with the sunlight and the fresh air, so that it becomes pale, flabby, and weak. In this condition it fails properly to protect the body against changes of temperature.

5. The vast majority of people in this country put on too much clothing and also overheat their homes and offices.

6. The normal healthy skin protects the body from cold and chills by adjusting it to the changing temperature and humidity of the atmosphere.

7. Cold air is one of the finest and most effective tonics. The tonic influence affects not only the skin, but all the organs of the body, including the brain. Further, this natural tonic leaves behind no depressing effects.

8. A temperate climate with its cold winters, such as that of these northern states, is the ideal from the standpoint of health.

9. Keeping warm in a cold climate is a much more simple problem than keeping cool in a hot climate.

#### DISCUSSION

DR. ELMER F. OTIS (Melrose, Mass.) I think this paper reveals to us that there are more lines in physical therapy than we often think. It is almost new to some of us to think there is treatment in a natural way without the expense of apparatus involved. There are many things involved in the treatment of people who have been sick. We are discussing in these days the idea of resorting to artificial procedures. We are eliminating the sun, the cold air and we will get our medicine, if you please, doped out to us in an absolutely scientific way. We even go so far as to say we can "beat the sun to it in its delivery of the goods," that we can take an arc light, an alpine lamp, a mercury vapor lamp and get out of it a definite amount of sunlight in a definite time. That is all very well, but remember when you enter the artificial you are getting away from the natural. We may get away from the basic principles and artificialize our methods so much that we fail to receive full benefit from them.

There is a disadvantage in having sunlight filtered through smokes, gasses, and dust. There is a great deal of advantage in having our temperature effect combined with the light. I am glad Dr. Olsen showed in the diagrams how it is possible to keep the patients in their rooms and yet obtain these beneficial effects with the artificial light and warmth.

Keeping cool in hot climates is quite a task. When I was in Porto Rico and Santo Domingo I found it quite a problem to keep cool in the tropics. I discovered a thing that was not generally known. It was asked why the American women cannot stand the tropics while their husbands can come down there and get along all right. It was put up to us in repeated meetings at Washington and other places until it was practically certain that the reason the American woman could not get along in the tropics was not because of the excessive heat. A woman's husband had the same proposition, but she had nothing to do but devote herself to what social opportunities she could cultivate. It was her habits of life, even her fretting over being away from home and

normal surroundings, that was the Waterloo for the American woman in the tropics. There is this advantage in the tropics, and I found it so, that you could have the air along with the heat and if you dressed properly you could get everything.

I was invited down on Cape Cod a few weeks ago by a wealthy New Yorker to his summer camp where he had every modern facility that could be desired. The refrigerating system was complete, and outdoors he had a balcony built up in the air out in the woods. He climbed the stairs to that balcony, undressed himself, and exposed himself to the open air. That was hot summer time and it was a very pleasant experience.

This bronzing effect, as Dr. Olsen has said, is a wonderful thing. On my trip to the Mediterranean last year I noticed a young man lying on deck. He said he was going down to Africa to do a little hunting and was lying out in the sun on the way down to get some bronzing to show when he got home. The bronzing is an important thing, and I noticed Dr. Olsen says specifically here, as observed by Rollier and others, that the skin pigment is not only a dynamic accumulator, that is I suppose it accumulates energies from the sun's rays and otherwise, of which we do not know perhaps all, but it is also an immunizer. People who are bronzed in their skin do not have half the fatality of others. The tuberculous subject put out in the sunlight is able to resist his tuberculosis. These are all matters of observation and they are also matters of scientific demonstration, and I think Dr. Olsen was fully justified in making the statements and suggestions along that line.

Now the question of cold fear. Dr. Olsen uses the usual scientific word *cryophobia*, the idea of fearing of cold and heat. That idea refers to the fear of any kind of treatment. If you fear your treatment, the results or the climate, you had better keep away. If you fear an epidemic coming along, that is the very best way to incur the disease. This fear is a very important thing, and we should bear that in mind.

So we should have tonic braces. We should brace our bodies against the devitalizing effect of our civilization, our habits of life, and I suppose Dr. Olsen means that when he says "Live the biologic life." That is a good suggestion, I think if we could live biologically, adapt our lives to the natural things, we would find it a great advantage.

In our trip abroad we took care to go through Italy and other parts and observed many interesting things along this line. For instance, in Pompeii we found reconstruction or rather excavation of the baths there. They had frigid air, tepid air, and various features by which they could administer hot and cold treatments. I congratulate all of us that we are at this day and age of the world, that physical therapy is a thing set on the map, that it is a thing that is going ahead, that it is a thing our national organizations and state societies are taking cognizance of, and I hope the time will come when we will stand up with stiff spines and say we are espousers of the latest thing and the oldest thing in the world.

DR. A. B. OLSEN (closing): While we hear much about the healing effects of sunlight nowadays, comparatively little attention is given to the fine tonic influence of the cold air which also bathes the bare skin. This is a mistake, for the air bath is almost as valuable as the sun bath. As a matter of fact the sun bath always includes exposure to the fresh air. The stimulating effects of cold air are secondary only to those of the solar rays. Further, with judicious care air baths can be given daily, whether there is sunshine or only skyshine.

## APPENDIX 8

### NORMAL COLON HABITS

By J. H. KELLOGG,\* M.D.

*The numbered notes ("1," etc.) refer to the list of references at the end of this Appendix.*

THE capacious colon of man and other mammals is provided by Nature to serve as a reservoir for the accumulation of alimentary residues and body wastes and their evacuation at regular intervals. This arrangement permits the disposal of refuse with the least possible interference with movement and other bodily activities.

The possible injury resulting from the overaccumulation of residues, and especially the fact that food residues readily undergo putrefaction and other changes resulting in the production of highly toxic substances, render the question of the proper spacing of the evacuations of the colon reservoir one of high importance. The researches of Bouchard,<sup>1</sup> Metchnikoff,<sup>2</sup> Christian Herter,<sup>3</sup> Combe,<sup>4</sup> and other physiologists and clinicians have clearly shown that the stasis or prolonged retention of food residues, bile, and other body wastes results in the development in the colon of a great number of parasitic bacteria and other organisms, some of which produce violent toxins, while others under special conditions become highly virulent, giving rise to colitis and other infections of the colon, small intestine, and gall bladder, and even penetrate the blood vessels, producing infections of the kidneys and urinary bladder and other parts. Putrescible accumulations of refuse in the colon afford favorable conditions for the development of amœbæ and scavenger parasites of other sorts.

Delayed evacuation necessarily results in accumulation of residues and undue distension of the colon with CO<sub>2</sub> and various noxious and malodorous gases, which are chiefly the result of the decomposition of carbohydrates and sugars. Fats give rise to butyric acid and other toxic products. Undigested protein encourages the rapid development

\* See footnote to Appendix 3.

of vast numbers of proteolytic or putrefactive bacteria, *B. coli*, *Cl. Welchii*, the gas bacillus, *Cl. sporogenes*, *Cl. putrificus*, and scores of other organisms which, according to Strassburger, may attain such prodigious numbers as 300 trillions in 24 hours. It is evident, then, that the evacuation of the colon residues at reasonably frequent intervals is desirable, while retention in the colon for a sufficient length of time to permit putrefactive changes to take place is in every way undesirable and may become a menace to life and health.

The colon, or large intestine, is about five feet in length. It is automatically divided into three sections: (1) the right, the cæcum and ascending colon; (2) the transverse colon; and (3) the left, the descending or distal colon, at the lower part of which the pelvic colon initiates bowel action by means of the "call," a desire for evacuation caused when residues are pushed forward from the pelvic colon into the rectum.

### Eating Causes Evacuation

As shown by the x-ray observations of Hurst of London, "the time required for [passing through] each part of the colon—ascending, transverse, and descending—is about two hours. That is, about the same period is occupied in passing through the 2 feet of colon between the cæcum and the splenic flexure as through the 22½ feet of small intestine.<sup>5</sup> The movements of the human colon, however, appear to be less active at night than during the day."

The careful studies of Hurst showed that the activity of the colon is greatly accelerated during the taking of food. He found that, apart from meals, progress through the colon was slow, but that during each meal there was perceptible advancement of the contents. More progress occurred, for example, during the dinner hour than during the previous four hours.<sup>6</sup> Says Hurst in relation to the rate of movement of food in the colon:

"If approximately nine hours are required for material to reach the descending colon in man, the waste from food taken at 8 o'clock in the morning might be discharged at 5 o'clock in the afternoon. If defecation should occur regularly at 4 o'clock, however, the waste from breakfast must be retained for another twenty-four hours."<sup>7</sup> In other words, if the bowels are moved but once daily, a large amount of residue which has reached the lower bowel and is ready for evacuation will be delayed for 24 hours or more, during which putrefaction, gas formation and various highly undesirable changes will occur.



The above facts indicate that, under normal conditions, an intake of food is usually followed by an output of residue of a previous meal—the natural result of the forward movement of the colon contents due to the act of eating, which pushes the residues forward into the pelvic colon, an automatic and highly efficient discharging device. The common practice of moving the bowels only once a day leads to the retention of residues for at least 36 hours, often several days, during which time a high degree of putrefaction may be attained, especially when free use is made of meats and other animal proteins.

From the above it is very clear that the number of evacuations will be strongly influenced by the number of meals, since, as pointed out by Hurst, the taking of food is the chief cause of colon activity. If a person takes but two meals a day, the contents of the bowel may not be advanced toward the exit with sufficient rapidity to secure more than two movements during the waking hours. If, however, the diet is of such a character that a good intestinal flora is maintained, and if the entire colon contents are evacuated every 24 hours, no harm will result, because putrefaction is inhibited, and toxins, virulent bacteria and other harmful factors are absent.

The number of evacuations per diem is influenced to a marked degree by the amount of exercise taken. The movements of the diaphragm in breathing aid the colon by compressing and advancing its contents toward the exit. The amount of help which the colon receives from the diaphragm depends largely, however, in sedentary persons, upon the maintenance of an erect posture.

### The Protective Germ

Tissier,<sup>8</sup> an assistant of Pasteur, began in the latter part of the last century and continued for many years an exhaustive study of the intestinal bacteria. He discovered in 1900 that the stools of infants, though sterile at birth, within a few hours become contaminated and show the presence in great numbers of the colon bacillus and other germs found in adult stools. These harmful bacteria are speedily driven out by a new germ which appears in the stools within two days after the infant begins to nurse, and within two weeks the newcomer occupies the entire field. This germ, the *Lactobacillus acidophilus*, produces lactic acid in such quantities that the growth of putrefactive and other harmful bacteria is inhibited and they quickly disappear.

The rapid development of the *Lactobacillus acidophilus* in the infant's intestine is the result of the presence in the mother's milk of a large percentage of lactose, or milk sugar. So long as the diet of the infant contains this sugar in sufficient amount, the *Lactobacillus acidophilus* continues to flourish. Dextrin, a derivative of starch, likewise encourages the development of the aciduric flora.

It is clearly evident that beneficent Nature has provided in the *Lactobacillus acidophilus* a highly efficient means of protecting the infant mammal against the invasion of its intestinal tract by putrefactive and other disease-producing germs. So long as the intestinal flora remains strongly aciduric, that is, 85 to 100 per cent *Lactobacillus acidophilus*, it remains free from the intestinal infections which produce diarrhea, gas, and other disturbances to which bottle-fed infants are much more subject than are those who are breast-fed.

### The Quintuplets Confirm Doctor Tissier's Discovery

The experience of the famous quintuplets affords a convincing demonstration of the protective value of *Lactobacillus acidophilus*. Owing to their mother's illness, they were never breast-fed, and hence missed the opportunity to develop a good protective flora. Although reared on breast milk, at four months they developed grave bowel troubles with highly offensive stools and great gas distention and were very ill. When, at the suggestion of the writer, Dr. Dafoe<sup>10</sup> gave them soy milk cultures of *Lactobacillus acidophilus*, they quickly recovered and have since, now more than three years, been kept free from bowel troubles by the daily use of the culture. The quintuplets required the artificial culture for the reason that although they had been fed with breast milk from their fourth day, they had missed the protection of the *Lactobacillus acidophilus* which infants normally receive in the act of nursing.

When the colon is emptied with normal frequency, that is, within less than 24 hours after the food is taken, the time between intake and output is insufficient for the development of advanced putrefaction; and if the diet is of proper character, an aciduric flora, once established, may be maintained. One-a-day stools always show a putrefactive flora.

In the examination of many thousands of stools made at the Battle Creek Sanitarium, occasionally one has been found which showed 75 per cent acidophilus and freedom from evidence of putrefaction. Such

stools were invariably from persons whose diet approximated the normal primate dietary.

### The Intestinal Flora of Apes is Protective

Bacteriological examinations recently made of the stools of a nine-year-old chimpanzee showed a well developed protective flora, 85 per cent *Lactobacillus acidophilus*. The animal was thoroughly healthy and had never suffered from bowel trouble. The animal's keeper informed me that the stools were never offensive. Evacuations occurred four or five times daily.

Carl Akeley informed the writer that in his studies of the gorilla in its native African wilds, he observed that the animal evacuated several times daily, and that the stools were free from putrefactive odor; also that the complete alimentary tract of a gorilla which he dissected, showed nothing in the slightest degree offensive. He added with emphasis, "It was the cleanest thing, internally and externally, that I ever encountered in my life."

### Apes and Savages Evacuate Three or More Times Daily

On inquiry at the London Zoo in reference to the bowel habits of the chimpanzee and other large apes, I was told by the keeper that they moved their bowels regularly four times a day. Dr. Hornaday informed me that the anthropoids of the Bronx Zoological Garden evacuated three times a day. At the Washington Zoo the keeper stated that the chimpanzee Koko normally evacuates four to six times a day.

At the present time, the writer has an aciduric flora showing an acidophilus percentage of 80 to 90, which has been maintained at the present level for several months.

A questionnaire sent to a large number of missionary physicians located among wild and primitive people brought 140 replies. The evidence obtained from these original sources clearly indicates that among native tribes which have been uninfluenced by the customs of civilization and who still adhere to primitive habits of diet, living a free and active life, two or three evacuations occur daily, the number of evacuations depending upon the number of meals eaten. These primitive people are keen observers. They give great attention to the bowels, carefully training their children in correct bowel habits. A single daily movement is regarded by them as constipation, and

gives rise to alarm. The one-evacuation-a-day habit appears only among those classes or castes whose habits are sedentary.

Said Dr. F. D. Shepard, an American surgeon who had practised thirty years in Turkey, "The universal habit is to move the bowels three times a day."

### One-a-day Constipation

A physician writing from South Africa said: "A native called on me yesterday morning and asked for medicine to relieve a dreadful constipation. I said to him, 'When did your bowels move last?' he replied, 'This morning, Doctor.' 'But I understood you to say you were constipated.' 'Yes,' replied the native, 'I am horribly constipated. My bowels move only once a day.'"

This state of one-a-day constipation is very prevalent in many highly civilized countries, but by no means universal. Among working men the habit of two or three evacuations daily is quite common.

The advantage of suppressing putrefaction in the intestinal canal by frequent evacuation is shown by the fact that among people who move the bowels frequently, bowel troubles and other disorders associated with intestinal infections and intoxications are relatively infrequent. For example, of 112 American physicians practising among the natives of the following countries, 43 reported that they had never seen cancer of the bowels: Mexico, Palestine, Arabia, Turkey, Egypt, South Africa, East Africa, Central Africa, Nigeria, Japan, Syria, Korea, Persia, Siam, India, Asia Minor, New Hebrides. Appendicitis was likewise infrequent.

Dr. Davidson of Travancore,<sup>11</sup> India, wrote me in reply to a questionnaire: "Appendicitis is very rare here. Only 6 cases out of 1000 operations." An annual report of the Mayo Clinic showed 19 per cent of all cases examined to be suffering from appendicitis and 21 per cent of all cases operated upon.

### Lord Dawson on Intestinal Toxemia

When the bowels move but once a day, the residues of a test meal are, according to Hurst, J. T. Case, M.D., and other X-ray experts, retained in the body 53 to 54 hours, or 2¼ days. In the meantime seven other meals have been taken and the residues of these meals are still retained, so that the colon, which at the most should never contain the residues of more than three meals, contains the residues

of six, or more than twice as many meals, and naturally becomes distended with putrefying residues and overdistended by gases, the result of putrefaction and fermentation. This stretching of the intestinal walls causes redundancy, atrophy and inability to evacuate completely. Pouches and diverticula are formed, and colitis develops with its long train of ills and a predisposition to appendicitis and diverticulitis.

The highly beneficial results which follow the adoption of the practice of evacuation after each meal bear very eloquent evidence of the physiologic value and correctness of this practice. Among the 200,000 persons who have visited the Battle Creek Sanitarium for medical relief during the last 30 years, many have become convinced of the great importance of regular after-meal evacuations. The writer has been informed by a very large number of persons that they had experienced notable relief from headache, dullness, inability to concentrate, deficient appetite, foul breath, coated tongue, chronic fatigue and other symptoms usually attributed to intestinal toxemia, and had noted a remarkable increase in endurance and working power. One well-known college professor, who for years found it necessary to rest a couple of hours in the middle of the day, within three weeks after the adoption of the practice of evacuating after each meal reported himself, as he said, "able to keep up a full head of steam the entire day, thereby adding two hours to my working day."

### **The After-Meal Evacuation Habit is Easily Acquired**

Strong evidence that after-meal evacuation is physiological is afforded by the ease with which the habit is acquired. Many years ago, I received a letter from the superintendent of an institution for the care of idiotic and feeble-minded children in which the writer stated that having heard of my advocacy of the three-a-day evacuation practice, she thought I might be interested in an observation she had made. She stated that she had often been complimented on the fact that her institution was free from the bad odors usually present in such establishments because of the lack of intelligent control of evacuations by the inmates. She said she was often asked the question, "How do you manage it?" The answer was, "After each meal I place each child upon the toilet. Nature does the rest."

If in addition to a regular visit to the toilet within an hour after each meal a person whose bowels move but once a day will add to a

laxative diet some colon-stimulating food accessory, and if prompt attention is habitually given to the "call," which indicates readiness for action by the colon, the colon usually may be easily trained to prompt elimination of its contents after every intake of food. Sometimes the colon becomes so sensitive to the stimulus of eating that a visit to the toilet is found necessary immediately after the meal is finished and in many cases even when an apple or fruit of other sorts is taken between meals.

When an x-ray examination shows that the colon is permanently crippled, the colon should be emptied daily at bedtime by an enema of 3 or 4 pints of water at 105°-110°. This harmless mechanical means may be used indefinitely without injury, and often when intelligently used will effect a cure of a badly crippled colon by training it to normal activity. In every case of serious colon function impairment a competent physician should be consulted.

*Colon Poisons*—Numerous highly poisonous substances have been found in the fecal matters of both animals and human beings by various investigators. Brieger and Selmi found muscarin, cholin, cadaverin, putrescin, neurin, neuridin and saprin, all highly potent toxins.

Dr. R. L. Benson in an article in the *Canadian Medical Association Journal* (February, 1937, p. 129), stated that "the colon contains enough histamin to kill a regiment."

### Symposium on the Colon by the Royal Society of Medicine

Several years ago, the Royal Society of Medicine of Great Britain held a symposium on the subject of alimentary toxemia in which numerous eminent medical men participated. Prof. Dixon of King's College, London, called special attention to sepsin, a very virulent toxin produced by streptococci which is always found in lean meat that has been long hung and in the stools of meat eaters. Many cases have been reported in which meat dealers have died from septicemia after receiving a small wound when cutting meats.

Barger and Walpole called attention to two poisons produced by the putrefaction of sepsin which raise the blood pressure, an observation of much importance for the reason that, as stated by Dr. Dixon, "In recent years it has been shown by different workers in our Cambridge laboratory that any drug that has the power of considerably raising blood pressure will, when injected into the circulation of healthy animals, bring about degeneration of the middle coat of the

arteries." These effects were observed in young animals as well as older ones. Bain found these colon poisons present in the blood of persons who have high blood pressure. It has been shown, according to Dr. Dixon, that the same effects are produced by these colon poisons that are known to be caused by digitalis, nicotin "and the inhalation of tobacco smoke."

Said the eminent Sir Lauder Brunton, "The *Bacillus coli* seems to have a special power of producing fatigue toxins, and many people in whose intestines it exists in great abundance suffer from constant weariness and a feeling of fatigue."

Said Dr. Mantle, "Rheumatoid arthritis and other joint symptoms may arise from poisons absorbed from the intestinal mucous membrane. The joints are especially susceptible to certain poisons."

Said Sir Lennox Wainwright, "I am quite sure of this, that the mental effect on many patients of prolonged intestinal toxemia is such as to make them almost demented."

"The state of the tongue may be a good index of intestinal health, and a foul condition of the breath speaks volumes of what may be suspected lower down, although the patient may not be constipated."

Lord Dawson of Penn, physician to King George V, drew the following picture of persons suffering from intestinal toxemia, the result of intestinal stasis: "The sallow, dirty complexion, the inelastic skin, the dusky lips and nails, the dirty tongue, evil-smelling breath, constant abdominal discomfort of one kind and other, doughy, inelastic abdomen, cold extremities, the physical and mental depression, are among the prominent features."

There are perhaps no medical questions which during the last 40 years have received more attention and been more widely discussed than those relating to the facts and effects of intestinal toxemia. At the present time I think it may be safely said that by far the great majority of leading clinicians will agree with Metchnikoff that "The microorganisms inhabiting our bodies have set going there a poison factory which shortens our existence and by secreting poisons which penetrate all our tissues, injures our most precious organs, our arteries, brain, liver and kidneys."

According to Tissier of the Pasteur Institute, student assistant of Pasteur, 90 per cent of all the bacteria in the intestine of a child brought up under biologic conditions (lacto-vegetarian diet) belong to the group of acid formers, and the protective *Lactobacillus acidophilus* is present to the extent of more than 70 per cent. Dr. Dafoe

reports that the flora of the Dionne quintuplets is maintained at 85 per cent aciduric by the daily use of soy acidophilus milk.

The writer found the intestinal flora of a nine-year-old chimpanzee to be 80 per cent *Lactobacillus acidophilus* and has under observation a child of two years whose intestinal flora has been carefully watched since birth and has rarely been found less than 90 per cent aciduric. At the time of this writing the percentage of *Lactobacillus acidophilus* in this case is 95.

The contaminated condition of the human colon is due, as Herter has shown, to the character of the diet of the average man. All uncooked meats contain great numbers of streptococci and other poison-forming and disease-producing bacteria with which meats become infected in the process of slaughtering. Herter found that a watery extract of the feces of a carnivorous animal produces speedy death when injected into the body of a guinea pig or a rabbit, while a similar extract of the feces of an herbivorous animal does not.

### Reforming the Colon

The colon, more than any other organ, needs "return-to-Nature" training. It must be remembered, however, that the colon is sick, not sluggish; that it is crippled, not lazy; that it needs help, not punishment; feeding and coaching, not drugs or mineral waters. Constipation is largely a deficiency disease. Every organ of the body has special needs which the daily food must supply. The denatured food-stuffs in current use by so-called civilized people, are greatly lacking in colon nutrients. The colon needs bulkage, emollient, lubricating mass, to awaken the activity of its muscular walls; vitamins to activate its nerves and glands, and special nutrients to feed its protective microorganism, the *Lactobacillus acidophilus*. All of these essential colon nutrients are found in a properly balanced lacto-vegetarian diet.

Colons differ greatly as regards the nature of the impediments which hinder their normal functioning and which prevent the establishment of a normal aciduric flora. By careful study and persevering effort in the application of available helps, with very rare exceptions, every colon not organically diseased may be made to function normally.

Drugs of every sort must be sedulously avoided. All are harmful when habitually used. The colon should never be forced, except in emergency, by the use of stimulating measures. Drugs make matters



worse by causing irritation, congestion, colitis, spastic contraction, diverticuli and appendicitis.

Colons which do not readily respond to a carefully regulated diet, efficient colon-helping food accessories, exercise, and other simple corrective measures, should be studied with the aid of the x-ray, and competent medical advice should be sought.

### Résumé

In the limited space allotted me, I have endeavored to make clear in the foregoing paragraphs the following points:

1. An evacuation by the colon of residues and wastes soon after each meal is the normal, or physiologic, order of colon functioning. Within 12 or 14 hours after food is eaten, it has traveled almost the entire 30 feet of the small intestine, residues being found in the lower colon within two or three feet of the exit.

The taking of a meal awakens the colon to activity, and by pushing the food into the rectum, creates a desire for evacuation. When the after-meal call has been lost, it may be re-acquired by habitually visiting the toilet and making an attempt to evacuate.

2. Through the protective action of the *Lactobacillus acidophilus*, discovered by Doctor Tissier, of the Pasteur Institute, Nature has provided for the prevention of the development of putrefactive and disease-producing bacteria in the digestive tract. The only conditions required are, maintenance of the physiologic rhythm of evacuation and adherence to the primitive, or biologic, bill of fare. This supplies the nutrients necessary to maintain an aciduric flora, which not only prevents putrefaction but is a physiologic stimulus to colon activity.

3. Neglect to empty the colon soon after eating, leads to accumulation and prolonged retention of residues in the colon and resulting putrefaction, with the formation of highly poisonous products which are by many eminent authorities believed to be a prolific cause of disease, degeneracy, and premature senility.

4. The normal diet of man (lacto-vegetarian) is non-putrefactive. Fresh fruits and vegetables and other plant foods are presented to us by Nature in an absolutely sterile condition. Dairy products contain many bacteria, but of a harmless sort, protective, in fact, because they produce lactic acid.

Fresh meats swarm with noxious colon germs with which they become infected in the act of slaughtering. Ordinary cooking does not

destroy meat germs. Canned meat is cooked for three hours at a temperature of 240° F. to prevent spoiling.

5. Through mistreatment, and especially by the use of cathartics and laxative drugs, the civilized colon has become badly crippled; but by proper treatment and training, it may be reformed and in most cases made to function normally after each meal, and with such results in improved vigor, increased efficiency, sense of fitness and well-being, as to well repay the effort required.

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# MODERN MEDICINE

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## BACTERIOLOGICAL REVIEW.

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### ORIGINAL ARTICLES.

#### THE VALUE OF STRENGTH TESTS IN THE PRESCRIPTION OF EXERCISE, AND A COMPARATIVE STUDY OF THE STRENGTH OF INDIVIDUAL GROUPS OF MUSCLES, AND OF HOMOLOGOUS MUSCLES, IN MEN AND IN WOMEN.<sup>1</sup>

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It will doubtless be admitted by all who have undertaken to make a scientific application of exercise as a means of physical development, that the dosage of exercise, or, in other words, the preparation of a day's order, or program, is a question which gives to the trainer more perplexity, and one concerning which he is more often in doubt, than any other subject relating to physical training.

Some twenty years ago, in taking charge of an institution for the treatment of chronic invalids, I was at once confronted by this difficulty, in attempting to make a practical application of exercise as a therapeutic means. It will be readily recognized that the adjustment of the amount of muscular work to be done to the condition of the subject, is a matter of much greater difficulty when dealing with invalids than in dealing with that class of persons who usually come under the care of the physical director, owing to the greater degree of muscular asymmetry which is commonly encountered in invalid adults. In fact, it is a very rare exception to find among adults a person whose habits of life have not been such as to allow important muscular groups to fall into a state of idleness. This is well attested by the fact that such deformities as hollow chest, round shoulders, promi-

nent abdomen, curvature of the spine, forward carriage of the head, and similar abnormalities are so prevalent that the majority of men and women who have reached the age of forty years or over, furnish illustrations of one or more of these defects. Among chronic invalids especially, it is exceptional to find a person who does not present asymmetry in some of the forms which I have shown in a series of outline studies of the human figure, presented elsewhere.<sup>2</sup>

I made use of the usual methods of anthropometry, exercising the greatest care in taking my measurements, only to be disconcerted by the fact that patients not infrequently decreased in measurement while gaining in strength, or were discouraged by making little or no change in their dimensions, notwithstanding hard and persevering efforts in the gymnasium.

I soon discovered that measurements are of very little value indeed in dealing with adult invalids, however useful they may be in the management of the physical training of growing boys and girls and undeveloped youths. I learned that quality, rather than quantity, of muscle was the important thing in dealing with adults—at least invalid adults. Through the assistance of Professor Sargent, I possessed myself of all the various forms of dynamometers which had been constructed for use in testing the strength of the muscles of the human body. I found, however, that these dynamometers had so little range of adaptability that only a few muscular groups could be studied by their aid; and, finding myself daily embarrassed in consequence of my inability to meet the requirements of my patients, and being unable to avoid most unhappy blunders in my exercise prescriptions, in sheer despair I sought to devise some accurate means for testing the strength,

<sup>1</sup> Read before the meeting of the American Association for the Advancement of Physical Education, New York, April 26, 1895.

<sup>2</sup> "Outline Studies of the Human Figure, Comprising 123 Figures, which Embody the Results of Several Thousand Observations, Embracing Studies of a Number of Different Civilized and Uncivilized Races."

which could be adapted to the principal muscular groups of the body.

After seven or eight years of experimentation, I succeeded in perfecting a dynamometer by means of which the strength of every important group of muscles of an individual can be tested. This instrument I have elsewhere described, and have one here for exhibition. By means of this apparatus, the strength of each of the following muscular groups may be accurately determined: For the upper extremities, hand flexors and extensors, forearm pronators and supinators, arm flexors and extensors, deltoid, latissimus dorsi, pectorals, and shoulder retractors; for the lower extremities, foot flexors and extensors, leg flexors and extensors, thigh flexors and extensors, thigh abductors and adductors; for the trunk, anterior, posterior, and right and left lateral muscular groups; for the neck, anterior, posterior, and right and left lateral muscles; for the thorax, the force of waist and chest expansion. Expiration and inspiration are also measured by means of Waldenburg's pneumatometer.

I have worked out a definite mode for testing each group of muscles. This method is followed with care in each test made. The general principle which I have followed is that the resistance of the dynamometer should be applied at the distal end of the bone which is operated upon by the group of muscles under examination, and in such a manner as to give the muscle an opportunity to act to the best advantage, at the same time isolating its action from that of other groups which might vitiate the results obtained.

The accompanying physical charts (Charts I and II) are reduced copies of those which I use for recording the condition of the muscular system of my patients. These charts are constructed on a percental plan somewhat similar to that followed by Professor Seaver in his anthropometric chart. In making these charts, based upon the examination of six hundred men and a like number of women, the figures obtained for each group of muscles were arranged in a column in regular order from the highest down to the lowest. The average of 50 per cent of those found in the middle column was obtained, and put down in the center of the corresponding column on my chart. Forty-five per cent, reaching 5 per cent above the upper level of the middle 50 per cent,

were next added together, the average found, and the result placed in the same column, just above the previous result. Forty per cent, 35 per cent, and so on down to 1 per cent of the numbers above the middle, were cut out in like manner, the averages found, and the results properly placed. Proceeding in a similar manner, the figures were obtained for the lower half of the column. By treating the data obtained for each group of muscles in the body in this manner, I have obtained a chart upon which I can make a graphic representation of the strength of the body, just as bodily dimensions have heretofore been graphically represented upon anthropometric charts and tables.

At the right-hand side of the chart are arranged columns for the totals of the arms, legs, trunk, chest, and the entire body, so as to bring under the eye at a single glance both the relative and the actual strength of the principal divisions of the body.

I have also prepared two other sets of tables, one based upon the examination of two hundred healthy men between twenty and thirty years of age, the other upon the data obtained from testing an equal number of women of the same age. This chart differs from the other chiefly in that the figures start at a higher level. In transferring the graphic representation of a person's muscular strength from one of these tables to another, I find that the characteristic features, although slightly modified, always remain the same.

As a further test of the value of the chart, I have platted the figures obtained for the various groups of muscles, and find that excellent curves are made. In the case of the left foot flexors, for example, an almost absolutely perfect binominal curve is obtained. The best test, however, for the value of this method of obtaining a basis for a prescription for exercise, is the fact that it meets in a most admirable manner the purposes for which it was designed.

The data afforded furnish exact information concerning the capacity of each of the principal groups of muscles in the body. Knowing the capacity of each muscle, it is easy to proportion the work in such a manner as to secure symmetry of development. My plan for accomplishing this is as follows:—

Taking 300,000 foot-pounds, 1-6 of a full day's work, as the proper daily





TABLE I.

A COMPARATIVE STUDY OF THE STRENGTH OF THE VARIOUS GROUPS OF MUSCLES IN THE HUMAN BODY, BASED UPON THE DATA OBTAINED BY DR. KELLOGG'S DYNAMOMETER.

NAMES OF THE GROUPS OF MUSCLES TESTED, COMPRISING ALL THE PRINCIPAL GROUPS OF VOLUNTARY MUSCLES. EXCEPT WHEN OTHERWISE STATED, THE FIGURES GIVEN RELATE TO THE COMBINED STRENGTH OF THE RIGHT AND LEFT GROUPS.	The actual strength of each of the several groups of muscles, and of the muscles found in each of the principal divisions of the body.		The strength of each group of muscles, and of the muscles of each division of the body, in women, as compared with men.		The relative strength of each group of muscles, of five muscles of each division of the body, and of the entire body, as compared with the average weight of the body.		The strength of each group of muscles, of the muscles of each of the principal divisions of the body, and the total strength, of the body, compared with height in inches.		The strength of each group of muscles, and of the muscles of each of the principal divisions of the body, as compared with the height of the whole body.		The strength of the muscles of the right and left sides, gathered and compared with the strength of the corresponding division of the body.		The strength of the muscles of the left side of the body as compared with the muscles of the right side of the body.		The actual strength of each group of muscles, of each division of the body, in tall men and short men.		Muscular strength of short men compared with that of tall men.		The actual strength of each group of muscles, and each division of the body, in tall women and short women.		Muscular strength of short women compared with that of tall women.		Relative differences in muscular development between men and women of equal height (60 inches).		The muscular strength of women 65 inches in height compared with men of the same height.
	Men.	Women.	Men.	Women.	Men.	Women.	Men.	Women.	Men.	Women.	Men.	Women.	TALL, 70 IN.	SHORT, 60 IN.	TALL, 60 IN.	SHORT, 60 IN.	Men.	Women.							
	I.	II.	III.	IV.	V.	VI.	VII.	VIII.	IX.	X.	XI.	XII.	XIII.	XIV.	XV.	XVI.	XVII.	XVIII.	XIX.	XX.	XXI.	XXII.			
Hand Flexors.....	349.	195.	.50	1.80	1.07	3.07	1.98	.048	.047	.163	.169	.97	.95	258	214	.83	137	118	.86	331	197	.41			
Hand Extensors.....	54.	29.	.31	.70	.24	.79	.40	.010	.011	.036	.039	.93	.91	95	54	.57	38	33	.87	64	43	.67			
Forearm Supinator.....	143.	57.	.39	1.03	.48	2.11	.90	.028	.021	.061	.077	.96	.90	192	117	.60	67	55	.82	194	67	.34			
Forearm Pronator.....	114.	37.	.42	.90	.48	1.97	.90	.026	.021	.088	.077	.97	.96	140	116	.83	68	58	.85	118	69	.58			
Arm Flexors.....	129.	48.	.40	.86	.41	1.77	.76	.020	.017	.078	.065	.97	1.00	125	113	.90	61	57	.93	126	62	.49			
Arm Extensors.....	127.	33.	.41	.81	.45	1.87	.84	.024	.019	.076	.072	.98	.96	113	113	1.00	62	56	.90	119	64	.34			
Latissimus Dorsi.....	155.	99.	.55	1.03	.85	2.74	1.57	.036	.036	.122	.134	.99	.98	.....	.....	.....	.....	.....	.....	.....	.....	.....			
Deltoid.....	143.	71.	.50	1.00	.60	2.06	1.12	.027	.026	.090	.096	.97	.97	127	128	1.01	75	68	.91	140	79	.56			
Pectoral.....	233.	102.	.48	1.50	.87	3.08	1.70	.042	.037	.137	.138	.97	.96	200	168	.84	90	100	1.11	192	100	.52			
Shoulder Retractors.....	179.	95.	.59	1.15	.81	2.36	1.51	.031	.035	.105	.120	1.00	1.02	184	156	.85	100	95	.95	161	95	.50			
Foot Extensors.....	614.	304.	.50	4.41	3.13	9.97	5.79	.118	.133	.271	.275	.99	.98	566	409	.83	319	296	.93	492	308	.65			
Foot Flexors.....	147.	89.	.61	1.04	.76	2.14	1.41	.028	.032	.064	.067	.99	1.02	160	149	.81	103	94	.91	139	99	.74			
Leg Flexors.....	299.	116.	.58	1.44	.99	2.95	1.84	.050	.042	.088	.088	.98	1.00	197	182	.92	109	97	.89	175	109	.62			
Leg Extensors.....	267.	125.	.51	1.70	1.05	3.50	1.95	.040	.045	.104	.093	.97	1.02	233	214	.92	125	107	.86	224	124	.55			
Thigh Flexors.....	394.	179.	.59	2.10	1.52	4.47	2.84	.058	.065	.154	.136	1.02	.99	280	263	.94	165	155	.94	313	162	.52			
Thigh Extensors.....	350.	174.	.52	2.50	1.49	4.87	2.76	.064	.064	.145	.131	1.01	1.00	351	276	.79	159	144	.91	302	159	.52			
Thigh Abductors.....	256.	135.	.65	1.49	1.15	3.04	2.14	.039	.049	.091	.102	1.00	.98	203	188	.93	146	136	.93	164	140	.72			
Thigh Adductors.....	227.	112.	.62	1.93	1.21	3.35	2.25	.044	.052	.100	.107	1.02	1.00	244	207	.85	128	122	.95	214	129	.60			
Trunk Anterior.....	119.	73.	.52	1.00	.62	2.05	1.16	.025	.027	.133	.141	.....	.....	139	121	.93	66	61	.92	129	68	.55			
Trunk Posterior.....	389.	179.	.45	2.79	1.47	5.61	2.75	.073	.063	.364	.325	.....	.....	314	215	.65	199	145	1.04	341	138	.10			
Trunk Lateral—R. and L.....	287.	154.	.54	2.06	1.31	4.23	2.44	.055	.056	.275	.298	.99	.97	248	206	1.07	146	137	.94	257	148	.58			
Neck Anterior.....	35.	19.	.54	.95	.46	.51	.30	.007	.007	.034	.037	.....	.....	38	34	.89	21	21	.91	34	23	.68			
Neck Posterior.....	75.	37.	.49	.54	.31	1.10	.58	.014	.013	.072	.071	.....	.....	70	71	1.01	39	36	.92	59	39	.56			
Neck Lateral—R. and L.....	129.	69.	.47	.99	.54	1.86	.95	.024	.022	.120	.116	1.00	1.00	112	116	1.04	64	60	.94	113	60	.54			
Inspiration—Water.....	173.	79.	.45	1.23	.67	2.54	1.25	.023	.029	.....	.....	.....	.....	139	135	.85	74	79	1.07	139	78	.56			
Inspiration—Chest.....	199.	85.	.44	1.26	.72	2.95	1.35	.037	.031	.....	.....	.....	.....	177	154	.85	88	82	.93	163	87	.53			
Inspiration—Pneumometer.....	.....	.....	.44	.006	.005	.013	.009	.0002	.0001	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....			
Expiration—Pneumometer.....	2.4	1.4	.54	.019	.012	.028	.022	.0003	.0003	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....			
Arms { Right.....	779.	379.	.48	5.54	3.19	11.38	5.93	.148	.136	.....	.....	.....	.....	684	601	.88	369	323	.90	617	358	.55			
Arms { Left.....	751.	363.	.48	5.40	3.10	11.00	5.77	.145	.132	.....	.....	.....	.....	679	589	.87	355	318	.90	623	359	.56			
Arms { Both.....	1531.	746.	.48	10.94	6.29	22.47	11.70	.293	.268	.....	.....	.....	.....	1363	1190	.87	715	641	.90	1270	708	.56			
Legs { Right.....	1331.	633.	.58	8.43	5.60	16.70	10.54	.218	.212	.....	.....	.....	.....	1434	987	.87	626	579	.92	1069	618	.61			
Legs { Left.....	1179.	659.	.58	8.13	5.63	16.70	10.48	.218	.211	.....	.....	.....	.....	1160	954	.87	628	567	.90	1067	618	.61			
Legs { Both.....	2510.	1322.	.58	16.26	11.23	33.41	21.02	.436	.423	.....	.....	.....	.....	2594	1941	.87	1254	1146	.91	2016	1236	.61			
Trunk.....	1042.	516.	.49	7.50	4.41	15.39	8.30	.201	.188	.....	.....	.....	.....	918	959	1.04	477	461	.97	942	476	.51			
Chest.....	365.	166.	.45	2.63	1.42	5.41	2.64	.071	.061	.....	.....	.....	.....	339	287	.85	163	163	1.00	304	166	.55			
Chest and Trunk.....	1407.	682.	.48	10.13	5.83	20.80	10.94	.271	.249	.....	.....	.....	.....	1257	1246	.99	640	624	.98	1246	642	.52			
Body.....	3499.	2740.	.53	37.34	23.42	76.68	43.56	.....	.....	.....	.....	.....	.....	4854	4377	.90	2609	2411	.92	4532	2586	.57			

\* Compared with chest.

\*\* Compared with both arms.

\*\*\* Compared with both legs.

\*\*\*\* Trunk anterior compared with trunk posterior.

\*\*\*\*\* Neck anterior compared with neck posterior.

amount of exercise for a man whose total strength capacity is 10,000 pounds, corresponding very nearly to the greatest capacity shown upon my table prepared from two hundred young men in vigorous health, I have undertaken to establish a definite relation between the strength capacity and the total amount of work to be performed. This is accomplished by simply dividing the total amount of work done by the total capacity of the muscles; that is, 1,800,000 is divided by 10,000, giving 180. In other words, for each pound of capacity, the muscles are capable of doing 180 foot-pounds of work daily, an interesting physiological fact thus for the first time determined. One sixth of 180 is 30. Hence it is clear that in a symmetrically developed man, with a total strength capacity of 10,000 pounds, each muscle, in order to do its proportion of the 300,000 foot-pounds prescribed, must do work to the amount of 30 times its lifting capacity represented in foot-pounds. It is only necessary, then, in order to ascertain the exact amount of work to be done by each group of muscles at each level, to multiply by 30 the figures of each column of the chart.

I have made a careful approximate calculation of the amount of work done in each exercise or set of exercises, with each apparatus in the gymnasium under my supervision. It is necessary to know the strength of the medicine as well as the needs of the patient. Knowing the amount of work required for each individual and for each set of muscles, and also the result obtained from each exercise, it is easy to construct tables of exercise exactly adapted to any capacity. I have arranged ten series of such tables, or day's orders, five for each of the two charts.

In making a prescription for exercise, I first note the total capacity of the individual, and then write down a number indicating the day's order which would secure for an individual of the given capacity the proper amount of work. Then, glancing over the chart, I note the low points, and check or underscore each of these, which indicates to the assistant who superintends the exercise in the gymnasium that the work is to be doubled on all such points, so as to secure to the weak muscles such rapid development and growth as will enable them to overtake the rest of the muscles, and thus re-

store muscular symmetry. In practice, I find that this method never results in giving to a muscle more than a full day's work, and consequently there is no danger of injury resulting from this doubling of the amount of work to be done by the weak muscles. In case of complete paralysis of the muscle, it is of course necessary at the beginning, to administer the exercise by electrical or mechanical means.

As a rule, I find it sufficient, for practical purposes, to divide the series of total capacities represented upon my table into five groups, instead of making a distinct schedule of work at each of the levels indicated by the several quantities representing total muscular capacity.

The ratio which I have established between the muscular capacity and the day's work is probably too small for those in vigorous health; but I find it well suited to the class of persons coming under my observation, who are mostly invalids or semi-invalids. The man who is in training, and desires to develop his whole body to its highest capacity, should be required to execute a full day's work, — 1,800,000 foot-pounds, or even more. In arranging a day's order of exercises, due account is of course taken of the work done in walking, running, and similar exercises which may be made a part of the program.

The patient does not undertake the first day to do all the exercises prescribed in the series, but gradually takes them up from day to day as he learns them, and becomes able to do them; and by the end of two or three weeks, he is expected to have thoroughly mastered all the exercises given him, and to have become able to take each day all that is directed in his prescription. At the end of a month, another chart is made, the changes noted, and a new prescription prepared according to the requirements. It is a matter of frequent observation that the points which at the first examination are lowest on the chart, are so improved by the specific exercise directed to these particularly weak muscles that they become the highest ones upon the second chart.

The advantages of this mode of studying the condition of the muscular system, and the great change which may be effected by a precise and definite prescription for exercise, in combination with massage and manual and mechanical Swedish movements, are well shown in Chart I, which represents the muscular



condition of a young woman at three different dates: respectively, April 6, May 2, and September 1, 1892. The great irregularities of the first tracing, and the low levels reached by many of the arm groups of muscles, with the low level of the total strength, indicate a very weak and unsymmetrical development at the beginning. The young woman was stooped, round shouldered, hollow chested, pale, anemic, and possessed of very little vigor. Less than a month later, when the second tracing was taken, the patient had made a gain of nearly 800 pounds in total strength, the greater part of the gain having been made in the arms, which in the beginning were very much weaker than the legs, but which by special attention had become proportionately stronger than the legs. The chest had also gained even more than the arms, so that this portion of the muscular system was slightly in the ascendancy. At this time another prescription was made, the effects of which appear in the further improvement shown by the test made September 1. By comparison of the totals, it will be seen that the asymmetry had largely disappeared.

No person is ever found whose chart gives a perfectly straight line; but the nearer the approach to a straight line across the chart, the more perfect, of course, the symmetry.

At the time of the last test, September 1, this unsymmetrical, feeble young woman would certainly have been pronounced one of more than average vigor and of excellent symmetry. She carried herself erect, her chest had become full and the respiratory movements deeper, and the whole body shared in the increase in physical vigor and stamina acquired by the muscular system.

By means of this method, it is possible to obtain exact knowledge respecting the requirements of each individual case. Possessed of this, it is not difficult to make a prescription which will be exactly adapted to the wants of the patient. It is possible to make in less than a minute's time, a prescription which is more perfectly adapted to the needs of the individual examined, than could be made by the most elaborate study and the consumption of any amount of time, without the aid of the accurate data obtained by this method.

One of the charts herewith presented,

that of Mr. A. (Chart II), shows the value of this mode of investigation in the diagnosis of morbid conditions affecting the motor system. The patient was suffering from paresis of the left arm. This would be apparent from the chart alone, without other evidence, as will be readily seen. The dynamometer picks out the particular groups of muscles which are affected by paresis or paralysis, and thus gives important indications respecting the location of the central lesion, of which the paralysis is merely a symptom. This chart also shows, in a most interesting manner, the value of the dynamometer as a means of indicating the progress made by a paretic patient under treatment.

Another advantage in this mode of studying the motor apparatus is the fact that the dynamometer tests not only the muscles, but the nerves and nerve centers as well, so that it is a precise measure of the condition of the individual's motor apparatus. It is a true measure of the dynamic energy of the body, and shows the actual ability of the individual to manifest energy through his muscular system as a whole, and through each particular part of it. The tape line merely gives the dimensions of a man, — it tells nothing as to whether he is alive or dead. The dynamometer gives us an accurate description of the living, active man. The chart obtained by means of a dynamometer enables the physical director to make a precise prescription for exercise without even seeing the subject, whereas the data furnished by the measurements of the tape line may relate to a man who is dead, or so completely paralyzed that all forms and degrees of exercise are alike impossible; so that without the aid of the dynamometer, anthropometry is a most unreliable guide and almost altogether useless, unless the subject is before the director, who, even then, is obliged to depend upon his intuitions and experience in arranging a program for gymnastic work, rather than upon the indications of the tape line.

After several years' use of my dynamometer and the charts which it has enabled me to prepare, I am so thoroughly dependent upon these means of directing the gymnastic work of my patients that I should be quite at a loss to know how to prescribe for them without this or some other equally good means of exact diagnosis.

A most interesting line of research which the dynamometer has enabled me to undertake, is a comparative study of the muscular system in men and women. The studies of this subject heretofore made, have been chiefly based upon the results obtained by the use of the tape line, which, as has already been remarked, are practically valueless, and always misleading. A few studies have been made by Quetelet and others, based upon such incomplete tests as the strength of the grasp of the hand, the weight which can be dragged over a level surface, etc.; but the facts presented have been so fragmentary as to be of little practical value.

In my personal studies by the aid of the dynamometer, the principal comparisons which have been made are as follows, the figures given (Table I, columns I-XIII) being based upon the study of two hundred healthy men between the ages of eighteen and thirty years, and an equal number of healthy women of the same ages:—

1. A comparative table of the actual strength of each of the several groups of muscles, and of all the muscles of each of the principal divisions of the body, in the average man and the average woman.

2. The relative strength of each group of muscles and of the muscles of each division of the body, and also of the total muscular strength, as compared with the average weight of the body.

3. The strength of each group of muscles, of the muscles of each of the principal divisions of the body, and of the total strength of the body compared with the average height in inches.

4. The strength of each group of muscles, and of the muscles of each of the principal divisions of the body, as compared with the total strength.

5. The strength of each group of muscles (right and left together) as compared with the strength of the corresponding division of the body.

6. The strength of the muscles of the left side of the body as compared with those of the right side of the body.

7. The strength of each group of muscles, of the muscles of each division of the body, and the total strength, in women, as compared with the same in men.

8. The strength of each group of muscles as compared with the antagonizing group.

9. The strength of the muscles of the arms as compared with the homologous, or corresponding, muscles of the legs.

10. A study of the muscular strength of men as compared with that of women of the same height.

11. A study of the muscular strength in short men and short women as compared respectively with that of tall men and tall women.

In the accompanying table (Table I) will be found the figures indicating the principal of these relations, which are made more evident by a series of graphic diagrams to be presented in our next issue.

TABLE II.

TABULAR ARRANGEMENT OF THE SEVERAL GROUPS OF MUSCLES WITH REFERENCE TO THEIR RELATIVE STRENGTH.

MEN.	WOMEN.
Muscles of Inspiration (pneumatometer)..... 4	Muscles of Inspiration (pneumatometer)..... 4
Muscles of Expiration (pneumatometer)..... 4.5	Muscles of Expiration (pneumatometer)..... 4.4
Neck Anterior..... 35	Neck Anterior..... 19
Hand Extensors..... 54	Hand Extensors..... 30
Neck Posterior..... 71	Neck Posterior..... 37
Arm Flexors..... 120	Arm Flexors..... 48
Neck Lateral..... 116	Arm Extensors..... 53
Arm Extensors..... 117	Forearm Supinators..... 57
Forearm Pronators..... 134	Forearm Pronators..... 57
Trunk Anterior..... 139	Neck Lateral..... 60
Deltoid..... 140	Deltoid..... 71
Forearm Supinators..... 143	Trunk Anterior..... 73
Foot Flexors..... 145	Inspiration (waist)..... 79
Shoulder Retractors..... 160	Inspiration (chest)..... 85
Inspiration (waist)..... 172	Foot Flexors..... 89
Latissimus Dorsi..... 185	Shoulder Retractors..... 95
Inspiration (chest)..... 190	Latissimus Dorsi..... 99
Leg Flexors..... 200	Pectoral..... 102
Thigh Abductors..... 206	Leg Flexors..... 116
Pectoral..... 209	Leg Extensors..... 123
Thigh Adductors..... 227	Hand Flexors..... 125
Leg Extensors..... 237	Thigh Abductors..... 135
Hand Flexors..... 249	Thigh Adductors..... 142
Trunk Lateral..... 257	Trunk Lateral..... 154
Thigh Flexors..... 273	Chest..... 166
Thigh Extensors..... 310	Trunk Posterior..... 173
Chest..... 365	Thigh Extensors..... 174
Trunk Posterior..... 380	Thigh Flexors..... 179
Foot Extensors..... 514	Left Arm..... 303
Left Arm..... 751	Foot Extensors..... 364
Right Arm..... 770	Right Arm..... 373
Trunk..... 1042	Trunk..... 516
Right Leg..... 1137	Left Leg..... 659
Left Leg..... 1131	Right Leg..... 663
Chest and Trunk..... 1207	Chest and Trunk..... 682
Both Arms..... 1521	Both Arms..... 736
Both Legs..... 2252	Both Legs..... 1322
Entire Body..... 3192	Entire Body..... 2740

*The Relative Strength of the Various Groups of Muscles.*—In Table II the figures which indicate the strength of each individual group of muscles for the average man and the average woman, are arranged in the order of their relative strength. It will be observed that the order in the two columns is not the same. Interesting differences and facts, a few only of which will be mentioned here, occur at many points:—

1. One of the most curious facts noted is that the foot extensors, or calf muscles, in the average woman, have a strength almost exactly equal to that of the left arm.

2. The anterior muscles of the neck, in both men and women, have about half the strength of the posterior.

3. The hand flexors in men have just twice the strength of the arm flexors; in women, the hand flexors are nearly three times as strong as the arm flexors.

4. The anterior muscles of the trunk, the deltoid, the forearm supinators, and the foot flexors have almost equal strength in man; in woman, the forearm supinators, forearm pronators, and the lateral muscles of the neck may be similarly grouped.

5. In man, the forearm supinators are considerably stronger than the pronators, whereas in women they are of equal strength, although much weaker than in men, these muscles being, in the average man, 2-1-2 times as strong as in the average woman.

6. In man, again, the thigh abductors and the pectorals have almost the same strength capacity; in woman, a similar parallel exists between the leg extensors and the hand flexors, and another group is found in the muscles of the back, the thigh extensors, and the thigh flexors, which are in the average woman almost exactly equal in strength capacity.

7. In man, the latissimus dorsi and the muscles which move the upper chest in inspiration, are equal in strength; while in woman a similar parallel exists between the latissimus dorsi, the pectorals, and the shoulder retractors.

8. The inspiratory powers of the waist and chest are practically equal in women; while in man the inspiratory power of the chest is perceptibly greater than that of the waist, although in each case the respiratory strength in man is double or more than double that of woman. This fact demonstrates the fallacy of the idea that restriction of the waist is a means of giving woman a superiority in upper chest development, and so acting as a preventive of pulmonary disease. Men, without waist constriction, have greater relative strength in the upper chest than have women.

9. The total strength of inspiration (chest) is, in women, just 1-8 that of the total for the chest and trunk.

10. The strength of one leg is almost exactly equal, in woman, to the strength of the chest and trunk; in man, the total for the chest and trunk is considerably greater than that for either leg.

11. The waist-expanding capacity is almost exactly 1-2 that of the total for the two sides of the trunk, in woman.

12. The thigh extensors in man have a capacity more than six times that of the hand extensors; while the foot extensors have a capacity almost exactly twelve times that of the hand extensors, and double that of the thigh flexors.

13. The strength of the arm extensors, in man, is almost exactly 1-12 that of the entire arm.

14. The strength of the deltoid, is, in woman, almost exactly 1-2 that of the homologous muscles,—the thigh abductors.

15. The lateral muscles of the neck have half the strength of the hand flexors, in both men and women.

Many other interesting comparisons might be made, especially those which relate to the strength of each group of muscles as compared with the whole body. This is graphically shown in one of the diagrams referred to.

(To be continued.)

## A NEW QUICK METHOD OF PERFORMING THE OPERATOR OF NEPHRORRHAPHY.

BY J. H. KELLOGG, M. D.

SINCE Glenard taught us the important relation of enteroptosis to a great number of nervous disorders and the disturbances of the sympathetic nervous system set up by prolapse of the abdominal viscera, greater attention has been paid to the displacements of the kidney as well as of other abdominal organs, than heretofore.

The frequency of prolapse of the right kidney, particularly in women, is a fact which has now become well established. Observations made by the writer and reported at the meeting of the American Medical Association held in Washington, June 24-27, 1894, show that movable kidney and floating kidney are, in women, generally associated with pelvic disorders. In not a few cases of women suffering from this class of ailments the symptoms



BATTLE CREEK, MICHIGAN.

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PHYSICAL DETERIORATION RESULTING FROM SCHOOL LIFE;  
CAUSE; REMEDY.<sup>1</sup>

BY J. H. KELLOGG, M. D.,

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SOME years ago, while spending a short time among the Yuma Indians in the vicinity of Old Fort Yuma, Arizona, I observed, one morning, a considerable number of old warriors and chiefs gathering in from the forest, and collecting in the old fort. Upon inquiry, I found that there was to be an Indian school-meeting, the first one ever held among the Yumas.

The school had been started some two years before by Sister Alphonse and two or three other devoted Catholic sisters, who had ventured into the wilds of Arizona to undertake the experiment of educating the Yuma boys and girls. But their school had not prospered. The children had been kindly treated; they had been supplied with an abundance of food, whereas before they were often hungry; they had been furnished with clothing, including hats, bonnets, shoes, and stockings, whereas before they had roamed the forest in nakedness. The schools were furnished with all the necessary modern appliances, and the teachers labored earnestly in behalf of the students; nevertheless, Sister Alphonse confessed to me that the school was not a success, and that the old Indians were very much opposed to it.

I inquired the reason for this opposition, and was told that the Indians complained that going to school did not agree with the health of the children; that after having been in school a few months, they were far less robust and vigorous than before, and that they suffered from indigestion, catarrh, and other diseases, from which they were before as free

as the birds, the antelopes, and the prairie-dogs among which they lived. The good sisters honestly admitted that the complaint of the old Indians was not without foundation, and that it was true that for some reason the little wild children of the forest began to lose their vigor and vivacity soon after entering school, and therefore some of the most sagacious parents had kept their children at home.

The school-meeting had been called for the purpose of presenting to the old Indians the advantages of an education, so as to convince them, if possible, that the children would better have an education even if the getting of it should spoil their stomachs, weaken their lungs, destroy their keen sense of smell through catarrh, impair their eyesight, dull their hearing, and deprive them of the hardihood which had enabled them for centuries to maintain the independence which they still possessed.

I did not remain to hear the conclusion of the matter, but a few years later, in passing through the country on a visit to the Pacific Coast, I spent a day among these same Indians. I found the school flourishing, to the great delight of the good sisters, but the children perishing. Their forest air of rollicking freedom had disappeared, and the evidences of physical depression and deterioration were unmistakably apparent. Civilization had conquered, and the Indians had become convinced that their children must be educated, even at the expense of health and vigor.

The deteriorating influence of school life upon children has been so long and so generally recognized that I do not need to undertake the demon-

<sup>1</sup> Read before the National Educational Association at Buffalo, N. Y., July 24, 1896.

stration of the reality of the stupendous evil, nor to cite the abundant statistics collected by various workers in this country, England, Germany, and Russia, which show so graphically the enormous proportions which the evil has assumed.

Until the recent development of gymnastics in connection with our colleges, seminaries, and, to some extent, the public schools, to be a scholar, a cultivated man or woman, meant almost universally to be a chronic invalid. The man or woman of letters is still generally pictured as a person of rather attenuated form, pale countenance, hollow eyes, lax muscles, and if not nervous or hysterical, escaping those dismal afflictions only by virtue of extraordinary force of character or especially favorable environment.

I think, however, there are good grounds for believing that the aristocracy of dyspeptic literati is diminishing in numbers, thanks to the influence of the bicycle, college athletics, the growth of more sturdy ideas relating to education in general, and the scores of missionaries sent out into different parts of the country by the Chautauqua School of Physical Culture and allied institutions.

It is still true, however, that the majority of persons engaged in the educational training of children and youth have little appreciation of the importance of giving attention to the physical condition of their pupils as well as to their mental and moral training. If the conditions of school life were properly related to the health of the children, the school period would be the most regular and healthful of the whole life. Childhood is not burdened with perplexing cares and anxieties, nor subjected to trying emergencies, as is adult life, and the perfect regulation of that period should be in the highest degree conducive to normal and healthful activity. But that this is not the case under existing conditions is everywhere recognized. The annual vacation is itself a confession of the unhealthful and exhausting character of school work. Exhausting work is by no means favorable to the best development. The permanent results of school training depend upon tissue changes in the brain structure, which, in turn, depend upon digestion, circulation, and the various nutritive processes of the body. Hence sound health and the proper performance of all the bodily functions are the conditions most essential to a sound education.

This question is one of the most important which could possibly be considered by the great body of educators gathered in this city to-day, and of such superlative importance is it, that every other ques-

tion might profitably be laid aside, and the entire time of this great convention devoted to the consideration of the causes which make school life unhealthful and exhausting, and the remedies required.

I shall not, however, in this brief paper, undertake to deal with the almost numberless phases of the subject which has been assigned me, especially as branches of this great question have been ably and comprehensively considered by various writers whose works may be readily consulted. I wish especially to place before this association for earnest consideration, a single phase of the subject which quite extensive observation leads me to believe has been, to a large extent, ignored. My paper will deal chiefly with the injurious effects of incorrect postures in sitting and standing in the development of displacements of the internal viscera, and the long train of evils arising therefrom.

*Incorrect Attitudes.*—The displacement of the internal viscera,—particularly prolapse of the stomach, prolapsed or floating kidney, prolapse of the bowels, and displacement of other viscera,—is a morbid condition, the existence and significance of which have been recognized only in comparatively recent times. Much has been written with reference to the influence of wrong positions in sitting in producing spinal curvature, flat chests, and other deformities which are externally visible; but, so far as I know, little or no attention has been given to the relation of incorrect posture to internal displacements.

My own attention was called to the importance of the relation of these displacements to the general health, by the writings of Glenard and Pasteur, two eminent French physicians, who, twelve or fourteen years ago, began to address the profession upon this subject. Glenard pointed out that with the great majority of persons suffering from chronic indigestion, prolapse of the stomach or bowels, or both, is the fundamental cause of the disease, and showed that many dyspeptics may be cured by the simple application of a bandage for the support of the prolapsed organs. Professor Bouchard, the eminent French pathologist, later pointed out the fact that Bright's disease of the kidneys, rheumatism, pulmonary consumption, and other chronic maladies, are traceable to the same cause, the foundation for these maladies being laid in indigestion resulting from displacement of the digestive organs.

Something more than six years ago I began a careful study of this subject, and soon noted a very distinct relation between displaced conditions of the internal organs and the external form of the body.

In order to make my observations more exact, I devised an instrument by which a profile of the entire body could be quickly made, and began to make tracings of my patients in connection with the physical examination, with reference to the location of the principal viscera of the trunk. I made in this way many hundreds of tracings, until I fully established the facts to which I wish especially to call attention, and which I will also demonstrate by copies of some of the typical forms of internal and external deformities which I have observed. The accompanying cuts will illustrate some of these deformities. (Figs. 1-4.)

Although I have found these deformities present in both men and women, they have been of very

instances the foundation of these defects is laid in childhood, and during the school-going period. But before making further remarks of a general character, I wish to call more particular attention to the exact nature of the evil which I am endeavoring to discuss.

The trunk is practically divided into two cavities. The division of the lower cavity into pelvis and abdomen is an artificial and not an anatomical subdivision, being useful for the purposes of description, but misleading and confusing unless ignored in studies concerning causation and pathological relations. Anatomically, the trunk is divided by the diaphragm into two cavities only, the upper containing the chief organs of respiration and circulation, and the lower

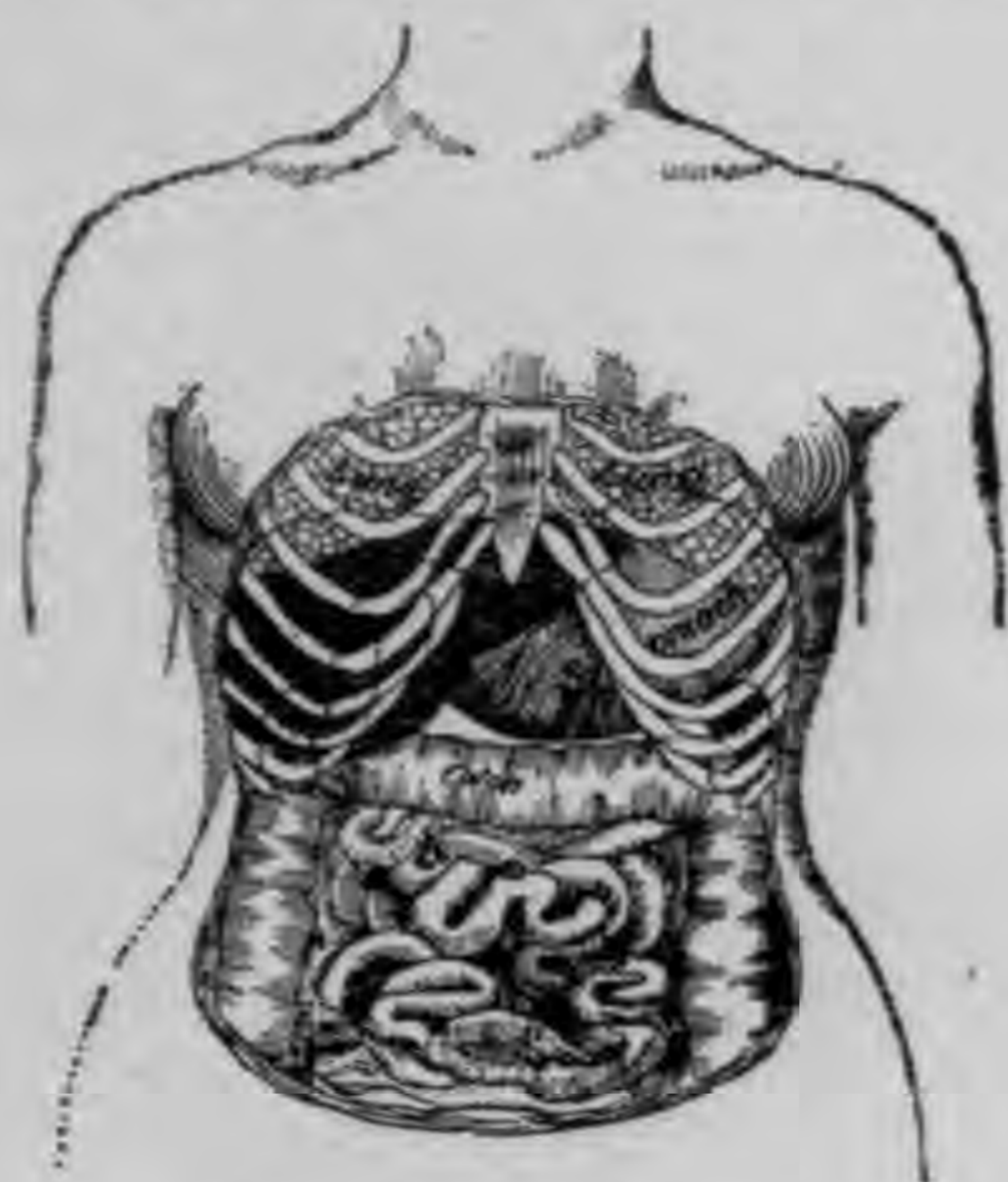


FIG. 1.—A Normal Figure.

much more frequent occurrence in women,—a fact which I have attributed to the unhealthful features of the conventional mode of dress, and to the weaker physical development of women. Nevertheless, I have found displacements of the viscera associated with certain external deformities in a large number of both men and women who had never injured themselves by constriction of the waist, in which cases I have, I believe, been able to trace them directly to improper attitudes in sitting. In the great majority of cases of the latter class, patients have not been aware of the internal deformities existing in the form of a prolapsed stomach, floating kidney, or prolapsed bowels, until I have called attention to the fact by a careful physical exploration, whereby the location of the stomach, kidneys, and other viscera may be exactly determined.

From a careful study of the health of these cases, I have become convinced that in the majority of

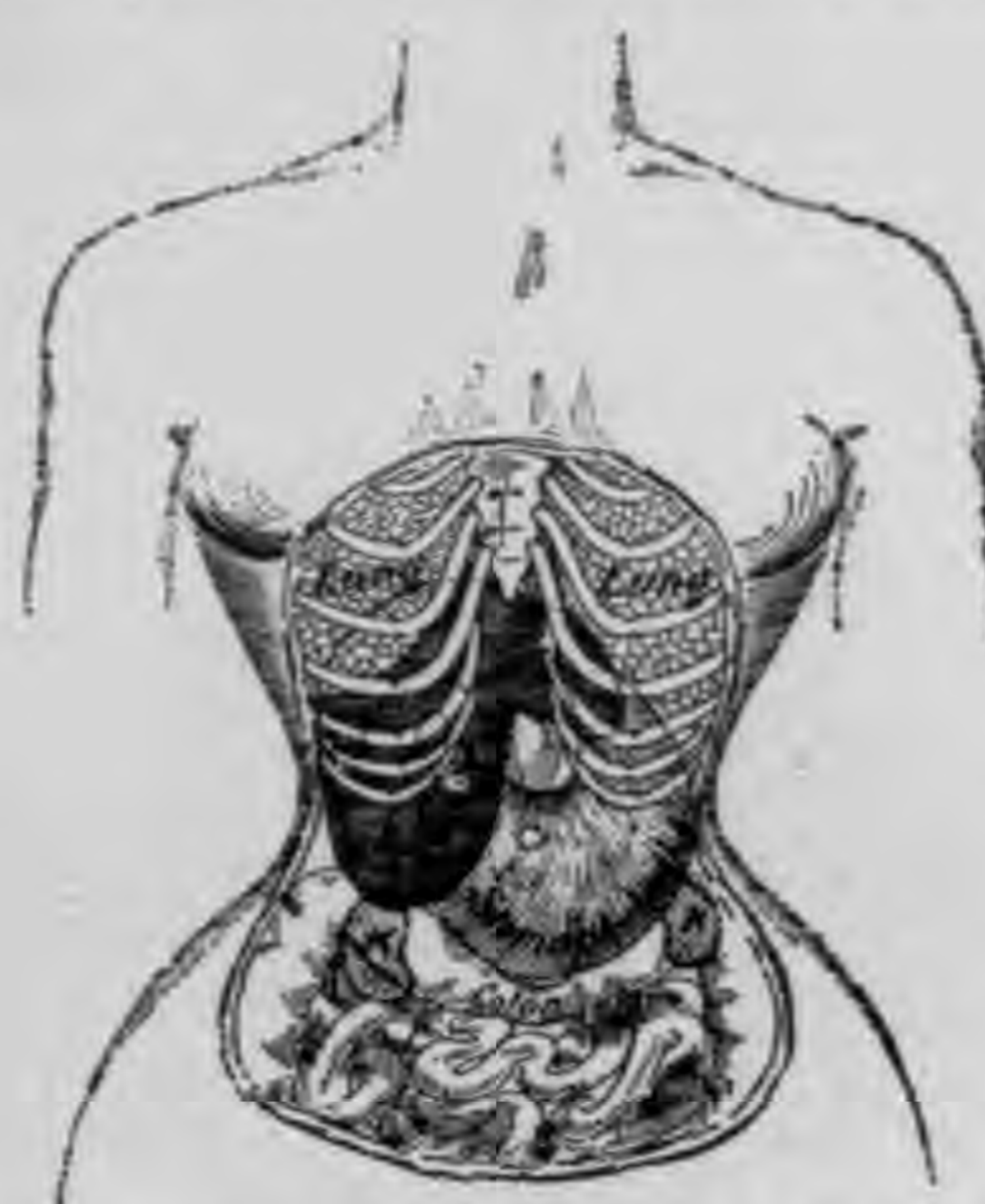


FIG. 2.—Stomach and other Viscera Displaced.

containing the principal organs of digestion and the genito-urinary apparatus. The chief anatomical facts which I desire to have kept in mind are the normal position of each of the viscera which occupy the lower cavity of the trunk, and the mode by which these various organs are held in place. It will be remembered that the liver, spleen, pancreas, and stomach are all located above the diaphragm, or at the waist, as shown in the accompanying diagram after Ziemssen. (Fig. 1.)

The transverse colon lies at the waist line, the point of junction of the ascending and transverse colon on the right side dropping a little below the line, while the point of conjunction of the transverse with the ascending colon at the left side rises considerably above the waist line, being held in place by the pleuro-colic fold of the meso-colon. The kidneys lie just at the waist. The greater portion of the space below the waist is occupied by the in-

testines and the bladder. It is noticeable that the organs of the greatest weight and functional importance are located at or above the waist.

How are these important organs held in position? Although fitted together with the nicety of an articulation, the viscera are certainly not held together by anything corresponding to the firm ligamentous bands which unite the osseous elements of the joints. The so-called ligaments which hold in place the liver, stomach, spleen, and bowels cannot properly be called ligaments, as very little ligamentous structure enters into their composition. The same must be said of the ligaments which are supposed to support the organs of the pelvis.

The organs are really held in position by the muscular walls of the abdomen and the support of the adjacent organs, as all are fitted snugly together like the various articles contained within a well-packed trunk. The liver and kidneys and the greater portion of the stomach, when in their proper positions, are almost entirely covered at the front of the body by the ribs. The abdominal muscles, which constitute the chief support of these organs, are joined to the ribs above, and to the upper border of the pelvic bone below. It will readily be seen that in bending forward, the two points at which these are attached—the ribs above and the pelvis below—are brought nearer together; consequently the abdominal muscles are relaxed, and the natural support of the organs of the trunk is removed. At the same time, in bending forward, the lower ribs approach the spinal column, thereby forcing downward the organs which lie beneath them; namely, the liver, kidneys, and stomach. These, in turn, crowd down the colon, intestines, and other organs which underlie them. Thus we have two causes operating together to produce displacement of the organs which lie at the upper part of the trunk,—an abnormal pressure above, and the removal of the natural support below.

A glance at Fig. 1 will show at once the relation of the ribs to the liver, stomach, and kidneys. It should be recollected, also, that the spleen and

pancreas lie beneath the ribs, as well as the organs before named.

In a person whose figure shows a normal outline, as in the accompanying figure (Fig. 6), that of a German peasant woman, it is noticed that there is a strong anterior curve of the spine, a full chest, and that the abdominal muscles are well drawn up. A



FIG. 3.—The Result of Relaxed Sitting.

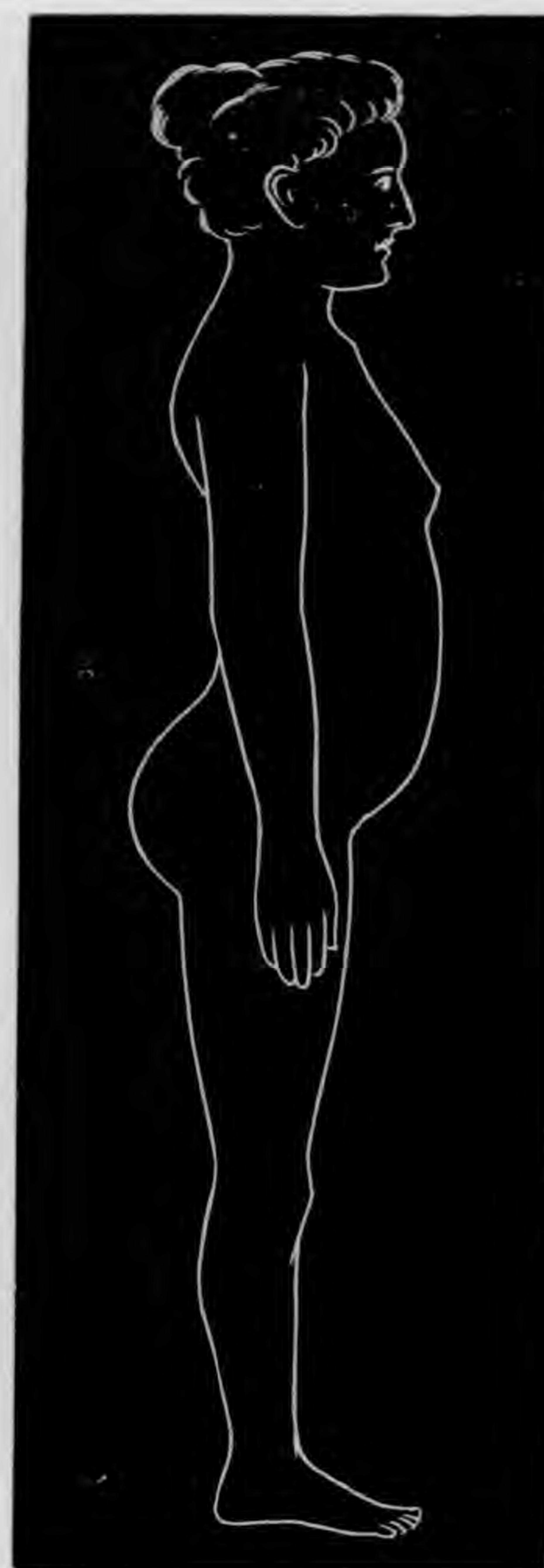


FIG. 4.—Same person as shown in Fig. 3, with posture deformities corrected.

lessening of the posterior curve of the trunk results at once in a depression of the chest and waist, and produces an abnormal fulness in the lower abdomen,—the natural consequence of the displacement of the organs lying about the waist downward, and a forward bulging of the abdominal walls. This is well

shown in Fig. 7, the outline of a seamstress, who, in her occupation, has acquired the habit of sitting in a relaxed position, bending forward over her work.

It thus at once appears that when the student sits at his desk in the schoolroom, leaning forward over his book or work, there is not only danger of acquiring a curvature of the spine and a correspondingly ugly shape, but there is an actual compression and displacement of internal organs, which, if the morbid condition becomes permanent, will, as the result of habit, produce serious disease, and cripple the individual for life.

We see a vast multitude of such cripples going about the world,—persons whose round shoulders, flat chests, forward carriage of head, and abnormally straight spine, indicate prolapsed and disordered stomachs, livers, kidneys, and bowels.

Not only are the organs within crippled in their action by the stooped position in sitting, walking, and standing, but the lungs are likewise hampered. On having a round-shouldered, flat-chested person breathe into a spirometer after a full breath, I have found the lung capacity to be only 270; whereas the same person, standing in a proper position, was able to expel 310 inches after taking a full inspiration, an increase of fifteen per cent.

The involuntary respiration must be interfered with to even a greater extent. The person breathing in a stooped sitting position is constantly in a state of air-starvation, a fact which is evidenced by the disposition to straighten up and draw a long, deep breath every now and then, which is constantly noticed in persons who habitually sit at study or work in a stooped attitude.

The physical injury which a person receives from an incorrect sitting posture is of far greater consequence than the mere ugliness of the appearance. The posterior curvature, or abnormal straightening of the spine, resulting from an improper sitting position, is the most common of all forms of spinal curvature, but singularly enough, is not mentioned even in special medical treatises. Round shoulders and flat, hollow chests are considered, but nothing is said of posterior curvature of the spine. By studying this matter closely, we find posterior curvature present in all these cases, if not the cause of the conditions. Every round-shouldered person, every flat-chested person, has posterior curvature of the spine.

There are three forms of posterior curvature:

1. That which affects the upper part of the spine, causing the head to be thrust forward over the chest. There is extreme roundness of the shoulders, and the hips are carried back. This form is most common in aged people, and in laboring men who have to bend over their work.

2. That form which affects the middle portion of the spine. In these cases the head and hips are both thrown forward. This form is found in young and middle-aged people, and is usually due to bad positions assumed in sitting and standing, and a lack of development of the muscles of the trunk.

3. That in which the lower, or lumbar, region of



FIG. 5, A. Spleen Displaced from Corset Wearing.



FIG. 5, B. Front View of same person.

the spine is affected. In these cases the forward curve is effaced, or nearly so, the spine becoming straight. The hips are nearly on a line with the spine, giving a most ungraceful figure.

Incorrect sitting may result either from defects in the seat, or from negligence on the part of the pupil. A seat that is too broad naturally results in posterior curvature, for the reason that no support can be obtained from the back of the seat unless the pupil leans back so far as to make his position absolutely insupportable without relaxation of the muscles.



Too high a seat drags the lungs downward, and produces a similar effect. A low desk encourages a stooped position in sitting.

If the student has a habit of sitting too far forward upon his seat in a relaxed position, posterior curvature of the spine naturally follows. Students not infrequently acquire a slack habit of sitting in a relaxed position with the trunk bent backward at the middle, even when the seat and desk are properly constructed both in relation to each other and to the pupil. Correct sitting is a forcible position,—not a strained position, but one in which the muscles of the trunk are active.

To remedy this evil, which I have sketched too briefly to give any adequate idea of its importance, requires:—

1. Constant correction by the teacher, of the improper attitudes assumed by students, and the employment of suitable corrective exercises for two or three minutes at every change in the day's program.

2. A regular, systematic course of scientific physical training as an essential part of the daily work of every pupil in every school in all grades.

The conditions which surround the child during its school life are a mold into which it grows, and whereby the whole after life of the man or woman is favorably or unfavorably influenced.

Later revelations in medical science have established beyond doubt the fact that a large share of chronic and disabling ailments from which men and women suffer, have their foundation in the erroneous habits and vicious conditions of life during childhood and youth.

When the writer was a pupil of Professor Hartelius, the director of the Royal College of Gymnastics at Stockholm, Sweden, some thirteen years ago, he was told by that eminent and experienced teacher of gymnastics that he had never encountered curvature of the spine in a single case in which the individual had had the advantage of gymnastic training during his school-going period. At that time, gymnastics had long held a prominent position in Sweden, being by law obligatory in every school. The result

is to be seen in the erect and well-developed physique which is the prevalent type in Sweden. One may see on the streets of Stockholm a larger proportion of men and women with fine figure and graceful carriage than in any other city in the world.

The benefits of exercise in connection with school work are not confined to its influence upon the

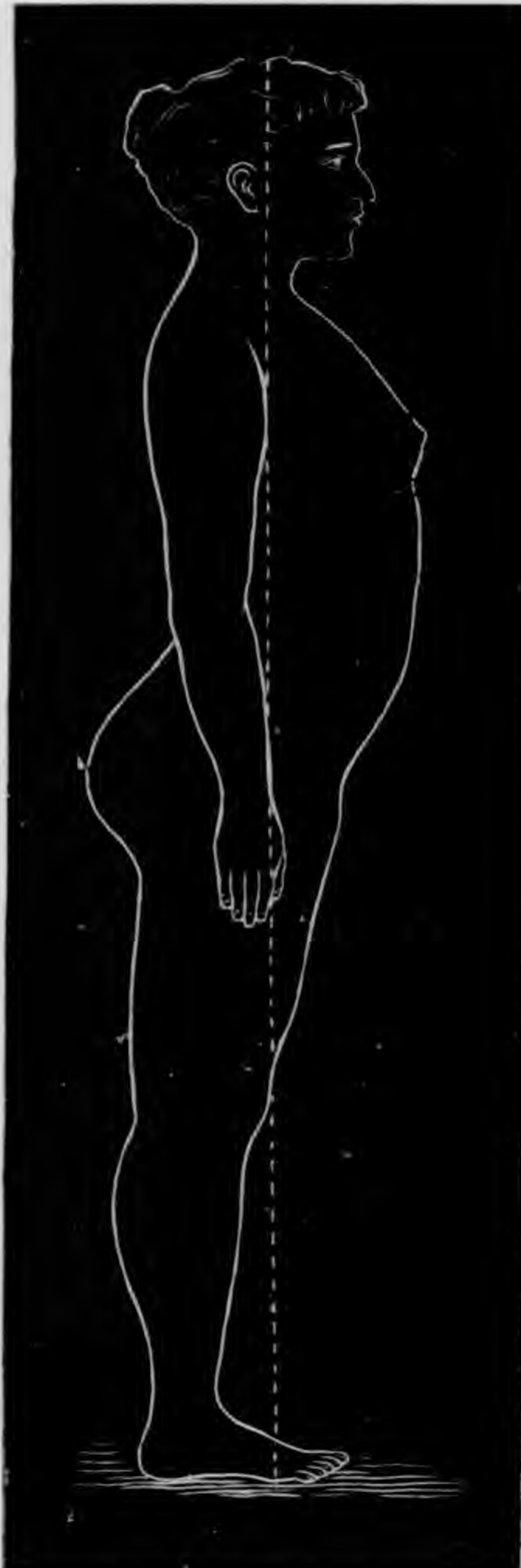


FIG. 6.



FIG. 7.

bodily shape. The growing period is the only time in life at which any marked changes can be effected in the physique. This is the time for enlargement of the lungs, development of the chest, and the correction of any errors, weaknesses, and morbid tendencies. Systematic daily exercise, carefully adapted to the age and strength of children, pro-

duce, even within a comparatively short period of time, marvelous results; e. g., an eminent French physiologist found the volume of respiration during sleep to have doubled in the students of a boarding-school, as the result of six months' systematic exercise.

During the twelve or fifteen years spent in school, the sedentary habit often becomes firmly established, so that in after life exercise is avoided as much as possible, through a natural aversion to it, whereas the physiological necessity for exercise increases with advancing age; so that a cultivation of the habit of exercise and the appetite for it may be properly regarded as one of the important objects to be attained during the school-going period.

A thoroughly enlightened community will provide, in connection with its public schools, gymnasia and lavatories; and when we become sufficiently civilized to value health as highly as does the savage, we may expect that our municipalities will take such steps as will save a sufficient amount of money now wasted in attempting to repair the ravages of alcoholic drunkenness and other forms of vice, to provide for every city a suitable number of public gymnasia and swimming-baths; and that it will be considered at least as important that a child should have a large pair of lungs and a vigorous chest as that he should understand Greek and Latin or natural philosophy, and more important that a man or woman should be able to swim than to calculate an eclipse of the moon. Our schools, seminaries, and colleges are every year turning out a lot of young

men and women who might properly be termed "school cripples," who are maimed in body by the neglect and the harmful environment to which they have been subjected, and damaged intellectually by the one-sided and artificial methods under which they have been trained.

A volume might easily be written—indeed, volumes have been written—upon the evils arising from deficient ventilation, bad lighting, dust, the vicious habit of spitting, and other means of transmitting disease, as well as the danger of moral contamination and the contraction of sexual vices, from the evil associations to which children are more or less exposed in our schools.

The limit of this paper has already been reached, however, and I will conclude by urging upon every teacher in our public schools the importance of making a careful study of all that pertains to the physical welfare of his pupils while under the teacher's care; and I would further add the suggestion that immense advantage might be gained by the holding of parents' meetings at regular intervals, for the purpose of discussing the needs and interests of the child in both the home and the school, and securing the co-operation of parents in establishing for the child in the home such conditions as will second the efforts of the teacher in the schoolroom in the development of a well-rounded character, and the attainment of the highest possible educational ideal,—that recognized by the ancient Greeks, who set us a noble example in so many matters pertaining to education; viz., "A sound mind in a sound body."

## ZOOLOGICAL HEALTH-STUDIES.

BY F. L. OSWALD, M. D.,

Author of "Physical Education," "The Bible of Nature," etc.

### 9. Climatic Instincts.

A FEW years ago the editors of an Eastern newspaper tried to assist home and health seekers by advertising a symposium of opinions on the question of "The Best Town to Live in."

But, as might have been expected, a plurality of votes was cast in favor of the most populous cities, many of which owed that distinction to the accident of their superior accessibility. New York and Baltimore, with the enormous scope of their harbor-nets, catch a thousand immigrants for one who strays to Southern Michigan or Northern Alabama, and fifty per cent. of those settlers will have no hesitation in backing their lot with their ballots; but should the

number of such votes be allowed to outweigh the reasons for selecting Ann Arbor or Huntsville as an all-the-year-round residence?

With precautions against the risk of a similar fallacy, sanitarians should use the statistics of such works as Russell Wallace's monograph on the geographical distribution of animals. As a general proposition, it may hold good that regions of our planet peopled by the greatest number and variety of animal aborigines must have been recommended by a preponderance of creature comforts, in the widest sense of the word, but the unqualified application of that rule would often lead to strange inferences. The

forests of the great West Indian Islands, for instance, abound with wild-growing fruit, but there are no monkeys; the herbage of the upper Sierras is not surpassed in the Eden of the European Alps, but there are no wild cows, no chamois, no deer, no sheep, and not even rabbits, the largest undoubted indigenous mammal being the *huttia*, — a sort of heavy-bodied bush-rat. North Dakota, when first discovered, had about forty times as many varieties of wild animals; but would that circumstance justify the conclusion that the Bad Lands of the upper Missouri were naturally forty times more attractive than the royal vega of San Domingo? The contrast remains a biological curiosum, but may be partly explained by the fact that migratory animals, following the valley of the Father of Waters in a northwesterly direction, would finally reach the stone-chaos of the Bitter Root Mountains, while the Elysium of the Antilles is divided from the mainland by a gulf which no wingless wanderer is able to pass.

In confining, however, our comparison to the great continents of the Old and the New World, we find three different regions vying in the variety of their native fauna: The tablelands of the tropics, the terrace lands and foot-hills of the temperate zone, and, in summer, the wooded lowlands of the higher latitudes.

The explorers of the hunting-grounds near the headwaters of the Orange River witnessed such scenes as might easily give one the impression that all the four-footers of Karl Hagenbeck's menagerie had broken loose together, and were inspired by too much confidence in the strength-in-union principle to mind the possibility of recapture. Quadrupeds that would create an unheard-of sensation in the tame hunting preserves of Europe, were classed as mere nuisances by Gordon Cumming and other hunters in quest of maximum-sized game. But the modern Nimrod cannot help recording his emotions when one morning he saw both elephants and rhinoceros in rifle-shot range, besides giraffes and lions and such trifles as half a dozen different species of antelopes and baboons. The plebiscite of that assemblage clearly seemed to give Southeastern Africa the preference over any other part of the present earth, and that verdict has been confirmed by the vote of more than one modern traveler. "If I had the means to choose my earthly abode according to my own fancy, where would I live? — In Paris, of course, the Mecca of all good Americans."

"Yes, but leaving made dishes out of the question, and speaking only of the unbought luxuries of nature?"

"East Africa, then, by great odds," said Colonel Frank Thompson of the Cincinnati Zoo; "I have poked about every continent thus far discovered, but the sunny South of the Transvaal beats them all for an absolutely perfect climate. One hundred and forty-two clear, genial days in a stretch, without one mist, without any night-chills worth mentioning, and no superheated afternoons — what more could one expect this side of paradise?"

"And that in the winter," he added, — "the June to August winter of the Southern Hemisphere. In midsummer they have an occasional thunder-shower, and need it, to keep the vegetation from withering to the roots."

North of the equator the Abyssinians enjoy their sunshine season from Christmas till March, at the same time of the year when Florida attracts Northern winter tourists, and it is then that the park-like valley of the Blue Nile, with its mountain-born tributaries, swarms with winged refugees from the less hospitable regions on the other side of the Alps. Half a hundred varieties of north European song-birds and water-fowl scorn the allurements of the intermediate countries, and travel straight from the Rhine to the Bar-el-Gazal, — from deer forests and the haunts of the hill fox to the pastures of the Oryx antelope and the cave castles of the mane baboon. It would be a mistake to suppose that those winter guests eke out the existence of mournful exiles; the naturalist Brehm heard pine-thrushes sing their anthems in the Zalla Range and Northern finches in the valley of the Settite, evidently quite at home, for the time being. "She went roaring from one blaze into another," said an ogre of a medieval witch hunter, in commenting on the laments of his victim; and the happy visitors of the tropical Switzerland go singing from Eden to Eden.

But about the end of March they rally their traveling companions for the return trip, the experience of many thousand generations having convinced them that the summers of the tropics cannot, after all, compete with those of the higher latitudes, where Nature, after the slumber of the long winter trance, awakens with the exuberant mirth of a new youth and new morning.

Hence the springtides of animal life that gather about the garden spots of the habitable North at the season of universal rebirth, returning emigrants from the tropics, from the temperate zone, and the hardier natives that have disdained to seek safety in flight, all unite to celebrate the sun-festival of a country that has expiated the surfeits of the preceding summer in all-redeeming ice-storms. Expurgat-

# The Restaurateur's Opportunity as a Health Leader\*

By DR. JOHN HARVEY KELLOGG

**M**R. CHAIRMAN, Members of the National Restaurant Association, Ladies and Gentlemen:

I accepted the invitation of your committee to contribute to the program of this meeting in the hope that I might be able to say a word in behalf of the American stomach. Your business is to supply what the public want to eat. My business, for more than fifty years, has been to persuade people to accept what they did not want to eat and to make them like it.

The restaurateur is naturally a purveyor rather than a prescriber. I have no criticisms to offer, but I desire to call your attention to the great opportunity for human service that modern scientific progress has brought to your door. Laboratory research and clinical observations have in recent times made startling discoveries respecting the relation of our eating habits to doctors' and undertakers' bills.

Science has shown us that in eating things we ought not to eat, and in neglecting to eat things we ought to eat, we on the one hand overload and wear out prematurely the human machine, and on the other starve and weaken it and reduce its efficiency to the level of ineptitude.

The nutrition laboratory with its animal experimentation, has made astonishing revelations, and new and revolutionary facts are appearing every day. And the people are becoming acquainted with this new knowledge through the public prints and the public schools. The children learn what neglect of greenstuffs and other feeding faults do to rats, and tell the story to their parents, and so the light spreads; and there is developing a change in the dietetic demands of the average citizen. He is forming new tastes. I am sure this is not news to you, for you have noted great changes in the distribution of food costs as you have followed the changes in the public appetite. But the work of reforming the American bill of fare has only just begun. Great changes are needed. There is probably no other animal that includes in its dietary so large a variety of substances as does civilized man. In fact the human race, taken as a whole, exploits the bills of fare of the entire animal world. There can be found scarcely a plant, a fruit, a nut, a vegetable, a bird, a beast, a fish or a reptile eaten by any

animal that is not also eaten in some form by some man.

In addition, man has produced a great number of artificial foods, some of which are denatured to such a degree as to make them unacceptable to many intelligent members of the animal kingdom. There are, indeed, few if any animals that could be induced to eat a spiced pickle or any one of a dozen common dishes that might be named.

## Human Limitations

And man essays this complex and varied bill of fare without having a digestive apparatus adapted to so complicated and difficult a task. Like the man-like apes, the chimpanzee and the orang-outang, he has a simple digestive machine adapted to the digestion of fruits, nuts, soft grains, juicy roots, eggs and milk. His digestive system includes no mechanism corresponding to the gizzard of the barnyard fowl, or the quadruple stomach of the bovine, or the seven-gastric-power digestive machine of the whale. He has only the simple, rather feeble stomach of the primate, the aristocrat of the animal kingdom, fashioned to dine on the top shelf of Mother Nature's pantry, so to speak, and adapted to the digestion of the choicest and most delicate of Nature's tidbits. And yet, with this delicate simian stomach, he does not hesitate to tackle the world's whole bill of fare, to do gastronomic stunts from which the hardiest beast of the forest might well recoil.

It is no wonder that the American stomach has become world famous for its gastronomic perverseness. The impression prevails abroad that the average American is a dyspeptic, and he is the world's greatest consumer of stomachics and mineral waters. In most highly civilized lands, and especially in this country, the human gastric machine has broken down, and dyspepsia, constipation and peristaltic woes of various sorts, have become almost universal. Dinner pills and post-prandial soursings of mineral water have become a part of the national regimen.

A return to more primitive and biologic modes of living is one of the world's most needed reforms, and today men and women everywhere are earnestly inquiring, "What shall I eat for comfort, health and efficiency?" There are still plenty of gormandizers, but eating is less frequently a

\*Read at the Eleventh Annual Convention of the National Restaurant Association, at Louisville, Kentucky, October 8, 1929.

in the ripe fruit. In thoroughly mature bananas, the quantity of sugar is relatively high and the quantity of starch correspondingly low. The banana is essentially a carbohydrate food, the percentage of protein not usually rising above one and three-tenths. Nearly all the carbohydrates in the ripe fruit consist of sugars which are present both as reducing and cane sugars. The average total percentage of sugars present in the banana is a little over twenty per cent."

The banana is rich in vitamins, especially so in vitamins A and C, and very good in vitamin B.

#### Other Constituents

The banana is also a good source of mineral salts. In addition to all of this it is one of our prominent carbohydrate heat or energy-producing foods. It also contains some protein and fat, but in small quantities.

The percentage analysis of the banana as given in Government Bulletin No. 28 by Atwater and Bryant, is as follows:

Water .....	75.3
Protein .....	1.3
Fat .....	.6
Carbohydrate .....	22.0
Mineral matter .....	.8
Calories per pound, 460.	

There are some who think the banana hard to digest. This is not so if it is eaten ripe. In this respect the banana does not differ from any other fruit which, if eaten before it is ripe, will, in the majority of cases, cause digestive disturbance.

During the process of ripening, the starch gradually becomes converted into easily digested sugar. Bananas should not be eaten in a partially ripe condition, unless cooked, and there are many tempting ways of cooking them. Before the banana is fully ripe the skin is bright golden yellow, with the tips slightly green. It should not be eaten in this condition, not until the skin is flecked with black or brown spots. An all dark skin banana can be used if the pulp is not mushy or brown. At that time the starch has turned to fruit sugar and the flavor is much more delicious.

When used with milk the banana provides a well-balanced ration. For undernourished children in some of the schools and tuberculosis camps, ripe bananas with milk are freely given



UNITED STATES DEPARTMENT OF AGRICULTURE

Banana Plant on Farm in Hawaii

in the diet. Until fully ripe the banana should be kept at a moderate room temperature—*not put in the refrigerator*. The cold prevents ripening and the development of the fine, natural flavor.

The banana can be prepared and served in many tempting ways. The fresh, ripe fruit served with milk or cream, with or without cereal, is wholesome and delicious for breakfast.

#### Methods of Serving

Banana fritters are especially delightful; so is the baked banana prepared with a little sugar and lemon juice. In fruit cocktail and fruit salad, the banana has its own particular place, giving not only flavor but substantial food value. For desserts the banana can be used in a number of delightful ways—in vegetable gelatin, in custards,

(CONTINUED ON PAGE 51)

dissipation than formerly. Multitudes of people scan the newspapers and magazines eagerly for some new hint about nutrition. Boys and girls in the grammar-school grades know more about scientific eating nowadays than most doctors knew a generation back. Nothing is so much talked about as foods, and the special burden of the talk is wholesomeness. And so the restaurateur and his business have acquired new significance and added importance.

The modern caterer is expected to think of wholesomeness as well as savory attractiveness. This opens up to the intelligent restaurateur an almost unparalleled opportunity for high public service. He may make of every eating place a health-information bureau. He may thus become a leader instead of a follower, a purveyor of ideals instead of a mere dispenser of gustatory thrills.

### Good Food Means Longer Life

The enlightened restaurateurs of today have an opportunity such as was never before offered to any similar group of men. Not only in America but in other highly civilized lands a larger percentage than ever before of the population now take at least a portion of their meals in restaurants, cafes and other eating places, and this fashion of taking some or all of the daily meals outside the home, is rapidly growing. If every eating place, or even a large share of our cafes, restaurants and cafeterias, could be made exemplars of scientific feeding, what a mighty revolution would result. Half the doctors of the country would starve, or retire to other vocations, and the death rate would fall to unprecedented figures. The dentists, too, would soon find a lessened demand for their services. Good nutrition is the foundation of physical health, personal or national. There is no means by which good nutrition and good health may be more efficiently promoted than by raising the standard of excellence in our public eating places. What we eat today is walking around and talking tomorrow. We are made of what we eat, mind and manners as well as brain, bones, and muscles and even morals.

Let us now note a few of the things that may be done by a restaurateur who desires to make his business count for the promotion of scientific eating:

Obviously, the restaurant has an unchallenged opportunity to raise the general standard of food quality. Any restaurant that can succeed in establishing full confidence in the superior quality of its viands will, in so doing, not only insure its own prosperity, but by its example, help raise the general standard of living.

One of the first steps to be taken in this direction is the more liberal use of natural foods. Grocers' shelves are covered with denatured foods whose names are legion. Handy because ready to serve at once, these inadequate products often constitute a large part of the bill of fare.

The wonderful discoveries through animal researches in nutrition laboratories made within the last few years have shown the need of a much larger use of fresh foods, cooked and uncooked, and particularly a much larger use of such green-stuffs as lettuce, romaine, chard and other salad greens. Every day we are learning something new about vitamins. These subtle substances rule our lives. When they are deficient, we deteriorate physically and mentally and, perhaps, morally.

According to the latest revelations of the nutrition laboratory, we are eating too much cereal as well as too much meat. Both of these food-stuffs contain an excess of phosphoric acid and when freely used tend to cause acidosis, a condition that opens the door to many maladies and accounts for a multitude of such common miseries as headaches, "that tired feeling," nervousness and premature senility. The ready-to-eat breakfast cereal is by no means the *ne plus ultra* of foodstuffs that the copy writers would make us believe, although it may have done good by displacing something worse.

### Lessened Eating of Meat

The steady decline in the per capita consumption of meat that has reduced it one-half within a century (Russell) is an instinctive trend toward a wholesome modification of the national bill of fare, and one that will continue in spite of the frantic opposing efforts of the Chicago Meat Board. Within the first eleven years of the twentieth century, our per-capita cattle population fell off one-third and the sheep population forty per cent, a trend in the right direction.

The fact that the consumption of lettuce has increased fivefold within a few years is another indication of a wholesome change in the right direction. The national tendency to acidosis that results from the long-popular meat-cereal diet is also being lessened by the increased consumption of vegetables, a timely trend that restaurateurs may greatly encourage by special attention to the preparation of vegetables. The demand for the "vegetable plate," now supplied by all leading hotels and first-class restaurants, is steadily growing. It would grow much more rapidly if made more attractive by better cooking of the vegetables.

Observing men and women everywhere are making the discovery that the craving for meat is excited not by the need of flesh as a nutrient, but for the satisfaction afforded by its palate-tickling osmazomes. As our good old friend, Dr. H. W. Wiley, long ago sagaciously suggested:

"The meat-eating of the future may not be regarded so much as a necessity as it has in the past, but meats will be used more as condimental substances than as staple foods."

Said Finck, also, in his incomparable "Food and Flavors:"

"Meats as condiments rather than foods. There is a revolutionary doctrine for you—a doctrine subversive of all the beliefs and practices of the past! Yet it is a doctrine which meat-eaters may accept calmly in view of the fact that what delights them in meat is its flavor, and that even with a minimum quantity of meat, this flavor can be preserved."

It is to be remembered, also, that meat-resembling food flavors of plant origin, now available, are wonderfully rich in vitamins, especially those in vitamin B group, which are among the most important of all. These vitamins promote growth, appetite, digestion and bowel action, build up the nerves and prevent and cure pellagra.

Restaurateurs may render a vast service to the public, the life-saving influence of which could not easily be estimated, by making use of the sane suggestion of Doctors Wiley and Finck to make larger use of meats as a condiment rather than a staple.

#### **The Nation's Sweet Tooth**

There is perhaps no direction in which the American people have gone farther astray than in the extravagant use of cane sugar.

The chief objections to the excessive use of cane sugar are its lack of minerals and vitamins, injury by over-strain to the liver-pancreas mechanism for regulating the utilization of sugar in the body, and excessive intake of carbohydrate.

The confectioners are perhaps chiefly responsible for the excessive use of sugar. A counter campaign ought to be started to save people from the inevitable injury already becoming apparent in the rapid increase of diabetes, colitis, peptic ulcer, obesity, etc. The mammoth American sugar tooth, already enormously overgrown, is growing at a rapid rate, as the result of adroit publicity. Restaurateurs may help the situation by giving sweets and saccharine products less prominence on the bills of fare, and by educating their patrons to like the wholesome acids and other flavors.

Another great service that the restaurateur might render the public is by the exercise of the greatest care possible in the selection of those most perishable products, meat and eggs. Great business will flow to any restaurateur who will guarantee to his public the purest water, certified milk, the freshest vegetables obtainable, eggs not only freshly laid but produced by fowls known to be free from common poultry diseases (which reappear in human beings as colitis and other infections), and fish, fowl and other meats freshly killed. It is true that there is a demand for "ripened" meats due to ignorance of scientific facts that ought to be known. For example, when the manager of one of the largest hotels in the country called on me a few months ago for suggestions as to how he might improve his bill of fare, I suggested that he should instruct his steward to take care in the purchase of meats, to avoid those that have been hung a long time for "ripening."

"Oh, I know about that," he explained. "My steward is on to that all right, and very keen about it. You know the beef furnished to hotels generally has a beard of green mold on it about an inch long. My steward is very particular; he never allows the beard to be more than a quarter of an inch long."

It doubtless matters some whether the growth of molds or "whiskers" on meats is an inch or a quarter of an inch in length, but the difference is small. Such meats are unwholesome. In most tropical countries, the prevailing custom is to eat meat the same day it is killed. The Hebrew law-giver, Moses, strictly prohibited the use of other than strictly fresh meats.

The wide-awake restaurateur will take note of the fact that there is a growing class of patrons who should command his special consideration, viz., the semi-invalid class. Among the millions of business men who bustle about city stores, counting-rooms and offices, and at meal time rush into restaurants and cafés to be fed, there are thousands whose doctors have discovered a threatening rise of blood-pressure or other evidence of hardening arteries, symptoms of Bright's disease, a failing heart, angina pectoris, or some other degenerative disorder, and who belong to the *morituri*. In most cases, wrong eating has been an active factor in bringing these men to their unfortunate state. Most of them have consulted intelligent physicians who have placed a taboo on meats and coffee and have emphasized the importance of potatoes and fresh vegetables and salads, and moderation in the use of eggs and cereals. Special catering to this class of patrons requires the services of a skilled dietitian.

#### **Menus from the Doctor**

I predict that in the near-future development of your business, there will appear a new type of restaurant to which a doctor may send his patient with a food prescription to be filled by dietary experts, just as he now sends patients to a pharmacy with prescriptions for drugs. Possibly the drug stores may be foremost in discovering and improving this opportunity, since the demand for drugs in recent times has fallen off to such an extent that most pharmacies have already become at least semi-cafeterias.

The keynote for the highest level in the art and science of human feeding is epicureanism. Research and experiment, added to centuries of human experience, have at last materialized the epicurean philosophy of the classic age and today, by an intelligent application of up-to-date knowledge of foods and feeding, one who so desires may become a true epicure. My good friend of many years, the late Dr. Finck, himself a real epicure, in an outburst of enthusiasm exclaimed:

"Were all of us, or most of us, epicures, what a change our markets would undergo! How the chemically denatured foods, the tainted cold-stor-

(CONTINUED ON PAGE 54)

## Meat-Eating Raises Blood Pressure

WHEN a man with high blood pressure consults an up-to-date physician, one of the first counsels he receives is "Cut out the beefsteaks." It is common knowledge that meat-eating contributes to the raising of the blood pressure. Of course, the doctor does not expect that avoiding meats will cure his patient, but he knows it will postpone his funeral somewhat. And the sooner such advice is heeded, the longer the funeral will be postponed.

The great life insurance companies of the country are studying the causes of premature senility and are discovering some very interesting facts. Dr. Arthur Hunter, actuary of the New York Life Insurance Company, in a recent paper points out the fact that the average blood pressure in China is lower than that of the people of this country. In looking for the cause, Doctor Hunter believes he finds it in meat-eating. He says:

"Until a few years ago the layman rarely heard of 'blood pressure,' yet today most intelligent men and women have a general idea of what it means. This is partly due to the increasing use by physicians of the test, and partly to discussions of the subject in newspapers and magazines. The public are beginning to realize that an early discovery of high blood pressure may enable the physician to lengthen the life of his patient, if not to remove the cause of the trouble. In many cases, the patient has no knowledge of his condition, the first warning coming from this modern aid in diagnosis.

"In the early part of this year *The Literary Digest* brought to the attention of its readers the low blood pressure among Orientals, especially the Chinese. In the course of a review of an article in the *Journal of the American Medical Association*, the editor stated 'whatever it may be that keeps the Chinese blood pressure down, we should like to borrow it or imitate it.' He added, in a facetious vein, that many a high-strung American, if he could thereby obtain relief, 'would be glad to subsist on Chinese food and spend his time in meditation on the doctrines of Confucius.' It was suggested in that article that some of the contributory causes might be simple diet with little meat, absence of nervous strain and increased skin secretion due to the tropical climate. In the hope of helping to find the reasons for the marked difference in blood pressure, my article has been prepared.

"The life insurance companies recognize an obligation to give to the public any information which might be of scientific value, and it is from their records that most of the available data on blood pressure may be obtained. It is to their interest to obtain exact information on this subject in order that they may issue policies to appli-

cants in accordance with their merits. Not content with the present knowledge, an investigation is in progress by the leading life insurance companies involving the records of probably a million lives."

Investigations by Hunter and many other eminent observers led to the following among other definite conclusions:

"The higher the blood pressure is above the average, the greater the mortality above the normal.

"Persons with a distinctly high pressure are prone to develop diseases of the heart, blood vessels and kidneys, the mortality from heart disease, apoplexy and Bright's disease being very high among them.

"A blood pressure slightly lower than the average is favorable to longevity, provided the persons in the group are in good health."

After determining by extensive compilation the average figures for American adults, and finding the average blood pressure nearly ten points higher than that of the Chinese in China, Doctor Hunter sought for the cause. He thus states the results of his study:

"Through the courtesy of Dr. John Harvey Kellogg, I am able to present the record of a group of three hundred and five healthy young women, students at the Battle Creek College affiliated with the Battle Creek Sanitarium, who have lived there for several months and who generally do not eat meat at all, but if they do, take it very seldom. These young women were Americans, aged from seventeen to twenty-five.

"For the sake of uniformity the standard of comparison is the same as in other tables in the paper, and applies to men. A group of young women insured in the United States by the American companies would have a record about three mm. lower than for men. The blood pressure of the non-meat-eating young American women was at least eight mm. lower than the average among women who apply for life insurance, which would be practically the same as among the population (women) at these ages."

The final conclusions reached by Doctor Hunter he summarizes as follows:

"1. The blood pressure among Chinese, Japanese, Hindus and Filipinos living in their native country is distinctly lower than among Americans in the United States.

"2. The blood pressure of Chinese, Japanese and Armenians resident in the United States does not differ by more than two mm. from the blood pressure of Americans.

"3. The blood pressure of residents of Australia and of Negroes in the United States is higher than among Americans in the United States.

(CONTINUED ON PAGE 54)





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## Meat-Eating Raises Blood Pressure

(CONTINUED FROM PAGE 53)

"4. The blood pressure among Chinese and Japanese in their native country is lower than among the same races when resident in the United States.

"5. The blood pressure among officers of the United States Army in the Philippines is lower than among Americans in the United States.

"6. The war-time restrictions in diet resulted in a decrease in blood pressure.

"7. The blood pressure among non-meat eaters in the United States is lower than among Americans as a whole."

Doctor Hunter concludes his highly interesting paper with the following very significant remarks:

"While there is little doubt that a reduction in blood pressure of Americans in the United States would result in greater longevity, a question might arise as to the effect on the quality and quantity of their work. Among brain workers and those in sedentary occupation there would be, in my judgment, as great efficiency. Among manual laborers there does not appear to be any satisfactory proof that a low-protein diet (non-flesh diet) decreases physical endurance. Taking the population of the United States as a whole, I believe that a better adjusted diet, with less animal food, would result in a lower blood pressure and in greater longevity with an equal ability to carry on their occupations."

## The Restaurateur's Opportunity as a Health Leader

(CONTINUED FROM PAGE 50)

age fowls, the drugged, soggy bread, the tasteless, frozen butchers' meats, would be swept away, together with frozen unpalatable fish, wilted vegetables, unclean milk, unripe and decayed fruits, all of them the daily source of discomforts and disease to thousands."

If the restaurateurs of the country will join hands in an effort to exemplify the highest ideals and standards in foods and feeding, eating places will become mighty levers in the promotion of human welfare and happiness. The large place filled in our lives by the feeding function gives it a dominating influence for weal or woe. When the late Doctor Eliot asked a very old woman what had been her greatest source of enjoyment, she instantly replied, "vittles." This primitive, elemental fact puts into the hands of the restaurateur the opportunity and the power, by making health and wholesomeness essential components of all his menus, to do more than almost any other man for the promotion of the health, happiness, efficiency and longevity of his fellow citizens. The efforts of individual restaurateurs have already accomplished much, and fully demonstrated what great things may be done by concerted effort.

# GOOD HEALTH

J. H. Kellogg, M. D.,  
Horace Fletcher, A. M.,

Editor  
Contributing Editor

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## The Downward March of Man

PROFESSOR COCKERELL, of the University of Colorado, a scientist of no mean note, contributes to a recent number of the *Popular Science Monthly* an article of unusual interest entitled, "The Future of the Human Race." The Professor calls attention to the fact that in the very fact of his great superiority over other mammals man is by the laws of evolution destined to destruction unless he himself contrives by some means to outwit the natural processes which are at work to destroy him.

Although superior to other mammals in intellectual gifts, man is in many ways quite inferior: "Denuded of hair, he is obliged to spend much of his time and energy providing artificial clothing; slow of foot, he is compelled to devise means of travel not depending upon his muscular activities; so deficient in the sense of smell that he does not know, as do the dog and the ant, that it is the most important of all the senses; lacking a tail, and with no grasping power in his feet, he rarely ventures to climb the trees; a poor creature indeed, well fitted to be the laughing stock of the rest of the animal creation."

PROFESSOR COCKERELL calls attention to the well-known fact that the geological history of the earth's crust shows unmistakably that all species of mammals are comparatively short lived, some much shorter than others. "The records of the tertiary rocks show a continually changing panorama of mammalia, in which genera and species come and go, while plants, mollusca, and other lowly organisms remain almost unaltered. We further notice that the comparatively brief existence of these animals may be terminated in either of two ways—by extinction, or by change into something else. When the creatures are very highly developed in special ways, they seem nearly always destined to die out, being supplanted by the descendants of simpler and more plastic forms. Supposing the career of man to resemble that of other special-

1025



ized mammalia, he might be expected to have before him perhaps another hundred thousand years, and then in all probability the end of the world, so far as he was concerned with it as an animal."

The simpler organisms, like the clam and the oyster, adapted as they are to simple and unchanging conditions of life, live on from age to age, according to the geologic record, while higher animals, leading a complex existence, are by change of food, climate, and by the development of natural enemies, gradually exterminated. Man has conquered the lion and the tiger, but by his indoor dwelling and other changes he has kept alive his most dangerous enemies, has increased their virulence, and has decreased his powers of resistance. According to Professor Cockerell, it is only because man has been able to move about from one country to another that he has been able to survive, notwithstanding the enormous ravages made by disease.

**B**Y the fixed laws of evolution, an animal that changes greatly its conditions of life, especially as regards food and climate, must either die or change into some other creature. Man, naturally a strict vegetable feeder, an eater of fruits and nuts, like the ape, has saved himself from starvation by learning to eat many other things as well, including flesh. Notwithstanding his naked skin, which naturally confines him to a tropical clime, he has managed to survive in the coldest climates by making for himself clothing to serve as an artificial skin, and by creating artificial climates to suit his needs or his fancy through house building.

**B**UT the flesh diet is not adapted to his body needs and he has not evolved the carnivorous constitution necessary to enable him to tolerate it. For example, the dog has a liver capacity four times that of man, and also a short intestine. The short intestine hurries the food remnants out of the body so rapidly that there is little time for putrefaction. The quadruple liver capacity insures the destruction of the poisons contained in the meat or developed by putrefaction. And yet the dog is short lived, though he shows more endurance, greater length of life and greater intelligence and efficiency when fed on a non-flesh dietary, as every hunter knows.

How, then, can man hope to attain length of days and racial permanency on a dog's diet without the dog's constitution and the special protection afforded by it?



If the tough, hardy beasts of the forest, even with their simple habits and their comparative closeness to natural conditions, sooner or later die out and disappear from the earth except as fossil remnants, what possible hope can there be for man, who has departed so widely from his normal life conditions?

**P**ROFESSOR COCKERELL gives man a possible hundred thousand years more of life on this planet, but vital statistics show that we are going down at a rate so rapid that a few centuries at the most will finish us up. Because of the vast number of vicious habits which we have cultivated, we have not one chance in a hundred for race permanency, as compared with mammals lower in the scale. No other animal has poison habits such as man has acquired in the use of alcohol, opium, tobacco, tea, coffee, and condiments, to say nothing of the thousands of drugs which he has discovered in the course of the centuries, and with which he belabors his liver, kidneys, stomach and nerves, on every possible pretense either with or without a doctor's prescription.

**P**ROFESSOR COCKERELL suggests that while man doubtless at some time found it necessary to depart from his natural dietary and to resort to the use of flesh food as a means of averting starvation, it is possible there will be a "distinct gain in a return to primitive simplicity in diet."

Most certainly man would gain by such a change, and he would not have to wait a hundred thousand years to find it out. The natural way is the right way and the best way, and the fact is at once apparent to any one who will take the trouble to make a test experiment such as that of Chittenden or those of Fisher and others.

But the race will not be saved by diet reform alone. A thoroughgoing return to nature is the only thing that can save us from extinction. We are glad to see that scientific men like Professor Cockerell are recognizing the need of a radical change in human habits, and that they are beginning to utter words of warning. Will they be heeded?

Our domestic animals are all improving under scientific feeding and intelligent breeding. We have larger and fleetier horses, cows that give more milk, sheep that produce finer wool, hens that lay more eggs, than any like creatures that the world ever saw; but man himself is going down the hill of race degeneracy be-



cause his treatment of himself is the opposite of his treatment of his domestic beasts. We need a National Department of Health to do for the human race what the Agricultural Department has done for horses and cows.

### An English Expert on the Increase of Insanity

**D**R. FORBES WINSLOW, an eminent English expert in criminal lunacy, in a book of reminiscences recently published, speaks as follows:

"By a simple arithmetical calculation it can be shown the exact year when there will be more insane persons in the world than sane. We in England are gradually approaching, with the decadence of our youth, near proximity to a nation of madmen.

"By comparing the lunacy statistics of 1869 with those of 1909, four decades having intervened, my reflections are sad indeed. A terrible but real curse is in store, and an insane world looks forward to me with certainty in the not far distant future.

"In 1869, out of a population of 22,223,209, there were 53,177 registered lunatics in England and Wales, there being one lunatic in every 418 of total population, whereas in 1909, out of a population of 35,756,615, the number of registered lunatics was 128,787, making on an average one lunatic in every 278 of population. So that in forty years an enormous increase in lunacy is seen. Surely a dreadful future for nations still unborn to have to cope with."

The figures given by Doctor Winslow are indeed startling and show that the prevalence of insanity has reached a stage in England even more advanced than in this country. In the United States the proportion is one insane person to 613 sane. The proportion in England is more than twice this. In certain sections of the United States, however, the insane population has become as great as in England. In the State of New York the proportion of insane is one to 266 of the total population, whereas in England the proportion is one to 278. The people of the State of New York are, therefore, on an average a little less sane than the people of England. These figures are truly appalling, but become still more startling when the fact is recalled that the registered insane represent only one-half of the actual number of insane persons. Taking this fact into consideration, it appears that in England the actual proportion of insane population to the sane



# Defective Nutrition and the Standard of Living

By Frank A. Manny

FORMERLY OF THE NEW YORK ASSOCIATION FOR IMPROVING THE CONDITION OF THE POOR

**W**AGE statistics, showing the proportion of any given population which receives less than can be computed as necessary for the maintenance of health and physical efficiency, often fail to produce an impression upon the public mind. Thus the statement of F. H. Streightoff that in 1915 one-half of the married men in New York were receiving less than \$15 a week while \$17 was the minimum requirement for the family's subsistence, though generally accepted, was not heeded. Even more familiar is the study of the standard of living in New York city by Robert C. Chapin, who some years previously showed that among families with incomes between \$600 and \$1000, 24 per cent were underfed, 43 per cent underclothed, 53 per cent overcrowded and 7 per cent suffering from a combination of all these evils. But it required the direct emotional appeal of known suffering to secure more than passing attention for the obvious discrepancy between incomes and necessary family expenditures. Even among the physicians and social workers of New York many were not aroused to the seriousness of the situation until the city's Bureau of Child Hygiene reported recently that between 12 and 15 per cent of the school children are underfed.

In order to secure a record free from the danger of error which must always inhere in a general presentment of facts,



## Be Strong and Healthy

### Good Food Habits are Essential to Health

- Drink at least two cups of milk every day.
- Eat freely of Bread or Cereal at every meal.
- Eat some Vegetable every day.
- Do not eat Sweets except at the end of a meal.
- Drink at least six cups of Water every day.
- Do not drink Coffee or Tea at all.
- Eat regularly, three times a day.
- Do not eat between meals—except an occasional light luncheon half way between two hearty meals.
- Eat slowly—chew food thoroughly.

*One of the food charts issued by the Association for Improving the Condition of the Poor in New York city in its campaign for better child nutrition.*

the present writer recently undertook a detailed and intimate study of the health and nutrition conditions among the pupils of two schools in the Gramercy district of New York city. The children were classified on the basis of the Dunfermline scale which places each child in one of four nutrition grades: I, superior condition; II, passable condition; III, requiring supervision; IV, requiring medical treatment.

It was found that of the 2,535 children examined with a view to their classification, the first two grades included each approximately one-third of the total, and the remaining third was divided between the other two.

The height and weight measurements of the several groups were then studied, and it was found that there were three distinct levels corresponding to the three larger nutrition grades (III and IV, containing one-third of the whole, being in this connection taken together). The average for the defective nutrition cases fell about as far below the "passable" group as the latter fell below the group tabulated as being in "superior" condition. A comparison of these averages with the results of studies made elsewhere showed a close coincidence. The height and weight line for the medium group was practically the same as that ascertained by the most extensive study made which forms the basis for the Boas-Burk tables of weight and height for American children. The weights and measurements of the superior grade were found to follow very closely the average of over 30,000 children attending leading private schools in New York city and Chicago which have been tabulated by Prof. Bird T. Baldwin.

It would seem then that in a typical industrial district of the city, by no means the worst, a third of the children at various ages approximate closely in height and weight to those whose parents can afford to pay tuition rates at private schools which often, for a single child, equal nearly one-half the average income of the majority of families in the city.

Another third represents the average of American children, while the remaining third is seriously underdeveloped—in many cases several years below the measurements proper to their ages under a reasonable standard of living. This shows a waste of physical efficiency and health which even the most elementary policy of human conservation would have to stop. If we adopt for our standard not the measurements of the "superior" one-third, but the average for the largest number of American children, it will be seen that one-third of the pupils examined require a change of conditions in order to rise to this level.

This statement is made with due regard for differences in race and in particular families of limited capacity of growth. There are no doubt many children whom no nutritional or environmental changes will promote into one of the two superior measurement groups. Nevertheless, considerable experience is now available from well conducted summer camps, all-the-year stations and from other special situations in which conditions of feeding, sleeping, exercises, etc., are carefully supervised, to prove that the growth of the majority of stunted children can be promoted with almost startling rapidity. The weight charts of the boys in truant schools, for instance, show

# THE RACE FOR LIFE

almost perpendicular advances as soon as a chance for normal growth is afforded.

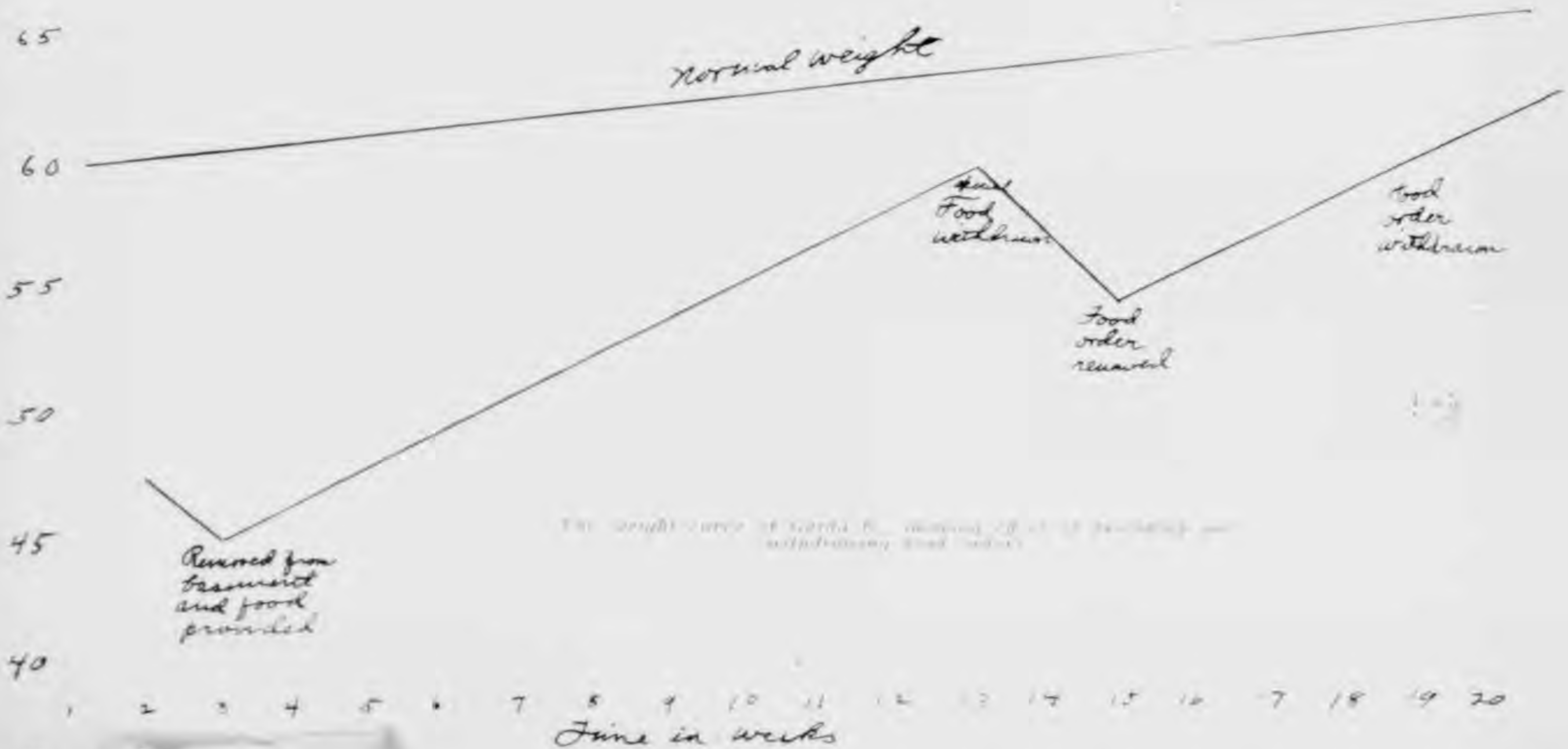
The studies of Dr. C. Ward Crampton and others have shown that there is a direct relationship between weight and height and the chronological age at which sexual maturity is reached. As Axel Key, the Danish anthropometrist, has stated, "Want prolongs the period of feeble growth preceding puberty." The undersized and undernourished children are usually delayed in reaching the normal sex development attained at a given age by children of more favorable living conditions. In many cases the difference in time amounts to four or five years.

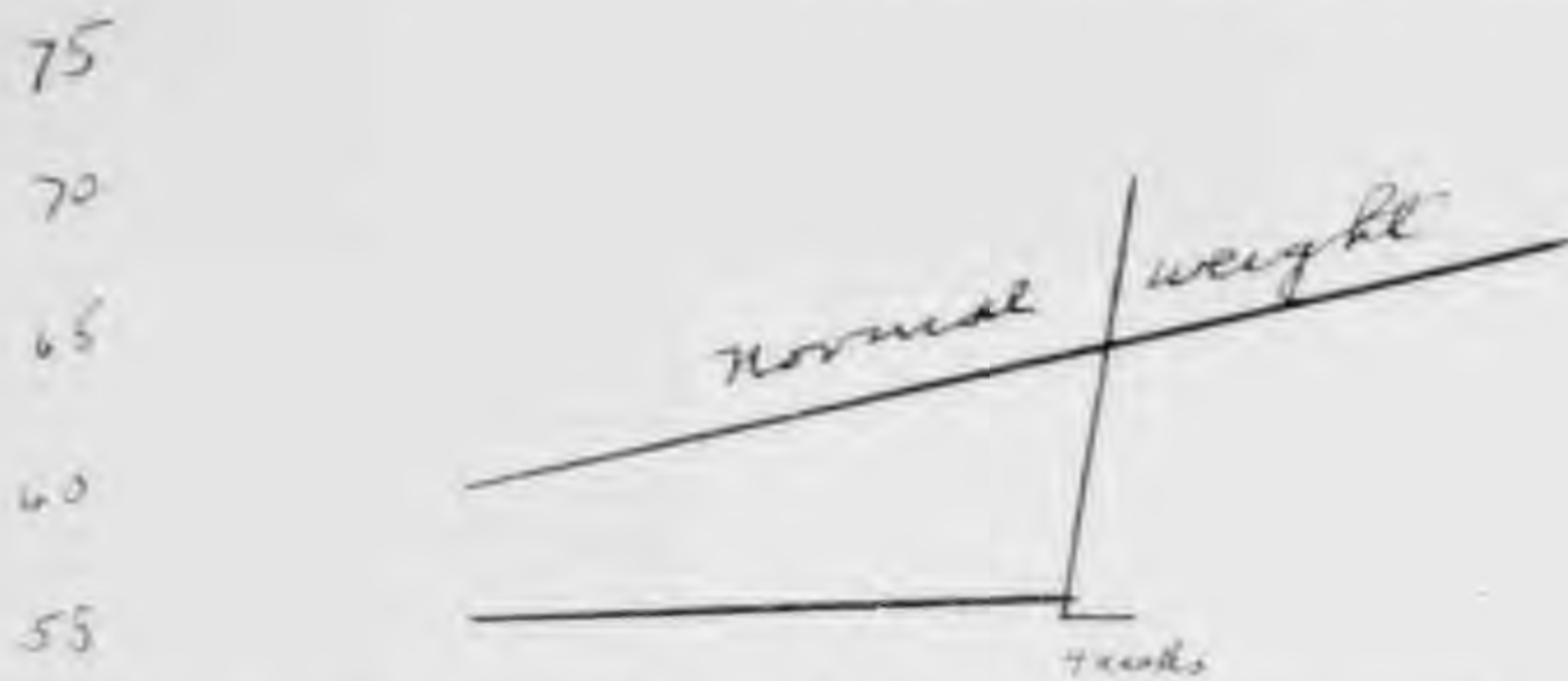
Most of us have known some child, small for his age, who was making remarkable progress in other ways. Usually this seeming incongruity is accentuated by contrast with larger but older children with whom he is associated. Despite these exceptions, however, there is good ground for the assumption that during the growing period the taller and heavier children at each age have the advantage also in every other respect. In the two schools studied, the records of promotion and attendance were compared with the results of the nutrition grading, and it was found that the members of the superior grades also had a decided superiority in these other respects.

Possibly no section of this study was more suggestive than that which concerned the relation between nutrition conditions and size of family. Inquiry showed that the families of the children who were undernourished and underdeveloped averaged 20 per cent more children than did those of "superior" condition. In comparing only the families of native-born children, this difference amounted to more than 30 per cent. The medium third in each case belonged to families averaging a mean number of children. Similar results were obtained by a survey of cases under the care of the Bellevue Nutrition Clinic in 1917 which established the fact that the number of children in the family tended to be in inverse ratio to the degree of improvement made in weight. It may be remarked in this connection that of several hundred names of school children examined in connection with our study which were



submitted to the Social Service Exchange (the clearing house of New York's relief organizations and various clinics and city departments) those known to the exchange as members of dependent families averaged one more child in the family than



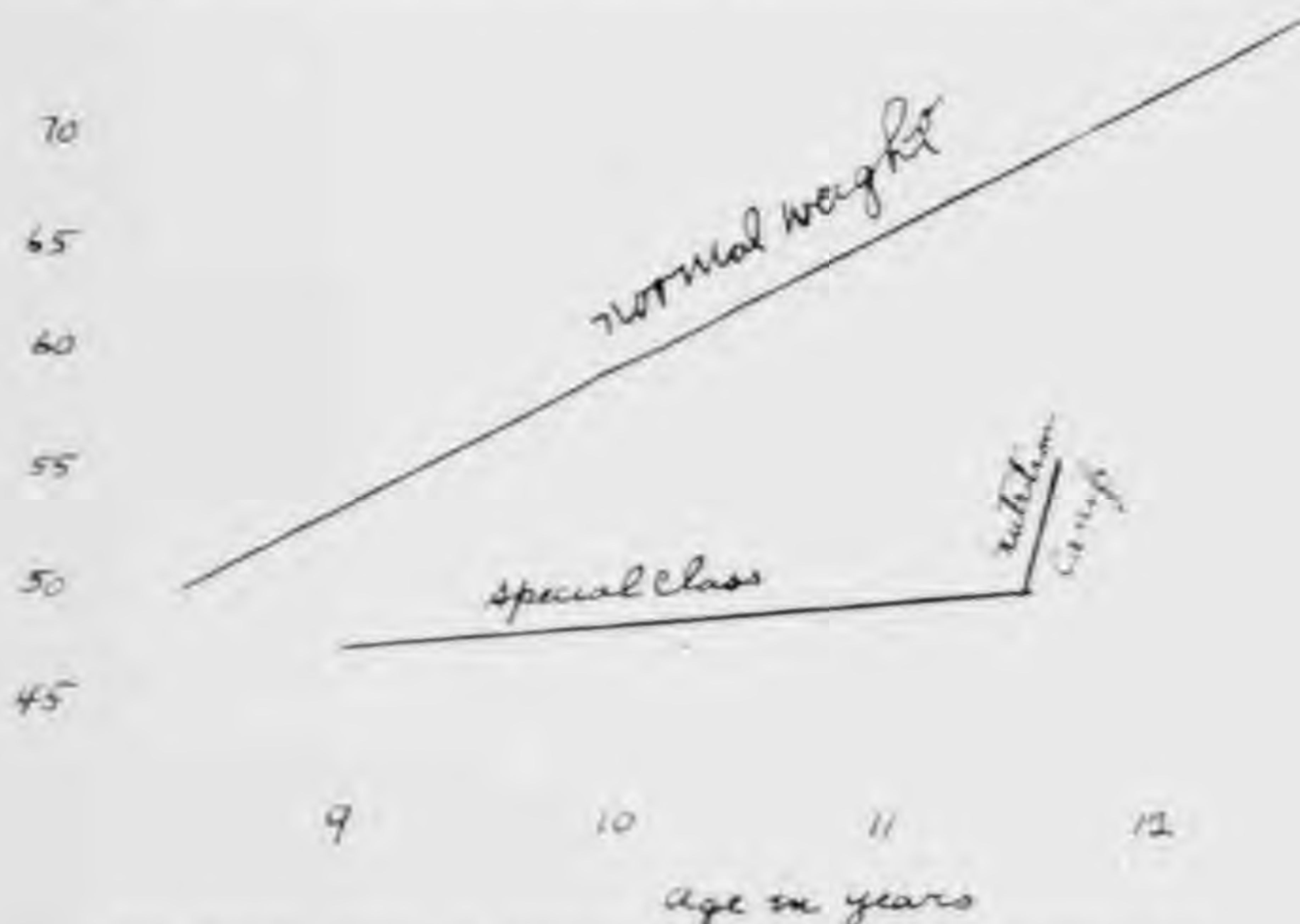


The weight curve of George T., showing remarkable growth during four weeks detention at the tenant school.

those not known to it. There is, of course, nothing new in figures such as these which merely substantiate the findings of Chapin and others that the families which have the most mouths to feed are responsible for the greatest amount of defective nutrition.

The nutrition statistics in New York city schools for 1917 showed fewer children in the lowest nutrition grade than had been found during the preceding year. This was supposed at first to show that living conditions in the city had improved during 1917. This interpretation did not account, however, for the fact that there had been an even more marked reduction in the number who had been rated as "superior" in nutrition. A similar reduction in both the highest and lowest nutrition grades was reported throughout England in the years 1915 and 1916. Many of the poorest families are receiving increased incomes on account of allowances to the families of soldiers, reduced periods of unemployment and possibilities of work for a larger number of the members of the family, as well as increased wages. On the other hand, thousands of families which have been able to live fairly well up to the present time are now unable to make both ends meet. Reports from Germany for 1915 showed that in certain cities, as Chemnitz, the loss in weight among school children was more evident in the families of the small salaried classes than it was in those of the working classes.

When the families were studied with reference to place of birth and nationality, it was found that the best conditions of nutrition belonged to native-born children of foreign-born parents—over one-half of those examined—and the worst conditions to the children of native parents—about one-sixth of



The weight curve of Herbert R., showing steady relative loss during two and a half years of special school care and rapid gain at the nutrition camp.

the cases. This bad condition among many American families in some sections of the city is confirmed by the studies of the Bureau of Educational Experiment and those of Dr. Chapin. Of the several race groups, the Jews came nearest to the Americans, followed by the miscellaneous group which included the Irish and British families. The Italians, Austrians and Russians stood higher in the scale; and the best conditions were found among the Germans.

In the clinic study already referred to, which included many of the children in these schools, the greatest improvement was made by Irish-American and American children, while the cases slowest in weight increase were found among the Italians and Jews.

To summarize the problem disclosed by these studies: At least one-third of the school children are so much below normal standards of growth as to call for special nutritional care. Of this group, at least one-third require medical treatment while two-thirds may be expected to respond to improved living conditions, especially as regards feeding. There are now in the public and parochial schools of New York city over a million children. Of other children between two and



The weight curve of Eubank A., representative of many cases which show gradual falling toward and finally below the standard of normal weight at the time of puberty.

six—the "pre-school" age—and between six and sixteen but out of school and either at home or at work, there are nearly as many again. This, if the conditions found by our study are at all typical, means that at a moderate estimate there are over half a million children in need of nutritional attention; over half a million children requiring an additional investment on the part of society if they are to be placed upon a plane of reasonable efficiency.

Among the methods of dealing with the emergency features of this situation has been the establishment of nutrition clinics at Bellevue Hospital, the Bowling Green Health Center, Cornell Hospital, the Post Graduate Hospital, and the Brooklyn Association for Improving the Condition of the Poor. All these are intended especially for cases requiring medical attention. The nutrition clinic works upon the fundamental needs and serves as a center of cooperation with the medical or surgical clinic which provides treatment, on this basis, for special defects. At Bellevue, nearly two hundred cases under care for three months averaged more than double the normal increase of weight to be expected at the several ages; and the growth of two-thirds of them, previously subnormal, was increased above the normal average. The interest aroused by the studies made at two schools sufficed, however, to swamp this clinic. Scarcely a beginning has yet been made on the large number of children who would benefit from nutritional care



but require no medical attention and who, therefore, could just as well be cared for in food clinics established independently.

Beyond the emergency program lies the need of a wisely organized plan which would bring these nutrition clinics for medical cases and food clinics for non-medical cases into effective cooperation with the school lunch system, the home economics departments of the schools, the open-air classes (as clearing houses and observation stations), the work of the school physicians and nurses, the milk stations, the district nurses and many other social agencies which could help in one way or another to meet this need.

The immediate need is for an emergency program which is commensurate with the size of the problem and does not hinder the investigation of more lasting solutions. The next

step is the better coordination of the existing social machinery so that its remedial processes, applied more early in life and covering the want more adequately, may also be preventive and conservatory. But all these measures of relief are social makeshifts compared with the immense work of education and economic readjustment which lies ahead. After all, "what is the matter with the poor is their poverty." And, it may be added, what is the matter with the ignorant is their ignorance. Unless we recognize that defective nutrition in childhood must ultimately be treated as only one aspect of poverty and only one aspect of ignorance and shape our social program accordingly, food clinics and the remedial work of social agencies may only increase the number of children reared in families too poor or too neglectful to be safely entrusted with the reproduction of the race.

*Reprinted from the SURVEY for March 20, 1918*

# The Perfected Posture Chair

By DR. JOHN HARVEY KELLOGG

THERE'S something wrong with the chairs. Everybody knows it. The chair manufacturers have confessed full knowledge of the imperfections of their wares in their constant but unsuccessful efforts to meet the public demand for better seats, especially in theaters, churches, schools and offices, to say nothing of homes. The Posture League has carried on a lively and fruitful educational campaign for a reform in our chairs, but even its seal of approval has not been able to conceal the fact that something still is lacking in the best posture chair models which have heretofore been produced. But the perfect seat has at last arrived. Here it is.

At the first glance, you may not see any difference in the new chair from the ordinary best models. But sit down in it and you will meet a real surprise. Such perfect comfort you never before experienced in a chair. You try to find its secret by relaxing, a crucial test for a seat. To your surprise, nothing happens. You don't slump! You remain exactly where you were; it holds you in perfect sitting posture, chest up, head well poised, abdominal muscles taut, and experiencing a sense of perfect comfort and rest.

A minute examination reveals the particular feature in which this chair differs from any other ever made. It is a support provided for the upper dorsal spine by which the chest is held forward. This support is supplied by means of a pad or an equivalent bulge in the stuffing if the back is upholstered, whereby the chest is held forward.

After nearly fifty years' study of posture and seats, I think I have at last discovered that while many elements enter into the perfect chair, the support of the upper dorsal spine is the master key which solves the problem and perfects the physiologic chair.

The idea of a support between the shoulders will probably strike you as absurd, but only because you have in your mind the picture of a mis-

shapen upper back instead of a normal one. If you will examine the upper back of a well-formed and not over-fat person who is sitting or standing

in correct posture, you will observe that there is a depression, a distinct hollow or furrow between the scapulae or shoulder blades. When the upper back rests against a straight or curved chair back of the usual sort, the shoulder blades are between the ribs and the chair back, so that the spine is held forward, and does not contact the chair back, leaving a space in the center between the shoulder blades. So long as the shoulders are held back by a voluntary effort, this space is maintained. When one becomes tired and allows the muscles to relax, the shoulder blades slip forward, the shoulders droop, the upper dorsal spine recedes until it rests against the chair, and the chest drops and flattens. And something more happens. As the chest flattens, the diaphragm, stomach, liver and

other viscera are pushed down. With the increase of the posterior upper dorsal curve, the anterior lumbar curve lessens, the lower spine straightens, and the lower abdomen bulges.

For complete rest when sitting, the body must be supported in its normal balanced posture and without muscular effort; that is, with complete relaxation. The normal curves must be maintained, to avoid displacement of the viscera, injurious strain upon the ligaments of the spine and a handicap of the heart.

When the body is held in an erect posture, there is a perfect balance between the anterior and posterior, muscular and ligamentary structures of the trunk and the vertebral column. The weight of the head is supported by the bony spinal column. The muscles which connect the head with the collar bone, or clavicle, and shoulder blades, or scapula, are called upon to do nothing more than to balance the head upon the spine, which requires little effort. But when the trunk is permitted to fall under the influence of gravity, that is, when the head drops, the shoulder blades slide



Case of Normal Spine

## *The Perfected Posture Chair*



*Office Chair*



*Theater Chair*

forward, allowing the upper dorsal spine to fall back, a severe and unnatural strain falls upon the costotransverse ligaments and other of the posterior ligaments and muscles of the neck and trunk.

Long continued strain of these parts is a common cause of backache, neck ache and certain forms of headache. These miseries are not only prevented by the interscapular support afforded the upper spine by the Perfected Posture Chair, but are quickly cured. It is most gratifying to note the change in facial expression of a tired desk worker after sitting in one of these chairs, even for a minute or two, and to listen to the exclamations of satisfaction and relief.

Another serious injury from the stooped posture induced by the ordinary chair, is the extra work required of the heart. The apex of the heart is attached to the diaphragm, while the base is attached to the spine at the upper part of the chest. When the diaphragm is in its normal position, arching high in the chest, the heart rests upon it easily in an oblique position; but when the diaphragm is depressed by the flattening of the upper chest, the apex of the heart is dragged downward, so that the heart is put under strain,

and at each beat is compelled to lift against the heavy weight of the liver, stomach and other organs attached to the under side of the diaphragm, thus wasting its energy and lessening its efficiency in supplying blood to the brain and maintaining the general circulation, and laying the foundation for chronic disease of the heart and lungs.

The injurious changes in the shape and posture of the trunk result from the receding of the upper dorsal spine. So long as this is held forward, the normal figure is maintained. By placing a proper support between the shoulders, the spine is held forward, the shoulder blades are held in place by gravity, and the weight of the head is carried by the spinal stem and thus the muscles are relieved. The lifting of this load of work off the neck muscles, gives a new and relieving sense of complete rest and comfort in sitting so striking as to be almost incredible until experienced. The accompanying cuts show the principle applied to an opera seat and an office chair.

These new chairs have been installed in the assembly room of the new library building of the Battle Creek College and have received universal and most enthusiastic approval.



# A New Method of Applying Heat

By DR. JOHN HARVEY KELLOGG

## *Discovery of the Electric Light Bath*

[The electric bath now used throughout the world, was invented, or discovered, and first used at the Battle Creek Sanitarium. The first bath, a vertical cabinet, was constructed in 1891. Cabinets of various forms, vertical and horizontal, were soon in use, and the bath was exhibited in 1893 at the World's Fair, Chicago.

[The following article was contributed by the author to the "Fortschritte der Hydrotherapie, Festschrift zum Vierzigjährigen Doctorjubiläum des Prof. Dr. W. Wüsteritz," published in 1897, and was the first article published in Europe on the use of radiant heat, calling attention to the penetrating quality of the thermic rays of light, particularly the radiation from the incandescent filament lamp which at that time had recently been perfected by Edison.]

**T**HE chief purpose of hydrotherapy is to produce thermic impressions upon the skin surface. It is true scientific hydrotherapy comprises other uses of water. Nevertheless, the most important service rendered by hydriatic applications is the influencing of the central nervous system through thermic impressions made upon the skin.

Since hydrotherapy is chiefly employed as a means of producing thermic impressions, it appears to me to be proper to include with hydriatic applications proper, other means of producing thermic impressions. While water is without doubt in general the most suitable means of producing thermic effects on the body, yet there are many pathological conditions which call for a different method of applying heat. This is especially true in relation to cases in which it is desirable to apply heat to deep-lying tissues. In the application of heat by means of water, the heat is communicated to the skin by contact, and when the temperature of the outer layers of the skin is raised above the normal temperature, heat is transmitted to deeper layers by conduction and is rapidly distributed to all parts of the body.

Nearly forty years ago (1891) it occurred to me that by making use of radiant heat it would be possible to reach deeper-lying structures than could be reached by conduction because of the rapid dispersion of heat by the blood vessels. The idea of using radiant heat was of course not new since the ancients made use of it in the form of the sun bath thousands of years ago, and the therapeutic value of the sun bath was understood in ancient as well as in modern times.

My purpose in employing heat by irradiation was to produce more profound effects by heating the deeper-lying structures and thereby reaching a greater number of nerve fibers, and so more profoundly affecting the nerve centers and various nutritive processes. I think it even possible that

the deeper-lying organs may be influenced to such a degree as to profoundly affect metabolic processes.

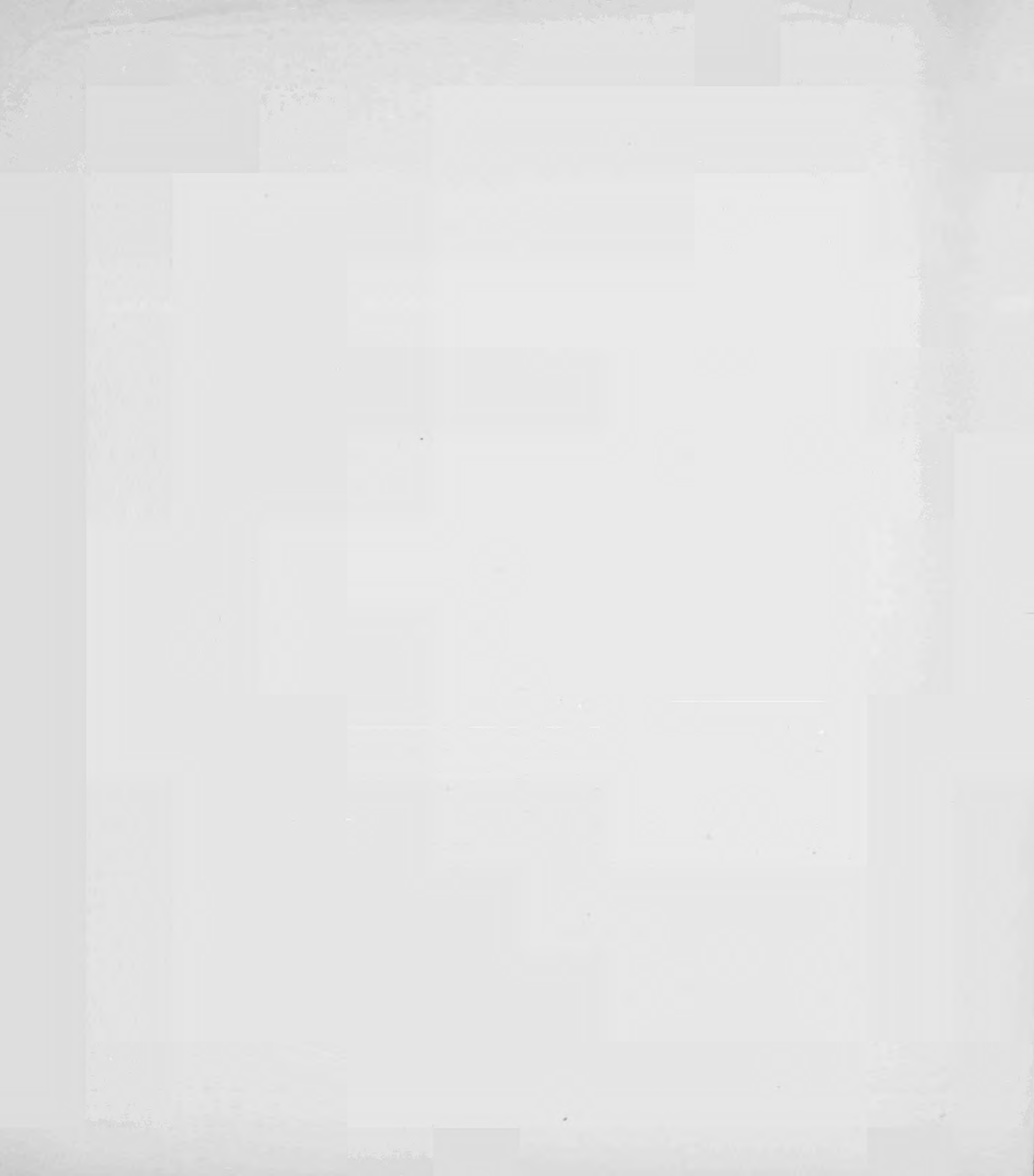
For nearly twenty years I have made use of radiant heat in the form of sunlight and with excellent results, but this method is unsatisfactory on account of unfavorable weather during the greater part of the year. In searching for another source of radiant heat than the sunlight, it occurred to me to make use of the sunlight stored up by tropical plants in the form of coal and now through modern human invention resuscitated in the form of the electric light. In experiments begun nearly six years ago in the use of incandescent electric lamps with reflectors, I was surprised at the great penetrating power of the electric light. Some time before I had noted that when a strong electric light was brought in contact with the abdomen a speculum introduced into the rectum or the vagina showed the whole abdominal cavity to be illuminated with a red glow.

Even the bones are transparent when living. This may be readily observed if the hand is placed in contact with a light lamp globe and there being no other light in the room. If the hand is close to the lamp each finger will be seen to glow and the bones as well as the soft tissues are translucent.

It is evident that the heat rays traverse the body just as they would penetrate any semi-transparent medium. The heat of a Turkish steam or Russian bath penetrates the body by slow conduction. On the other hand, the successive layers of tissue are permeable to the rays of radiant heat as is glass.

Both luminous and non-luminous rays are produced by incandescent heated bodies. The scale of radiant energy consists of about four octaves of which two octaves are in the red below and one whole octave in the ultra-violet above the visible spectrum. The non-luminous heat waves are less penetrating than the luminous.

In the Turkish bath heat is communicated to the body by the contact of hot air with the skin and penetrates the body by conduction. In steam and Russian baths there is a combined action of heated air and heated particles of water. The air is a bad conductor of heat and transmits heat to the body slowly. The skin is a bad conductor and thus heat penetrates the body very slowly. The heating of the body is also hindered by the cooling of the skin through the evaporation of water. This cooling of the skin by evaporation



## A New Method of Applying Heat

is so rapid it is possible to expose the skin to the contact of dry air at a temperature much above the boiling point of water. I have often exposed myself in Turkish baths to a temperature of 300° F. and even higher without suffering injury, and much higher temperatures have been endured with no bad effects.

Physicists have shown experimentally that the tissues are capable of transmitting radiant heat to a considerable degree. A globe-shaped bottle containing a solution of iodine in carbon disulphide may be used as a burning glass although no luminous rays pass through it. In like manner the body when subjected to rays from a highly heated body is penetrated by heat rays even though opaque to luminous rays.

After making many experiments with a small light apparatus I had constructed cabinets of sufficient size to receive the entire body, as shown in the accompanying illustration. The cabinet is lined with mirrors in front of which are placed in parallel rows fifty or sixty electric lamps.

One cabinet was so constructed as to receive either the entire body or the body with the head excluded, as in a steam bath. The amount of heat is readily controlled by means of a rheostat. A description of this apparatus was first published by Dr. Gebhardt in a German medical journal. This man visited the Battle Creek Sanitarium, where I first made use of this bath, and personally tried it.

Another cabinet, constructed on the same principle, was made on a horizontal plan. It was seven feet long, five feet high and four feet wide. In this cabinet the patient lies upon a rolling couch which may be pushed entirely into the cabinet or only so far as is necessary to bring any desired portion of the body under the influence of the light and heat rays. Thus the light may be applied to the feet, the legs or any other part of the body, up to the neck. In case it is desired to exclude the effects of the light from any portion of the body, it is only necessary to apply a linen cloth covered with mackintosh.

I have also had constructed several small cabinets by means of which the spine, the trunk, the legs and other parts of the body may be separately treated.

In 1880 Siemens published an interesting article describing the effects of the electric light upon plants. This author reached the following conclusions:

1. The electric light aids the growth of plants and the production of chlorophyll.
2. An electric light of 1,400 candles at a distance of two meters from a plant produces the same effect as daylight in March; a stronger light produces greater effects.
3. Plants show no need of rest but produce increased growth when subjected to the sunlight during the day and the electric light during the night.
4. The radiant heat from powerful electric arc lamps may be used to prevent the injurious effects of night freezes and appears to hasten the ripening of fruits in the open air.
5. Plants when exposed to the electric light are better able to endure the effects of stove heat. Similar observations have been made by others, some before the experiments of Siemens.

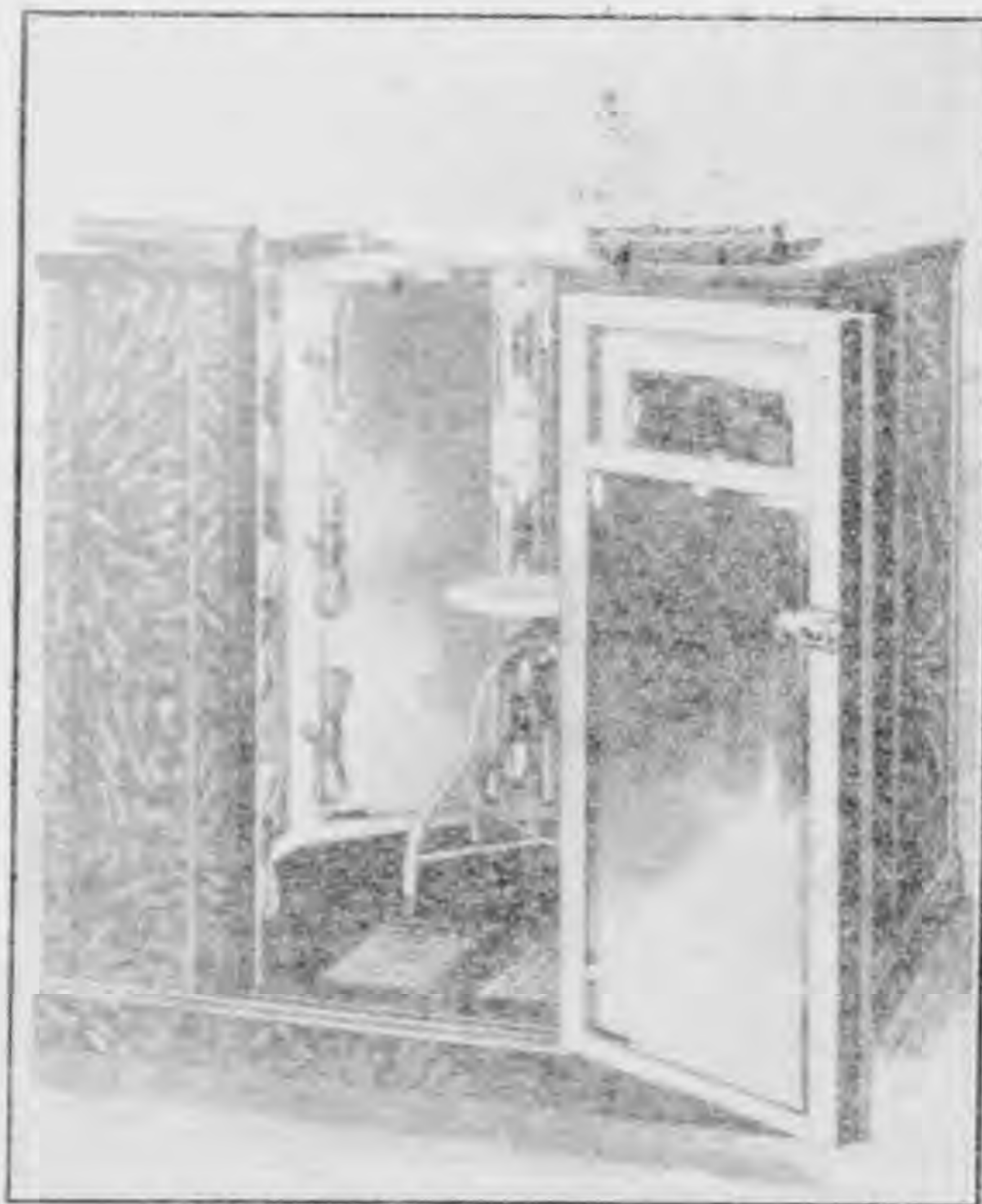
Herve Magon was first in this field (*Comptes Rendus*, 53, 243). His experiments showed that the electric light is capable of causing the development of chlorophyll and causing plants to turn toward the light.

Prillieux (*Comptes Rendus*, 69, 410) showed in 1869 that the electric light is capable of causing plants to assimilate CO<sub>2</sub>.

Siemens found that plants treated by the electric light for six hours in addition to exposure to the usual daylight, surpassed other plants in the greenness of their leaves and general thrifty appearance. Strawberries and other fruits were equal to those grown in the sunlight and grapes had an even better flavor; lemons were large and aromatic and bananas were very tasty.

Many experiments have also been made in the United States. Among the most important were those of the Agricultural Station of Cornell University. The data obtained there has clearly shown:

1. That the electric light compares favorably with sunlight in its power to stimulate protoplasmic activity.
2. The electric light has a tonic effect upon



The Electric Light Bath



plants and renders them better capable of enduring unfavorable conditions which without the aid of the light might cause death.

3. That the electric light is a true life stimulant, the effect of exposing plants to light during the night being essentially the same as that produced in plants by the longer days of the polar region.

Besides these scientific investigations numerous observations have been made which show the powerful effect of light on the life and activity of the human body. Thus, for instance, it has been known for a long time that the skin of the parts of the body which are exposed to the rays of a strong electric light becomes brown and even blistered. Symptoms resembling sunstroke have been observed in persons subjected to the direct rays of a powerful arc lamp. To these facts may be added the chemical effects of the electric light, which is analogous to that of the sunlight.

In order to find a truly scientific basis for the use of the electric light or radiant heat bath I undertook a series of experiments for the purpose of determining the effect of the electric light (1) on the elimination of  $\text{CO}_2$ ; (2) perspiration.

First a careful comparison was made of the effects of the electric light and the Turkish bath upon  $\text{CO}_2$  elimination.

A series of observations was also made with the Russian bath. It was found that during thirty minutes the  $\text{CO}_2$  elimination reached 3.96 per cent. During one-half hour in the electric light bath elimination of  $\text{CO}_2$  was 4.92 liters.

Three healthy young men were subjected to the electric light and heat bath during five, twenty and thirty minutes. The same baths were given to the same young men on different days at the same hour and for the same periods. Care was taken to see that the diet was carefully controlled. The amount of  $\text{CO}_2$  was determined by collecting all the air breathed out for ten minutes before the experiment, mixing and analyzing the same for  $\text{CO}_2$ . During the bath, air was collected for the same period of time. When the duration of the bath was only five minutes the figures were doubled for comparison. When the bath was continued for twenty minutes the air was collected only for the last ten minutes. The figures obtained were corrected for barometric pressure.

The results obtained were as follows:

After 5 minutes, 4.10.

After 10 minutes, 4.10.

After 20 minutes, 4.20.

After 30 minutes, 5.13.

For the Turkish bath:

After 5 minutes, 4.03.

After 10 minutes, 4.07.

After 30 minutes, 4.01.

The temperature of air in bath:

Electric bath  $28^\circ \text{C}$ . ( $85^\circ \text{F}$ .) or considerably below the bodily temperature.

Russian bath  $38^\circ \text{C}$ . ( $100^\circ \text{F}$ .)

Turkish bath  $55\text{-}60^\circ \text{C}$ . ( $131\text{-}150^\circ \text{F}$ .)

Second, perspiration. Three points were observed about the effect of bath on perspiration:

1. Necessary time for producing perspiration.
2. Temperature at the beginning of perspiration.
3. Quantity of sweat produced in a given time.

The results were as follows:

The average time for producing perspiration by the electric light bath was three minutes thirty-two seconds; in the Turkish bath, five minutes thirty-five seconds. The time in the Turkish bath for causing perspiration was shorter than usual as the experiment was made in warm weather so that the young men under experiment were in a condition favorable for quick perspiring even when coming to take the bath.

With repetition of these experiments in cold weather it was found that the Turkish bath requires for perspiration exactly four times more time than the electric light bath. The Russian bath takes even a longer time. In the electric light bath the perspiration often begins even in one or two minutes.

The average temperature at which perspiration occurs in the electric light bath is  $27.2^\circ \text{C}$ . and in the Turkish bath,  $60\text{-}65^\circ \text{C}$ .

The quantity of sweat in the electric light bath was twice as great as in the Turkish bath for the same time.

A series of interesting experiments was made with the object of finding the effect of the electric light bath on the blood cell count and other bodily states.

The chief advantages of the electric light bath are as follows:

1. The ease with which the heat penetrates the body to a considerable depth so that the deep-lying tissues may be subject to the effect of light.

Bouchard has pointed out that perspiration is caused by the rise of inner temperature by  $.4^\circ \text{C}$ . In the electric light bath the heat penetrates the body instantly instead of by the slow action of conduction. Therefore the temperature of the blood rises quicker and causes perspiration. The heat thus introduced influences not only the perspiratory glands but also the tissues. The heat irradiation of the electric light bath penetrates directly to the deep-lying tissues of the body instead of working its way slowly through the badly conducting layers of the body and thus greatly stimulates the tissues.

2. The electric light bath may be used so that either a tonic and strengthening or a depressing effect may be produced. A short bath of high intensity, just long enough to produce skin conges-



## *A New Method of Applying Heat*

tion without causing perspiration, is one of the most efficacious means of peripheral stimulation. The tonic effect of such a bath may be increased by directly following with a cold douche or some other form of cold application. By this means the good effects are greatly increased and a most pleasant and favorable reaction is produced. The short, intense heating of the skin prepares the way for the cold application without overheating or relaxing the blood vessels to that degree that the elasticity of the skin tissues recover slowly, leaving the patient exhausted and liable to chill.

3. The convenience of using the electric light bath makes it superior to the Turkish or Russian baths. The temperature is easily regulated. As the heated filaments form here the source of heat and not the heated atmosphere, the control is easily and quickly achieved. As soon as a lamp is turned off, the heat sent from it is immediately stopped. If an increase in the heat is desired a needed number of lamps may be added and put into action at once.

4. Another particular advantage of the electric light bath over other sources of heating is the ease with which the electric heat is applied. In this respect it surpasses the fomentation or other means of heating the body. With a suitable apparatus one may center the heat on a small surface and it will not only reach the surface but also the deeper-lying tissues. I am convinced through personal observations that the electric light penetrates the tissues for several inches.

5. The cheapness of the electric light bath should be considered along with its convenience.

No expensive heating apparatus is required. The apparatus used is twice as useful as that of the Turkish bath but is simpler and much more easily controlled. The whole power of the bath is always ready for immediate use. Its action can be instantly arrested. The cost of maintenance of such a bath is very small, being limited to the cost of current and bulbs. The cost of the current for one bath on an average in our large cities is not over two-thirds cents (8-12 Pfennings).

6. A further important advantage of this bath is that the patient is not in a closed hot room and does not breathe overheated air which may be polluted, but during the treatment he breathes air of ordinary temperature. Thus the danger of certain bad results observed in other hot baths is absolutely excluded.

I have used a number of electric light cabinets many years in the institution of which I have charge and together with my colleagues have applied over twenty thousand such baths for different diseases. They have proved very efficacious in the treatment of obesity, rheumatism, Bright's disease and all diseases which Bouchard has characterized a slowed nutrition (*"verlangsamte Ernährung"*). This is the most efficacious of all non-medicinal pain-relieving methods. As a tonic and strengthening method it is valuable. An electric light bath followed by a cold spray causes a considerable increase in the number of red blood cells, resulting from the reaction following a cold application to the skin, for the first time observed and appreciated by that eminent master of hydrotherapy, Professor Winternitz.

# Engine Trouble

## *A Call for Help from the Pump Room*

By DR. JOHN HARVEY KELLOGG

### SECOND ARTICLE

**T**HE blood pressure is measured by means of an instrument called a sphygmometer. A long rubber bag is wound about the upper arm. Air is pumped into the sac, compressing the arm until the pulse is obliterated, and the amount of pressure required to stop the pulse is measured by a mercury column which is graduated in millimeters or twenty-fifths of an inch.

The sphygmometer shows that there are two blood pressures—the systolic and the diastolic. The systolic pressure is the maximum pressure developed during the heart beat. The diastolic pressure is the pressure constantly present in the arteries, even between the heart beats. The diastolic pressure is thus a “head” against which the heart pump has to work. The diastolic pressure must be overcome before the heart can force any blood into the arteries. Hence, it is evident that of the two pressures, the diastolic is most important, because it determines the work which the heart has to do. A high diastolic pressure means more work for the heart and more overwork, and hence an earlier failure from exhaustion.

#### The Normal Blood Pressure

When taking of the blood pressure was somewhat new as a method of diagnosis, it was observed that the blood pressure often increases with advancing years, especially after the age of forty years, and the belief became current that the normal blood pressure for the average individual might be conveniently determined by simply adding one hundred to his age. That is, a man twenty years of age should have a blood pressure of one hundred and twenty and a man of seventy a systolic pressure of one hundred and seventy. This is now known to be an error. Old age is a disease, not a physiologic state. The changes in

the heart and blood vessels which cause increase of blood pressure when a person becomes senile are the same as those which are caused by disease in various forms. It has been certainly established that the blood pressure does not necessarily rise because of advancing years. An eminent French physiologist said, “A man is as old as his arteries.” In recent years, physicians have learned that a man is also as old as his kidneys, his heart, his liver and even his skin. When any vital organ fails, the whole body collapses. A chain is broken when one link fails. So long as the heart, arteries, kidneys and other vital organs retain their youthful vigor and efficiency, the body is young, no matter what the age in years may be. In such a person, the blood pressure may remain at seventy the same as it was at forty or even at twenty years.

Life insurance authorities publish the following table (Hunter) as representing

The Average Blood Pressure of Men in the United States and Canada

Age	Systolic	Diastolic	Life Expectancy
20	120	80	45
25	122	81	41
30	123	82	37
35	124	83	32
40	126	84	28
45	128	85	24
50	130	86	21
55	132	87	17
60	135	89	14

The writer is acquainted with persons long past middle life whose arteries are still soft and their blood pressures the same as when young. In the writer's opinion the figures given in the



A Kidney Cell

above table are higher than the real normal for healthy men. Five Indian long-distance runners measured by the writer, showed pressures averaging twenty points lower; and Hunter, the actuary of the New York Life Insurance Company, internationally famous as a statistician, reports that the Chinese have an average blood pressure ten points lower than the American average.

This question is naturally of special interest in relation to life insurance. Consequently, several of the great life insurance companies have in recent years made careful statistical observations and studies for the purpose of determining the degree to which life is necessarily shortened by high blood pressure, both systolic and diastolic, because of the extra burden of work imposed upon the blood pump.

It is to be remembered also that high blood pressure is a symptom, not a disease, and that in general the blood pressure is no higher than it needs to be. The real menace is not the high blood pressure but the disease process behind it, of which it is the result and which is causing degenerative changes in liver, kidneys, heart and other vital parts as well as in the blood vessels.

The experience of the New York Life Insurance Company has led to the conclusion that on the average the mortality rate of persons whose blood pressure is above the average, is about two and one half times the normal. That is, a man for whose age the normal life expectancy is twenty years, if his blood pressure is higher than

normal, will have a life expectancy of eight years, thus losing twelve years of life.

According to Hunter, the New York Life Insurance Company insures persons with high blood pressure, basing the premium upon extra mortality rates as follows:

Extra Mortality	
Systolic blood pressure 10 to 25 above average	40 per cent
Systolic blood pressure 26 to 35 above average	88 per cent
Systolic blood pressure 36 to 50 above average	148 per cent

An increase in diastolic pressure has a more pronounced effect upon life expectancy than does increase of the systolic, as shown in the following table:

Increased Mortality	
Increase of 90 to 100 mm. diastolic pressure	63 per cent
Increase of 100 to 105 mm. diastolic pressure	111 per cent
Increase of 106 and above mm. diastolic pressure	235 per cent

The following table shows the loss in life expectancy or longevity due to increased systolic pressure at different ages:

Age	Normal Systolic Blood Pressure - 10 to 25			High Systolic Blood Pressure - 26 to 35			High Systolic Blood Pressure - 36 to 50		
	B. P.	Expectancy	Years Lost	B. P.	Expectancy	Years Lost	B. P.	Expectancy	Years Lost
20	120	45	14	146	24	21	156	18	15
25	122	41	13	148	21	20	158	16	25
30	123	37	12	149	19	17	159	14	22
35	124	32	10	150	17	15	160	13	16
40	126	28	8	152	15	13	162	11	17
45	128	24	8	154	13	11	164	10	14
50	130	21	7	156	11	10	166	8	13
55	132	17	5	158	9	8	168	7	10
60	135	14	4	161	7	7	171	6	8
65	138	11	3	164	6	6	174	5	7
70	142	9	3	168	4	4	178	4	6
75	146	7	3	172	3.5	3.5	182	3	4
80	150	5	2	176	2.5	2.5	186	2	3

A person who comforts himself with the thought that his blood pressure is only a little above the average, will be surprised to find by a glance at the table how great is the loss in years of life occasioned by even so small a rise in systolic pressure as ten points. At the age of twenty, a systolic pressure of one hundred and thirty means a loss of one-third of one's life expectancy, or fourteen years. A systolic pressure of one hundred and forty at fifty years means a loss of six and one half years, while the higher pressure of one hundred and sixty-six doubles the loss to twelve and one half years.

It is not to be forgotten that an increase in blood pressure is due to progressive disease and that when the increase begins there is likely to be a steady rise from year to year, and not infrequently the increase is rapid.

The mortality shown in the above table, large as it is, does not represent nearly the actual loss from conditions of the heart and blood vessels involving high blood pressure. Many such patients die of pneumonia, influenza and other maladies because of inability of the heart to meet the extra demands upon it, who might recover if not thus handicapped.

The diastolic pressure, often overlooked, is really the most important, for it indicates, when

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### RELATION OF EXERCISE TO RESPIRATION AND HEART ACTION.

(BY J. H. KELLOGG, M. D.)

RESPIRATION is very closely connected with muscular activity and muscular effort. Even a slight change of position is sufficient to cause a change in the rhythm of respiration. When a person is lying upon a level, in a horizontal position, the respiration may not be more than ten to twelve in a minute, slow and deep; while in sitting up, it will be increased two or three per minute; in standing it will be increased to eighteen or twenty movements in a minute; while in walking it will be increased still more; and in running, the rate of respiration may be as high as forty or fifty breaths per minute. Respiration is increased by exercise, because the poisons produced by the activity of the muscles excite the nerve centers, and these stimulate the muscles of respiration to greater activity. The effect of this increased activity is, first, to throw off the poisons which are being produced and thrown into the blood; and secondly, to take in a larger quantity of oxygen, the purpose of which is to burn up this poison, and also to furnish to the muscles an element which is indispensable to support muscular activity. It is found that the muscles absorb oxygen much more rapidly while active than while at rest. The lungs eliminate carbon dioxide (CO<sub>2</sub>) during exercise in increased quantity, and it is possible that the increased quantity of carbon dioxide in the blood may be one reason for the increased activity of respiration.

The normal activity of the lungs differs in different persons. It is the result of impulses received from the *medulla oblongata*. A curious case has recently been reported from New York: a man was received into one of the hospitals there, who, a year or two ago, received an injury at the base of the brain, and since that time has been compelled to

breathe at the rate of 150 times a minute. For more than a year this man has been breathing at this remarkable rate, instead of sixteen or twenty times a minute.

It has been found that during exercise the blood undergoes a change. While at rest, the blood is alkaline, but during exercise it loses its alkalinity, as the result of absorption of wastes by the muscles. The lungs may be considered as both the chimney and the draft of the vital furnace; the fresh air is brought in, and the poisonous gases are poured out, through the respiratory organs. Hence it is necessary, when the wastes are accumulating in the muscles from exercise, that the vital draft shall be increased; so the usual rate of respiration is increased during exercise. Dr. Edward Smith has made a careful study of this subject, and taking the amount of air or oxygen received per minute while lying down, as the standard of measurement, or 1, has constructed the following table:—

Sitting up.....	1.22
Sitting and singing.....	1.20
Standing.....	1.33
Walking at the rate of 1 mile an hour.....	1.90
Walking at the rate of 2 miles an hour.....	2.76
Walking at the rate of 3 miles an hour.....	3.20
Walking at the rate of 3 miles an hour and carrying a weight of 34 lbs.....	3.50
Walking at the rate of 3 miles an hour and carrying a weight of 118 lbs.....	4.75
Walking at the rate of 4 miles an hour (five times as much as when lying down).....	5.00
Running at the rate of 6 miles an hour (seven times as much as when lying down).....	7.00
Walking in a treadmill and ascending at the rate of 45 steps a minute.....	5.70
Swimming.....	4.33

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The amount of air taken into the lungs is in direct proportion to the degree of muscular activity, being increased from 1 to 7 — sevenfold — by increasing the muscular activity from the passive state of lying down, to the active condition of running at the rate of six miles an hour; that would not be a very rapid run.

It has also been observed that there is a close connection between the exercise of animals and their respiration, or the amount of oxygen which they receive. The frog uses so little air that it is not necessary to supply it with so efficient a respiratory apparatus as in human beings and the higher order of animals. The frog has ribs, but no breastbone, and consequently no diaphragm, so that he cannot breathe as we breathe, by expanding the chest; he simply has an air-bag within the body. When he wishes to fill his lungs, he swallows air in the same way that we swallow water; the air is taken in through the nostrils, which are guarded by valves; these close, and by compression of the throat, the air is taken down into the air-bag. Just notice the frog when he is taking in air, with his nose out of the water; you will see the throat moving up and down, which is these little valves opening and closing during the process of drinking air.

The bird has an extraordinary capacity for receiving oxygen. It not only has an enormous chest and lungs, but its air capacity is also increased by means of its chest bones, which are hollow; these bone cavities connect with the lungs, so that the bird stores up air in its bones, and thus keeps a large amount of air on hand. The bones being hollow lessens the specific gravity of the bird. The bones of fish are solid.

Now notice the difference between the temperature of the frog and that of the bird. The frog is said to be a cold-blooded animal. It is not really a cold-blooded animal, since its blood is just as warm as the air or water in which it lives. The frog makes so little heat and receives so little oxygen into its body that its temperature does not rise above the surrounding air or water; while in the bird we have a temperature three or four degrees higher than in man, and in some instances it rises still higher than that. This high temperature is due to the great activity of the bird. The bird flying through the air lives a wonderfully active life; the swallow will easily keep up with the swiftest railroad train. Compare the high grade of life of the bird with the low, groveling life of the frog, and then remember that the difference between their modes of life is due to the difference in the amount of oxygen which they consume.

The direct effect of exercise is to bring into play the respiratory muscles, and hence to increase their strength. If the subject is a young person, in whom the joints of the vertebrae and the cartilages which join them to each other and to the breastbone, have not become ossified by age or idleness, the *size* of his chest will be increased by exercise which brings the lungs into play, as well as the muscles of the chest, and the joints and cartilages being flexible, the ribs are drawn apart and the chest capacity is increased. In old persons, in whom the cartilages and joints have become ossified, there can be no increase in chest capacity, although there may be an increased activity of the muscles of the chest.

Prof. Marey, a prominent English physiologist, has made some experiments as regards lung capacity, through systematic observations of the students of the Joinville school. Examinations were made at the beginning of the term, and after about six months it was observed that the rhythm of respiration had been changed; while asleep, their respiration was slower, deeper, and more profound, and the amount of air taken in was found to be double that which had formerly been observed. The respiration had thus been permanently modified by exercise. So we see that exercise increases the breathing capacity of an individual when idle or asleep, as well as during the moments of exercise.

The relation of exercise to heart action is also a matter of interest. The heart beats, ordinarily, 4 times to every movement of the lungs; so if we breathe 18 times a minute, the heart beats about 72 times a minute. This is the normal relation between the movements of the heart and the lungs, although in disease this relation often changes. So it does not follow that if a person, like the gentleman in New York above referred to, should breathe at the rate of 140 times a minute, his heart would beat 600 times a minute.

The acceleration of the vital activities by exercise usually increases the heart beat from 10 to 30 times a minute. Even such slight movements as a change from a lying to a sitting, or from a sitting to a standing position will increase the heart beat. For example, suppose a person's heart beats 60 times a minute when lying down; when sitting up, it will beat from 68 to 70 times a minute; standing up, it will beat from 72 to 76 times a minute; if he walks quietly along, the heart beat will be at the rate of from 80 to 85; and if he runs violently, the heart beats may be increased to 120 or 140 beats per minute. I examined a young man some time ago, just after he had been exercising in running up and down

stairs a couple of times, and found his heart beating 176 times a minute. If the heart beat is perfectly regular, with no intermissions between the beats and no irregularity of any sort, the rapid beating is simply the result of the violent exercise, and is not significant of any injury, nor of danger; but if exercise induces irregular action of the heart, then it is a matter which demands the most careful consideration.

Why does the heart beat increase by exercise? It is doubtless in consequence of the need of the muscles for oxygen; the muscles get oxygen through the medium of the blood, and this the heart supplies. The muscles need more oxygen during active exercise, and so it is arranged by nature that the heart shall beat more rapidly to supply the muscles with oxygen sufficient for their nourishment, and also for the purpose of washing away the poisons.

It is necessary, also, that the lungs should be supplied with oxygen to oxidize the poisons in the system, as well as to contribute an element necessary for its support.

It is observed that when a person has been exercising violently, the respiration becomes quiet much before the heart does. Why is this? Probably because the mechanism which impels the heart to action is within itself. The heart contains little nerve centers stimulating it to activity, so that in many animals it may continue to beat even after removal from the body. I have seen the heart of a turtle, for instance, still beating days after the turtle was killed. The lungs receive their impulses from the *medulla oblongata*, and quickly cease their excessive activity when the necessity disappears. The heart centers become excited during activity, so that the heart returns more slowly to its natural rhythm.

Another fact of importance in relation to the heart is the result of fatigue. The heart beat becomes slower than usual a little time after violent exercise, probably because the heart itself, being a muscle, becomes fatigued, so that it does not act as energetically as it should.

The advantage to the heart of proper exercise is that it increases its size and strength; it becomes larger, stronger, and more vigorous as the result of

judicious physical exercise. In the oarsman, or the man who is training for rowing, the heart as well as the other muscles becomes larger; in fact, this increase in the size and vigor of the heart is one of the essential features of training. If it were not for the increased size and vigor of the heart, the rower would not be able to sustain the violent exertion to which he subjects his muscles during the contest. It is necessary that his heart should grow in order for him to accomplish a certain feat in rowing; he could not do it unless his heart had been prepared for it by previous work.

It is rapid work which brings the heart into greatest activity. A person might make his muscles strong by lifting a heavy weight, and yet his heart might be comparatively weak. So with an oarsman; his muscles may be strong, and yet his heart not be strong enough to pump the amount of blood through the lungs which would be necessary to supply the proper amount of oxygen to the body in rowing, running, etc. Oarsmen and short-distance runners always have large hearts.

This training may be overdone. Training may be carried so far as to produce an over-development of the heart, and thus harm may result. The consideration of this fact is very important, because, as the heart becomes larger and stronger and its activities are increased, all the vital activities are increased with it; digestion improves, etc.; but if the activity of the heart is overdrawn, and it becomes too great, then the natural balance of the vital activities is destroyed. The brain may receive too much blood, and sleeplessness may result. The lungs may be so congested by the increase of blood that the individual upon lying down, finds it difficult to breathe, so that he must be propped up in bed. The stomach may receive so much blood that it will also become congested. So with many other organs of the body, most serious results may follow. Overtraining the heart is thus very injurious, and may be exceedingly harmful. It has been found that oarsmen and short-distance runners very often become seriously diseased, and die prematurely, in consequence of the damaging effect of excessive work upon the heart.



# THE HOME GYMNASIUM

## THE NECESSITY FOR PHYSICAL TRAINING.

We quote as follows from an article in the *Canadian Practitioner*, by B. E. McKenzie, B. A. B., of Toronto:—

“The necessity for attention to the physical development of children will be apparent to any one who will notice how many of them, especially in large centers of population, are unsymmetrical, distorted, and imperfectly developed. It is questionable whether the so-called blessings of civilization represent an unmixed good; the intellectual and social attainments of our times are great, but they have not been effected without cost.

“In earlier times, when less humanitarian views prevailed, and the customs of life did not permit a survival of the weakling, a process of natural selection made man more robust; and the great lungs, stout heart, mighty muscles, sturdy bearing, and unquailing nerves of the forest dweller called for no special care to bring him to a high condition of physical efficiency. The rush of modern times, the competition in the schools, the prizes to be attained through intellectual and social advancement, however, seem to have made us forgetful of the fact that man is first an animal in order of development, and that physical vigor is the necessary substratum upon which must ever rest great attainments.

“The examination and careful measurements of primitive and uncivilized races and of the best models of Greek statuary prove that modern modes of dressing have greatly reduced the girth of the waist, displacing the stomach, liver, kidneys, and other abdominal and pelvic viscera, and interfering with their functional activity. The girth of the waist in woman should be but little less than that of the thorax, and normally it is larger proportionately to the height in women than in men.

Dr. Seaver, of Yale, reports measurements made of some of the best Greek statues, showing the girth of the waist among women to be only two or three per cent. smaller than the circumference of the thorax.

“The following figures, taken from Kellogg,\* obtained in the measurement of women among the Chinese, Indian tribes, French, German, and Italian peasants, as well as English and American women and men, show important facts regarding the relation of waist girth to height:—

	Average Height.	Average Waist.	Per cent.
American women	58.94	24.79	42
Telugu women of India	50.49	24.52	48.6
French women (peasants)	51.04	28	54.4
Chinese women	52.51	26.27	50.4
Yuma women	50.86	26.84	52.7
Civilized American men	67.00	29.40	43.7
Venus de Milo (statue)			47.0
Mrs. Langtry	67	26	38.8

“At Wellesley College Dr. Anna M. Wood has measured 1100 women between the ages of nineteen and twenty-one years, with the following results: Average height, 63; average waist, 24.6; per cent., 39.

“Some measurements which I have made of women by whom I have been consulted because of some deformity of the trunk, show the average percentage of waist to height to be below 37 per cent.

“It is worthy of note that the measurements just given of American women were of those who ordinarily dressed in the conventional styles. The Telugu women wear their skirts supported by a cord drawn tightly about the waist. The French and German peasants, for the most part, support theirs

\* *Influence of Dress*, by J. H. Kellogg, M. D., Battle Creek, Mich.

Ecuador and Mexico indicate the possibilities of reaching an advanced age. A climate that allows much outdoor living is the best for health. More depends on food than on climate. Exercise, fresh air to live in and to sleep in, daily bathing, and freedom from medicine are the important things.

In July, 1893, the *Courier Journal*, of Louisville,

**INFLUENCE OF TOBACCO UPON THE BLOOD.**—The *Popular Science News* asserts that the injurious effects of tobacco-using upon the blood may be readily discovered by microscopical examination. In ordinary blood, corpuscles are sometimes noticed which are irregular in outline, presenting a crenated, or scalloped, appearance of their borders. These corpuscles are very rare, however, the proportion not being more than one to three or four hundred of the ordinary corpuscles. In the blood of the tobacco-user, however, these crenated corpuscles are often found to be present in the proportion of one to ten,

**MARK TWAIN'S SANITARY SURVEY.**—In Mark Twain's account of his Mediterranean excursion, he states how he arrived at "Civita Vecchia the forlorn" on a hot day in July, and proceeds to describe the place as follows:—

"This is the vilest nest of dirt, vermin, and ignorance we have got into yet, except that African perdition they call Tangier, which is just like it. The people here live in alleys two yards wide. It is lucky the alleys are not wide, because they hold as much smell now as a person can stand; and, of course, if they were wider, they would hold more, and then the people would die. These alleys are paved with stone, carpeted with slush, decayed rags, decomposed vegetable tops, and remnants of old boots, all soaked with dish-water, and the people sit around on stools and enjoy it. They work two or three hours at a time, but not hard, and then they knock off and catch fleas. This does not require talent, because they have only to grab. If they don't get the one they are after, they get another; it is all the same to them, they are not particular."

**WOMEN AS BARMAIDS IN GREAT BRITAIN.**—Countess Carlisle, Lady Henry Somerset, and other prominent women of England have taken active steps to abolish the scandalous and degrading custom of employing young women as barmaids. There are fifty thousand women so employed in the United Kingdom, and the greatest opposition will come

published a long account of James Mc Mullin, who died in Carlisle County, Ky., at one hundred and seventeen years of age. When Buffon, Hufeland, Flourens, and men of that class, who had studied the subject, believed in the possibility of one hundred and fifty or two hundred years of life, the subject is not one to be ridiculed.—*Sci.*

from the women themselves and those employing them. The women object to having their livelihood taken away, and as the liquor men find it very profitable to have them, the movement will no doubt meet great resistance.—*National Temperance Advocate.*

It is well known that Thomas Carlyle became a pessimist in his latter days, due no doubt to his lifelong dissipation. He smoked a short pipe incessantly, and was fond of dyspepsia-producing viands. One night, when disturbed by the barking of a dog, he expressed a wish that he had the animal by its hind legs within reach of a stone wall. A man with such a feeling toward a poor brute could scarcely be otherwise than savage toward his fellow men.

**HOW ANIMALS PRACTISE MEDICINE.**—Animals get rid of their parasites by using dust, mud, clay, etc. When a dog has lost its appetite, it eats that species of grass known as dog grass, which acts both as an emetic and a purgative. When cats are ill, it is a matter of common observation that they eat grass. Animals suffering from chronic rheumatism always keep, as far as possible, in the sun. If a chimpanzee be wounded, it stops the blood by placing its hands on the wound, or by dressing it with leaves and grass. A dog, on being stung in the muzzle by a viper, was observed to plunge its head repeatedly for several days in running water. Animals that have been injured in the eyes avoid the light and heat. It is also very generally known that when animals are ill, they abstain from food; in fact, many times this is the only way the farmer knows that his horses and cattle are sick.—*Medical Record.*

**A NEW KIND OF THERMOMETER.**—"I wish, Susan, that when you give baby a bath, you would be careful to ascertain whether the water is at the proper temperature. Use the thermometer."

"Oh, that's all right, mum. I don't need no thermometer. If baby turns red, the water's too hot; if it turns blue, the water's too cold. I can always tell nicely that way."



from the shoulders, and discard waistbands. The Chinese are low of stature, being two inches below five feet, but have waists two inches greater in circumference than either the ordinary American woman or the women of India. The women of the tribes of Arizona and New Mexico, unfettered by dress, have a waist measurement 55.2 per cent. of their height.

"A large number of schoolgirls, between the ages of eleven and thirteen years, showed a waist measurement of 23.5 inches. A number of college girls about nineteen or twenty years of age gave an average waist measurement of 23.5 inches, thus showing that while general development had been going on, the waist had been reduced two-tenths of an inch."

"My purpose in referring to these measurements is to point out some of the evil results of modern customs and fashions, — evils which are very far-reaching, and require varying means for their remedy, but many of which are readily corrected by improved methods of dressing, as taking off the corset, bands, and all such restrictions from the thorax and waist, and following this by a proper attention to physical development. The erectness and symmetry of the trunk must depend largely upon its having an opportunity to develop fully in all its diameters. The

injury resulting from restriction, though marked in the atrophy of the muscles, is not limited to these structures, but affects the osseous framework, and cripples the contained viscera, whereby injury is done to the progeny, and a condition results which strongly predisposes to deformities of the trunk, without the intervention of any distinctive pathological state.

"Modern methods of dressing young women and girls cause the circumference of the waist and lower thorax to be reduced from one to five or six inches below the normal amount. Though it is always claimed by women that no part of the clothing is tight, yet it is seldom that more than a half an inch of expansion is permitted in the lower thorax; and it may safely be stated that if the calf of one leg be restricted for a few months or weeks in the same manner as the waist of the ordinary young woman, it would show marked atrophy when compared with the other.

"In woman, the liver is proportionately larger than in man, and her girth at the waist should be proportionately larger. Constriction, therefore, is responsible for much of the displacement found in the abdominal and pelvic viscera, and for atrophy of the trunk muscles, resulting finally in the distorted spine and other trunk deformities."

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### THE DECLINE OF THE FRAGILE WAIST.

It is a matter for rejoicing that fashion no longer decrees a slender waist as something indispensable to propriety and grace. The natural waist of the woman of average height is about twenty-eight inches, and any less size is attained only through arrested development, or compression by means of whalebone and steel. The amount of room inside these twenty-eight inches is absolutely needed for the proper working of the machinery of the internal economy. In spite of this fact, girls very often bind the yielding ribs into such narrow compass that the waist measures twenty or twenty-two inches only; and you will every now and then hear some mother of a family, with a very different waist now, boast, as if it were something to be proud of, that when she was nineteen years old, her waist measure was nineteen, too. It is, however, of no use to talk to young people about the injurious effect of compression on the stomach, heart, lungs, liver, and the arterial system. They are not anatomists, and they do not comprehend the matter, nor want to do so; they observe that they feel as well now as they did before; and

without weighing the thought that it requires time to work ruin, take it for granted that they will always feel well, although they have been told and taught that in post-mortem examinations, wherever tight lacing has been the rule, every organ is found to be out of place and seriously injured. But although it does move them a trifle to be told that red noses and eruptive skins and flat chests are to be laid to the account of the too slender waist, yet, on the whole, neither common sense, nor auld-wife wisdom, nor doctors, have the power of conviction that fashion does; and when fashion says there is no beauty in a wasp waist, but that the lines of mobility and health made by deep breathing are the really lovely lines, fragility being something rather to be avoided than cultivated, why, then fragility begins to decline, and the lines of the Venus de Milo, of the Diana, of the Pallas, begin to come in.

The habit of tight lacing has already done almost irretrievable injury. If it were continued, there is no knowing what shape it might eventually have evolved. Even sculptors declare that a model with

a natural waist, sloping outward rather than inward, is something not to be found, even the most charming figures otherwise having the hour-glass tendency, which, in however slight a form, is sufficient to spoil them for posing for anything demanding the freedom, the beauty, and the grace of the antique. The Greek woman supported and stayed herself with bands of linen, but there was no compression in the swathe, and her natural waist made her of a perfect beauty; and to-day the natural waist of the Circassian does not interfere with the reputation of her loveliness. The adoption of European dress by ladies of the harem and of Japan, showing, as it does, either a want of the knowledge of true

beauty or a wilful abandonment of its principles, will probably lead to tight lacing in the Orient just as we are relinquishing it here.

Why any one should ever have imagined that a waist which looked as if it were going to break in two was more attractive than a waist which looked capable of supporting the head and arms and shoulders, is a mystery, — so great a mystery that the effort to solve it is to be given up in satisfaction over the report that the foreign creators of the mode have recently asked themselves the question if the shape that the Creator chose to give to the human body was one they could improve. — *Harper's Bazar*.

### HEALTH RULES FOR CYCLISTS.

1. No one should become an habitual cyclist without medical authorization. Before committing himself to an opinion, the medical man consulted will do well to examine the beginner on dismounting from the machine as well as beforehand; there are certain cardiac defects which become recognizable only when the subject is under the influence of excitement or fatigue.

2. A cyclist should at first be contented with a moderate pace, not exceeding twelve kilometers per hour (about seven miles and a half). A higher rate of speed should only be indulged in after the rider has gone through a regular course of training. If a

break in the practise occurs, lasting even for a few days, the cyclist should recommence at the slower rate.

3. The temptation to go fast must be controlled as far as possible. A bicycle travels well-nigh of its own accord, and it is very hard to resist the "delirium of speed." With a light machine on a good road, and helped ever so little by the breeze, an amateur, even when only half trained, can easily achieve his twenty-five kilometers within the hour (fifteen miles and a half). This is too much, seeing that when doing from fourteen to sixteen kilometers, the rider's pulse rises to 150. — *London Lancet*.

### TRAINING THE BRAIN.

THE home has been compared to the ship-yard, where the vessel's construction is slowly and painstakingly elaborated step by step, so that the structure may be able to outlive the strains and disintegrating tendencies that are sure to attack it later, just as the growing human organism is built up, under fostering influences, by the gradual incorporation of helpful habits and useful physical reactions. Self-control and transparent honesty in the parent are as essential as obedience and self-reliance in the child. "He that will have a cake of the wheat must tarry in the grinding." The child does not exist who can grow up natural or healthy without a fair share of wholesome neglect and judicious exposure. Few realize the tremendous risk of over-caution and over-attention. A youngster is invariably happier with few and simple playthings than with a multitude of complicated toys.

There is no such good fun or good training as making one's self useful, and it is cruelty to deprive the child of this pleasure and stimulus. Let the brain and body be trained through hand, foot, and eye. Dump a load of sand into the back yard, and let the children roll in it. Give the boys a carpenter's bench; encourage the girls to do housework. Where possible, let both boy and girl have a little garden patch, if only a few feet square, and the care of a few plants. A woman in her home, a man in his garden; this seems to be a fundamental type from which we cannot entirely depart without risk to body and mind. The training of the muscular reflexes should go hand in hand with the cultivation of simple, natural, beneficent reactions in the higher planes. Cheerfulness, sincerity, industry, perseverance, and unselfishness may be acquired by practise and constant repetition, as much as the art of cor-

MODERN LACK OF SYMMETRY.—The newspapers were recently very much interested in the discussion of the question as to who should pose for the Montana silver statue. There was much rivalry among the beauties of Montana for this coveted honor, but it seems that not a woman could be found in the whole State of Montana whose figure was considered sufficiently symmetrical to meet the demands of the artist. Mr. J. M. Hill, of New York, an art critic of no mean ability, remarked in the course of the discussion, that the only means by which a really perfect form could be secured was by making a composite statue. This plan, which is like Gilbert's recipe for a heavy dragoon, has been followed by all modern artists of eminence. Canova, for example, studied sixty different women for his statue of Venus.

Another artist asserts that a perfectly symmetrical woman cannot be found in any single modern nation, but that one must go back to the ancient nations also.

This lack of symmetry, so noticeable among civilized women, is not so universal among savage women who live under reasonably natural conditions. The women of civilized nations have for many centuries been subjected to the deteriorating influences of harmful fashions and an artificial mode of life, and it is no wonder that the effects of these health-and-beauty-destroying influences have become painfully apparent.



## SYMMETRY AND DEFORMITY.

BY J. H. KELLOGG, M. D.

In the Scriptures we read that "God made man upright," but by his gross neglect and abuse of nature's laws he has become very greatly deformed and mis-shapen. Symmetry of form means more to us than merely an element of beauty; it is much more essential to real beauty than is mere prettiness of face, although a beautiful, symmetrical face is quite likely to be accompanied by a symmetrical development of the whole body.

There are two principal elements which go to make up symmetry of body; first, proper proportions in the size of the different parts of the body; secondly, symmetry in the lines or curves which form the exterior of the body.

Prof. Hogarth's "line of beauty" is found in every living organism,—in the drooping flower, in the drooping lily stalk, in the beak and neck of birds, in the curved back of the horse,—everywhere. And we have this same line of beauty, modified in various ways, in the human figure.

The ancient Greeks gave great attention to the matter of proportion in the body. They studied the subject very carefully, and sought by training to develop the highest degree of symmetry in their own bodies. They also laid down various rules in respect to the symmetry of the body. One of the most noticeable features in Greek statuary is the smallness of the head in proportion to the rest of the body, which gives to these figures an air of grace and beauty which cannot be secured in any other way. These sculptors made the length of the model head about one eighth that of the entire body. This subject was also a study among the ancient Egyptians.

According to their rules, the height of the body should be nineteen times the length of the fore-finger. The foot, and other parts of the body, have been taken as standards of measurement of the body, in different times and by different peoples.

By a comparative study of the physical proportions of modern nations, we find that the length of the body is about seven and one half to eight times the length of the head. The body of a very short person is generally about seven times the length of the head; if the person is tall, his body is eight or eight and one half times the length of his head. Short persons always have short legs, while tall persons have long legs, the difference in height being due chiefly to difference in the length of the legs. Tall persons usually have longer long bones than short persons. It is a noticeable fact that even in persons of great height, there is not a very great increase in the size of the head and trunk; the increase lies in the lengthening of the bones of the legs. Long limbs give a graceful and easy movement of the body. The sculptor who is fashioning an undraped figure, makes the legs long in proportion to the rest of the body, because it adds grace to the figure.

Prof. Giovanni, of Italy, has recently published a book, in which he gives the results of a careful study of the proportions and symmetry of the human figure. He finds that the stretch of the ideal arms is exactly the height of the entire body. The circumference of the chest he found to be one half the height, and the length of the sternum, leaving off the cartilage at the lower end, is just one fifth the circumference of the chest. The length from the lower

had no vessels for receiving their sputa, which were discharged in their pocket-handkerchiefs, to be scattered over pillows, coverlets, and blankets. They left the car in the morning, and I saw those same berths—it is true, with change of linen sheets and pillow-cases, but with no change of blankets, mattresses, or pillows—occupied that very night by other travelers, who were thus subjected to contact with a pathogenic microbe far more tenacious of life and power of evil doing than the dreaded cholera spirillum. One has only to sit in a crowded street-car on a winter day and watch the clouds of respiratory steam circling from the mouths and nostrils of the unclean and diseased, into the mouths and nostrils of the clean and healthy, as the expiratory effort of the one corresponds with the inspiratory act of the other. The road is short but straight and sure from vomica and mucous patch to the receptive nidus in another's body. Who that has ever had forced upon him an aerial feast of cabbage, onions, garlic, alcohol, tobacco, and the gastric effluvia of an old debauchee, can doubt that aqueous vapor can transport microscopic germs by the same route?

Not long ago I traveled by sea from New York to Charleston, and for two nights was cabined with some twenty consumptives going to Florida. The air was chilly, and they huddled around the stoves and fearfully and fearlessly closed doors and windows, until the atmosphere became stifling and surcharged with their emanations, and the dried sputa which they ejected on every side. It was comparatively easy to escape during the day by staying on deck, and I slept with my state-room windows wide open, but the curtains, carpets, pillows, and mattresses had been saturated by I know not how many expectorating predecessors. I have visited fifty smallpox cases a day, have gone through yellow-fever wards, and stood by cholera bedsides with far less apprehension than I experienced on that trip, yet it was one taken by many thousands of people, who would have been terrified to know that there had been a case of cholera within a mile to leeward of their homes.

(To be continued.)

IBSEN does not eat much when he is writing one of his dramas. He thinks eating heartily prevents the keenest brain work.

HEALTH SHOULD BE THE RULE.—God made and meant us to be strong and well, and not sick. His health decalogue is as binding as the ten commandments. When one is not well and strong, the ques-

tion in order is, Who did sin, this man or his parents? There is no more sense in men and women being ill than there would be of birds and buffaloes being ill. The reason that so many domestic animals are sick is because of the company they keep. We are a poisoned race, poisoned by tobacco, alcohol, drugs, bad air, bad food, and clothing far from hygienic.—*Frances E. Willard.*

Recall in your several experiences the instances of members of a family who have occupied the same chamber and bed with a gentle and beloved invalid aunt or sister, and those of tuberculous husbands or wives, who have become ill like them with pulmonary phthisis attributed to everything but the manifest cause. . . .

I do not expect that all who have eyes will see as I do, or, having ears, hearken to what I say. The idle and perverse generation of the first century will have its following in the twentieth, and men and women will continue to do the unsanitary things they ought not to do, and leave undone the sanitary precautions they ought to take, despite our warning, our imploring, our advice, or our denunciation. However benevolent and beneficent the hygienist's aim, his unappreciated, unrequited, and often unprofitable labor is enough to deter him from what has been derisively described as only an effort to procure the survival of the unfit, and thus thwart nature's own attempt to rid the world of them. He encounters another obstacle to success as aggravating as the disbelief in the necessity for his work. The authorities listen to his warnings, and then employ their own perfunctory and superficial methods of protection. Told that absolute cleanliness is the fundamental fact of sanitation, street cleaners are set at work brushing the surface dirt into little heaps, which passing vehicles again distribute, or the winds carry into the open windows of adjacent residences. The refuse of the household is deposited in vessels on the sidewalks of crowded thoroughfares, to be emptied after a time into collecting carts, from which clouds of dust envelop passers and circulate back into the houses—*living* dust, for Manfredi found an average of 761,521,000 microbes to the gram of the street dust of Naples, from which he cultivated pus, malignant oedema, tetanus, tubercle, and septicæmia. Swarms of flies feed on the decomposing contents of exposed garbage pans and buckets, and carry their germ-laden booty into the butcher shop of the poor and the kitchen of the millionaire.

tion in order is, Who did sin, this man or his parents? There is no more sense in men and women being ill than there would be of birds and buffaloes being ill. The reason that so many domestic animals are sick is because of the company they keep. We are a poisoned race, poisoned by tobacco, alcohol, drugs, bad air, bad food, and clothing far from hygienic.—*Frances E. Willard.*

end of the sternum to the pubic bone is just twice the length of the sternum.

These facts are of very great interest and value in the fine arts; for the true artist always studies these matters with the greatest care. Give an artist the length of the spinal column and of the sternum, and he can construct a complete skeleton, because he knows the proportionate length of each bone in the body.

The curves of the body are perhaps still more important than are the proportions in relation to symmetry. A slight discrepancy in the proportion between one bone and another may be overlooked, but ugly curves and abnormal lines in the figure are so conspicuous as to attract attention immediately.

Probably the most conspicuous curves are those affecting the spine. Curvature of the spine may be divided into two classes; namely, lateral and posterior. There are several varieties of lateral curvature, such as single lateral curvature, in which the spine is convex to one side; double curvature, the upper part being curved to the right and the lower part to the left, or vice versa; and posterior curvature. We now refer to forms of curvature unaccompanied by disease, but wholly due to disordered muscular action.

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There are three forms of posterior curvature: First, that which affects the upper part of the spine, causing the head to be thrust forward over the chest. There is extreme roundness of the shoulders, and the hips are carried back. This form is most common in aged people, and in laboring men who have to bend over their work, and is the result of weakness of the upper part of the body.

The second form is that which affects the middle portion of the spine. In these cases the head and hips are both thrown forward. This form is found in young and middle-aged people, and is usually due to bad positions in sitting and standing, and a lack of development of the muscles of the trunk.

The third form is that in which the lower, or lumbar, region of the spine is affected, causing what is known as the lumbar curve. In these cases the forward curve is effaced, or almost completely destroyed, so that this part of the spine becomes straight. The hips are nearly on a line with the spine, giving a most ungraceful posture.

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## MUSCULAR DEVELOPMENT AND HEALTH.

It was, we believe, a saying of Pascal that the evils that afflict mankind arise from our inability to sit still in a room — meaning thereby that in useless and ill-considered action is to be found the origin of much tribulation, and that calmly thinking out the best methods of action in advance would obviate it. But the modern physician and hygienist must often feel like reversing Pascal's motto, and saying that the evils that afflict mankind come mainly from sitting still in a room. We mean by this that the great and increasing prevalence of sedentary and indoor occupations inflicted on human bodies is already

ripening a wretched source of physical (and hence psychic and moral) suffering. If there is any truth at all in evolution, it is that animal and human life and progress have always been conditioned upon the exercise of the muscular system, that function precedes and begets structure, and that disuse leads to atrophy and death.

The disuse of the muscular system is the prolific source of much of the disease of modern life and an illustration of the biologic law. All the discoveries of modern medicine and science, every bacteriological truth, every known etiology of disease, simply

confirms the truth that, together with cleanliness, muscular health and development are the necessary conditions of freedom from disease, and that there is no health of the muscles without use of the muscles. The bacillus of tuberculosis has no power of harm to a person with proper thoracic and pulmonary expansion and development. All "consumption cures" except this one are useless, and this with some exceptions is effective in prophylaxis or cure. There is hardly a disease that does not equally well illustrate this truth.

What is civilization doing for this law? It is crowding people into huge cities, where every means of artificial locomotion, every labor-saving apparatus, and every necessity of business are all working to the same end of inactive muscles. From the weak, half-atrophied muscles naturally follow the defective digestion and assimilation of food, and the overwrought, hyperæsthetic, morbid nervous system, ever vainly seeking to undo and right the evils of denutrition, hyper-nutrition, and muscular inactivity. Our food is pre-masticated and we are becoming edentulous; and from the advertisements of predigested foods it would appear that we shall soon have no need of a private stomach, liver, or pancreas, because we can and should buy these products from the slaughter-house and laboratory, and thus save personal wear and tear. . . .

And even our frantic attempts to remedy the evil of muscular inactivity, with its spawn of varied dis-

ease, are themselves morbid, and sometimes serve to increase the evil. This fact becomes plain in our rage for athletics by proxy, and in the steady trend of athletic games toward professionalism and newspaper notoriety, sensationalism, to the encouragement of betting, and to the more brutal sorts of arena combats.

So far as our cities are concerned, one of the most crying evils is over-pressure of school children. Every physician has daily before his eyes the sad results, and he knows that instead of medicine the poor little body needs play and exercise, and outdoor air and sunshine. All the book-cramming that can be jammed into them will never compensate for the pallor, the pipe-stem legs, the narrow chests, and the stunted or abnormal growth. The city child needs what it cannot have, country life. Failing in this, it should be supplied with abundant, healthful gymnasiom exercise, under the careful eye of expert and discriminating teachers of hygiene and physiological development. All of this is doubly true as regards girls and women. Fashion and house-incarceration and wealth are reducing our women to sad specimens of bodily and muscular ill health, flabbiness, and undevelopment. Either publicly, or in private to parents, every physician can point out the truth, and by his advice may help to avert the crop of coming disease or, in some degree, to cure the pathetic instances that fall under his care.—*Medical News*.

WHY THE BODY SHOULD BE CULTIVATED.—The important subject of physical culture is not considered as it ought to be by the majority of men and women, and there is almost absolute ignorance of the make-up of the body on the part of even intelligent people, with little desire for such knowledge, although health, beauty, and success depend largely on the treatment given to the body. Mental acquirements are blindly worshiped, while the essential question of health receives little thought; and hence it is almost impossible to find men in the ordinary walks of active life, at middle age, who do not complain of impaired health and want of vital force.

Without a sound body one cannot have a sound mind, and unless proper attention is given to the culture of the body, good health cannot be expected. Plato is said to have called a certain man lame because he exercised the mind while the body was allowed to suffer. This is done to an alarming extent nowadays. Brain-workers, as a rule, exercise no part of the body except the head, and conse-

quently suffer from indigestion, palpitation of the heart, insomnia, and other ills, which, if neglected, generally prove fatal. Brilliant and successful men are constantly obliged to give up work through the growing malady of nervous prostration; the number of those who succumb to it has increased to an alarming extent of late years, and that of suicides hardly less. Few will question that this is owing to overworking the brain and the neglect of body-culture. Vitality becomes impaired and strength consumed by mental demands, which are nowadays raised to a perilous height, and it is only by careful attention to physical development and by judicious bodily exercise that the brain-worker can counteract the mental strain. Women rarely consider the importance of physical culture, yet they need physical training almost more than men do. Thousands of our young women are unfit to become wives or mothers, who might be strong and beautiful if they gave a short time daily to physical development.—*Wilton Tournier, in Lippincott's*.

54

SYMMETRY AND DEFORMITY.

In the Scriptures we read that "God made man upright," but by his gross neglect and abuse of nature's laws he has become very greatly deformed and mis-shapen. Symmetry of form means more to us than merely an element of beauty; it is much more essential to real beauty than is mere prettiness of face, although a beautiful, symmetrical face is quite likely to be accompanied by a symmetrical development of the whole body.

There are two principal elements which go to make up symmetry of body; first, proper proportions in the size of the different parts of the body; secondly, symmetry in the lines or curves which form the exterior of the body.

Prof. Hogarth's "line of beauty" is found in every living organism, — in the ~~drooping~~ flower, in the drooping lily stalk, in the beak and neck of birds, in the curved back of the horse, — everywhere. And we have this same line of beauty, modified in various ways, in the human figure.

The ancient Greeks gave great attention to the matter of proportion in the body. They studied the subject very carefully, and sought by training to develop the highest degree of symmetry in their own bodies. They also laid down various rules in respect to the symmetry of the body. One of the most noticeable features in Greek statuary is the smallness of the head in proportion to the rest of the body, which gives to these figures an air of grace and beauty which cannot be secured in any other way. These sculptors made the length of the model head about one eighth that of the entire body. This subject was also a study among the ancient Egyptians.

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According to their rules, the height of the body should be nineteen times the length of the forefinger. The foot, and other parts of the body, have been taken as standards of measurement of the body, in different times and by different peoples.

By a comparative study of the physical proportions of modern nations, we find that the length of the body is about seven and one half to eight times the length of the head. The body of a very short person is generally about seven times the length of the head; if the person is tall, his body is eight or eight and one half times the length of his head. Short persons always have short legs, while tall persons have long legs, the difference in height being due chiefly to difference in the length of the legs. Tall persons usually have longer long bones than short persons. It is a noticeable fact that even in persons of great height, there is not a very great increase in the size of the head and trunk; the increase lies in the lengthening of the bones of the legs. Long limbs give a graceful and easy movement of the body. The sculptor who is fashioning an undraped figure, makes the legs long in proportion to the rest of the body, because it adds grace to the figure.

Prof. Giovanni, of Italy, has recently published a book, in which he gives the results of a careful study of the proportions and symmetry of the human figure. He finds that the stretch of the ideal arms is exactly the height of the entire body. The circumference of the chest he found to be one half the height, and the length of the sternum, leaving off the cartilage at the lower end, is just one fifth the circumference of the chest. The length from the lower end of the sternum to the pubic bone is just twice the length of the sternum.

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43

## The Effect of Exercise upon the Brain and Nerves

THE effect of exercise upon the brain and nerves is an important and practical matter. Every one knows that after a walk in the open air, or moderate exercise of any kind, the brain is clearer, one can think more clearly, and can accomplish a greater amount of mental work than before. When the student finds himself drowsy, and his brain dull, let him take a run out in the open air, and he will come back fresh for his work; his exercise seems to have cleared away the cobwebs from his brain by giving it a fresh supply of oxygen. Oxygen is the most important of all the foods of the brain, and the brain is the most important of the organs of the body. As the brain becomes stupefied and unable to work when the proper supply of oxygen is cut off, so when a new supply of oxygen is given, the activity of the brain is increased.

Another way in which exercise aids the brain, is by removing tissue wastes. The increased amount of oxygen, received by exercise, not only vitalizes the brain, but burns up the waste substances, which are poisonous. Dr. Ferrier, some years ago, in experimenting upon monkeys, found that beef juice or extract of meat caused paralysis when applied to the brain, so that it was impossible to stimulate the motor centers so as to cause the muscles to contract. This shows that tissue poisons stupefy the brain. Exercise purifies the blood by causing the reception of a larger quantity of oxygen, which burns up the wastes, and so the brain becomes clear and vigorous.

Every one knows that nervousness is relieved by exercise. A feeling of nervous irritability is often relieved by walking in the open air. This condition of the nervous system is often due to the accumulation

of poisons. It may be due to an accumulation of stagnant blood in the brain; and by a withdrawal of this through exercise, the nervousness is relieved.

The condition known as insomnia, or sleeplessness, is produced by poisons; and these impurities of the blood are taken away by the oxygen supplied by exercise. The Bible says that "the sleep of the laboring man is sweet;" and the reason is that exercise purifies the blood and supplies to the brain and nerves plenty of oxygen, so that the irritability which causes sleeplessness is unknown to him.

Another important point to be observed in relation to exercise in reference to the brain and nerves, is the fact that whenever the muscles are exercised, the brain and nerves are also exercised. Whatever brings the muscles into activity, brings the brain and nerves into activity; and as the muscles grow, the brain and nerves grow also. The nerves which supply the muscles connected with the nerve centers increase in size and activity and efficiency as the result of exercise, just as do the muscles themselves. We find, then, that exercise is a means of mental development.

In a more direct way exercise aids mental development by cultivating attention. We have an illustration of this in the little child just learning to write. When he first takes his pen in hand, he writes with his fingers, tongue, mouth, in fact with all the muscles of the body; but as he becomes more and more accustomed to writing, this use of numerous groups of muscles in writing gradually disappears; he is better able to segregate his muscles, and finally uses only the muscles of the hand or arm, instead of moving such a large number. What has made the change?

The child has simply developed his control of the nerve centers so that he is able to concentrate his attention and effort to a single group of muscles. In this way exercise cultivates attention.

This fact indicates the importance of gymnastics, the necessity for such exercises as require skill and training; not such exercises as running, walking, or shoveling, but exercises requiring concentration of the mind, and constant mental activity for their execution. In Swedish gymnastics and calisthenics we have exercises which are useful to the brain as well as to the muscles; because they constitute in themselves a nerve training which is of very great value. The trained gymnast has a control of himself which the untrained man has not. He has control of every group of muscles in his body.

The untrained man is awkward and clumsy because he does not have proper control of his muscles; he may direct a muscle to act, and that muscle may not act, but another muscle may act instead. For example, I often tell such a man to put his hips back. He tries to do as directed, but the shoulders go back instead. Why?—Because he has not trained his muscles to act properly. In the case of the gymnast, his muscles do just what he tells them to do. The average individual has very small command of his muscles. How clumsy most persons are with the left hand. It is only the right hand that is trained to any considerable degree, with most persons. We write with the right hand, and if we have any fine work of any sort, it is done chiefly with the right hand; so the right hand becomes fairly well educated. And so with the rest of the body. The untrained man is ignorant of the power of his body, while the gymnast, as the result of physical training, gets the whole body under control. If one could have the whole body under as full control as you have the right hand, how convenient it would be!

The awkwardness of the untrained man is shown in many other ways, for instance, in jumping. One man jumps with his right foot, while another can jump only with his left foot. If the man who can jump with his right foot should try to jump with his left foot, he would fail, because his left foot has not been trained. Now the left foot and hand should be trained to be dextrous. In proper training, both sides of the body must be brought into active use, and must be equally well trained, so that we shall be ambidextrous. The thoroughly trained person will have the whole body under full control.

There is another way in which exercise is exceedingly helpful as regards brains and nerves: It furnishes an outlet for surplus energy. In every steam

boiler there is an escape-valve or blow-off valve, the purpose of which is to let off the surplus steam. In a similar manner, exercise is an excellent outlet for the surplus energy which may be pent up in the body requiring an exit. If this surplus strength and vigor (especially in the young) is not consumed in some useful way, it is likely to be utilized in some bad way. It is certain to find expression in some way.

Sometimes a small boy is told to sit down in a chair and keep still, as a punishment. But it is next to impossible for him to keep still. He has an amount of pent-up energy furnished by the vital activities of the body, which must be utilized, and the boy would actually become sick if this excess of vital energy were not worked off. When a healthy boy is left to himself, if he has no other occupation, he will turn somersaults when out of doors, chase the cat, throw stones at the barn, and build a pyramid of stones and tear it down again. He works just for the sake of working, because he feels an irresistible impulse to activity. No young child should be made to sit down and sit still as a punishment; he can't sit still; it is practically impossible. You see the same tendency in young animals,—in the colt, for instance. It is not natural for young animals of any kind to keep still.

Regular, systematic exercise affords an excellent means of working off the surplus energy which is not needed by the internal organs; and it must be worked off, or it will make mischief. This working off of energy affords one of the best possible means of regulating the emotions and propensities; for when this extra amount of energy is consumed, that is, when it is worked off through exercise, it is not left to find expression in harmful ways. So we find that exercise is not only a vital regulator, but one of the very best aids to purity. Man under training "keeps his body under," he keeps his propensities under control; this is one of the essential conditions of good training and development, and for the man under training is by no means so difficult a task as for the sedentary young man. Byron sometimes had lucid intervals in his insanely immoral life, in which by plainness of regimen and a vast amount of vigorous muscular work, he kept his terrible nature under control.

Now a few words with reference to the general effects of exercise. In the first place, exercise promotes general vital activity by the stimulation of the vital processes. The increased amount of oxygen taken into the blood, the increased heart-activity, the increased respiratory activity, the increased ac-

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tivity of these two great vital pumps, the lungs and the heart, set in quicker motion all the vital activities of the body, so that we have increased vital activity of every sort. We see this in all living things. Every living thing exercises; even a tree exercises, it receives a sort of passive exercise, by the aid of the wind; the wind blows and the tree bends to one side, thus loosening its roots a little on the opposite side, and it strikes its roots a little deeper into the earth; then it sways in the opposite direction and the roots of the tree take a firmer hold on the other side. So the strength of the tree is increased by this kind of exercise. If you have seen a tree standing on the mountain-side where a freshet, perhaps, had washed the dirt off from the roots, you have perhaps noticed that the tree under ground is often twice as large as the tree above ground, because it stands on a high point, exposed to the wind, which is constantly swaying it to and fro, so that it was obliged to strike its roots farther into the earth or the crevices of the rocks, in order to hold itself steady. In this way, you see, exercise stimulates the vital activity, even of the tree.

If you examine the wood of the trunk and branches of such a tree, you will find that they are tough and firm and close-grained. The Bible speaks of the cedars of Lebanon. These cedars grow upon the mountain-sides where the winds are strong and blow about them until their fibers become strong, firm, and dense. These cedars were doubtless particularly valuable in consequence of the hardness and firmness of their wood, and its durability.

Now compare such a tree with a tree that grows up in a dense wood. It grows up tall and slim, and its branches are small and spindling; while the tree that stands upon the mountain-side or out in the open field, where the wind strikes it, is thick and strong, and its fibers are dense and firm, and the tree under ground may be even larger than the tree above ground, as I have said, in consequence of the exercise which it receives from the wind.

I have often noticed a man under training, whose former habits had been gross, who had been bad-tempered, whose eyes were dull, and whose skin was tawny, and his step slow; in the course of a few weeks' training, he became a transformed man; his eye became bright, his step elastic, his temper amiable; his skin so white and clear that to use the expression of the English trainers, it was "as white as a woman's." His skin becomes clear and white by means of his exercise, so the expression referred to is used as an indication that the man under training is in good condition. This elasticity of step means a great deal, indicating an increased vitality and activity of the whole body. It is not the skin alone that is clear and clean, but the brain and muscles also are clean. It is not the eye alone that is bright, but every nerve fiber is wide awake and bright. The man is good-natured and even-tempered because the brain is clear and free from irritating substances, which so often make one irritable and sour. We see, then, that the effect of exercise is to take a deep hold of all the faculties of the body, quickening and stimulating them in a marvelous way.



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### THE EFFECT OF EXERCISE UPON DIGESTION.

J. H. KELLOGG, M. D.

EXERCISE aids digestion in a great variety of ways, some of which are here enumerated:—

1. Exercise aids digestion by increasing the appetite. It creates an appetite by the removal of waste substances from the tissues, and by the consumption of the reserve tissues of the body, so that there is room for new material. Oxygen is the best of all appetizers, and as exercise increases the amount of oxygen taken into the system, it can be readily seen how it is an aid to digestion in this way.

2. Exercise aids digestion by stimulating the stomach to the production of a better quality and a greater quantity of digestive fluid. Oxygen itself is one of the most necessary elements of digestion; it is also required in the production of the digestive fluids.

3. Exercise very materially aids digestion through the healthful influence of the increased respiratory movements acting directly upon the digestive organs. By respiration, an expansion of the chest is produced, which creates a partial vacuum within the chest, or rather a diminished pressure, and this diminished pressure created within the chest-cavity is communicated to the large bloodvessels in the chest, and thus produces a suctional force acting in the direction of the heart. So with every act of inspiration, the blood is drawn into the chest. The liver and the stomach lie just below the diaphragm, so that the respiratory movement has the effect of drawing the blood into the stomach and liver, and thence into the portal circulation. Thus the portal circulation is promoted. Respiratory activity not only aids the stomach and liver, but it aids absorption by drawing the blood away from the

liver, and prepares the way for the fluids which are absorbed in the alimentary canal. And so digestion, you see, is aided in a variety of ways,—by the creation of appetite; by making room for new material; by supplying oxygen, the element essential to the production of digestive fluids; by stimulating the circulation so as to supply more blood; by stimulating the venous circulation by which effete elements are removed; and by emptying the bloodvessels and thereby aiding absorption. Thus the respiratory apparatus is a sort of pump by which the digested food is pumped into the bloodvessels of the stomach, from which it is drawn through the liver, and thus the whole digestive process depends upon the movements of the chest. There is another way in which the circulation through the abdominal organs is aided by the respiratory movements. As the diaphragm contracts, it compresses the stomach and the liver between the diaphragm and the abdominal walls; the tense abdominal walls hold the organs in place, while the diaphragm contracts and presses the blood out, as you would squeeze water out of a sponge.

4. Exercise aids digestion by creating a thirst for fluids. After a person has been exercising, if he then drinks as much as he pleases, the amount of fluid absorbed is so great that the weight that had been lost through perspiration will be more than balanced by the fluids taken in; so that a person's weight will be greater after exercise than before.

The advantage of exercise has not been fully recognized. A quaint old doctor has said that sawdust pills were the best remedy for dyspepsia that he knew of, provided the patient made them himself. Dr. Boerhaave, an old Dutch physician living some

two hundred years ago, says that for a dyspeptic, climbing a bitterwood tree is better than taking a decoction of its leaves. There is no doubt but that exercise is one of the best remedies for disease.

5. Another way in which digestion is specially aided, is by the quickening of intestinal activity, which is accomplished by exercise. The food circulates through about twenty-five feet of the small intestine, and it is very likely to become stagnant in some part of the alimentary canal; hence by inducing intestinal activity, exercise stimulates the intestines to action, and by that means promotes digestion.

6. Exercise also aids digestion by increasing the development of the abdominal muscles. When the abdominal muscles become weak and relaxed, so much so that they allow the stomach, bowels, liver, kidneys, spleen, and pancreas to drop down out of place, they very quickly become diseased. Pro-lapsed stomach, liver, and bowels are the result of this relaxation of the abdominal muscles, and this is certain to produce serious trouble in a variety of ways; sometimes the liver is so distorted that it folds upon itself.

In this state of general prolapse there is a continual strain upon the nerves which connect the organs with the abdominal walls; the roots of the nerves remain fixed, so when the organs drop down out of position, the nerves are continually upon a stretch. This is the same as if your arm or any other part of the body were constantly kept on a stretch by a heavy weight; the result is pain in various parts of the body. These pains are often attributed to a wrong cause, but they are due to a prolapse of some of these internal viscera, as the result of weakness of the abdominal muscles.

A knowledge of the effect of exercise upon the excretory organs, particularly of the skin and the kidneys, is very important. It is found that exercise always increases perspiration. There is a constant relation between the fluid that is thrown off through the kidneys and that thrown off through the skin,—the ordinary relation is about as 2 to 1; that is, the amount of fluid removed from the body in twenty-four hours by the kidneys, is about twice as great as that removed by the skin; but, as the result of active exercise, this relation may be reversed, so that the amount of fluid thrown off by the skin may be two and one half times as great as that thrown off by the kidneys. The amount of fluid thrown off by the skin does not necessarily indicate the amount of poisonous matter removed; for the poisonous matter could scarcely be two and one half times as great as that removed by the kidneys.

Only the more important poisons in the secretions of the skin have been recognized by chemists, but that these poisons are of a very deadly character, is known.

It is found by experiment that when an animal is varnished, its temperature gradually falls, the elimination through the skin is destroyed, and it soon dies. It was formerly supposed that death in these cases was due to a too rapid radiation of heat from the body; but recent discoveries have shown that the real cause of the fall of temperature is the interference with the action of the skin, causing an accumulation of poisons in the body. It is found that when a particular poison which has been separated from the perspiration is injected into the skin of an animal, the temperature is lowered. So the accumulation of this poison in the body checks heat production and lowers the temperature.

The purpose of the action of the skin, is to regulate the temperature of the body, as well as to dispose of poisons produced in the body. With the skin in a normal condition, when the temperature of the body becomes too high, exercise will cause the skin to perspire freely, and throw off a large quantity of water, which evaporates and cools the skin, and by this means the temperature is lowered; so the skin is a regulator of heat. When exercising violently, the temperature of the body would rise to a dangerously high degree in a short time, if nature did not obviate the danger by increasing the amount of perspiration.

The chief purpose, as I have said, of the increased elimination of water by the skin, is to lower the temperature. This effect continues after a person ceases to exercise. During exercise, there is little danger of taking cold, because there is an increased production of heat; but after the exercise is discontinued, and there is no activity of the muscles, the increased production of heat ceases; but the increased heat-elimination through the cooling of the body still goes on, and there is great danger that the body will become abnormally cool. That is why there is so much danger of taking cold after exercise.

It is found by careful study and experimentation, as regards the action of the kidneys, that the amount of uric acid and other poisonous substances thrown off by the kidneys is not increased by exercise in one who is accustomed to exercise. Suppose a person has been accustomed to rowing several miles an hour; if he is in good training, the exercise does not increase the amount of uric acid or of waste matters thrown off by the kidneys, probably because the increased amount of oxygen taken into the system

completely burns up the poisons and carries them off as carbon dioxide. There is a great increase of carbon dioxide, or  $\text{CO}_2$ , during exercise, but there is not an increase of nitrogenous waste. However, if a person takes exercise to which he is not accustomed, and becomes greatly fatigued in consequence of the urates and other poisonous substances produced, the amount of these substances thrown off may be greatly increased, especially under diseased conditions. It is because of diseased conditions that persons who take severe exercise find themselves suffering the next day from stiffness of the joints and muscles. The poisons which have been produced have been precipitated into the tissues, and an inflammation has been set up there.

Prof. Bouchard has shown by experimentation the

interesting fact that the quantity of poisonous properties secreted by the kidneys is very much less during exercise than during idleness. It was found, for example, that when a man was made to exercise vigorously in the open air, it required twice as much urinary secretion to kill a rabbit, when it was injected into its veins, as of the urinary secretion produced during idleness. That is, the urinary secretion produced during idleness was twice as poisonous as that produced during exercise; and the probable reason of this was, that during exercise the great quantity of oxygen taken in consumed the most deadly poisons, because these are oxidized by the oxygen; so that the amount of poisonous matters thrown off through this channel during exercise is lessened.

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Health

**PRACTICAL HINTS.**

19-117

HOW NOT TO MIND THE WEATHER.

WHAT makes one feel blue, gloomy, and depressed when the sky is lowery and the atmosphere damp? Some one says, "The weather does not affect me." That is a great mistake. Our feelings naturally go up and down with the barometer. Now and then a person has such a superabundance of good spirits that the weather makes little difference with his feelings; but when one is sick and the vital capital is reduced, then all these changes in the atmosphere are noted. The chronic dyspeptic, the rheumatic and the neurasthenic invalid are barometers in themselves, which record all the changes of the weather. The telephone and some other electrical apparatus are extremely sensitive to changes in the amount of electricity in the atmosphere, and indicate clearly an approaching storm, even though it be miles away. The great mass of brain matter, made up of delicate nerve protoplasm, is infinitely more fully alive and sensitive to atmospheric changes than the tin, iron, and copper wire which make up the telephone. The human body is more sensitive than any physical instrument ever invented.

Now in order to combat these influences, we must make up our minds, when the sky is lowering, that there is sunshine on the other side, and that morbid thoughts shall be resolutely put away. If you say to yourself, "The sky is cloudy, it is going to rain, I am certain that my rheumatic pains will be worse to-day,

that my liver will be troublesome and my head and back will ache," and thus lay out a full program of dismal expectations, it is quite likely to be well carried out. But if you want to make the best of it, you must start out in an altogether different way. Say firmly that you are not going to be trodden under foot by this gloomy weather, that you will be master of the situation, and manufacture sunshine for yourself and other people. Determine to radiate mental and moral sunshine all the day long, and you will find that the reflex influence upon yourself is one of happiness and cheer. Gloom begets gloom, and smiles beget smiles. Note the different effect upon a roomful of people at the entrance of one who is depressed, whose countenance is cast down, and the corners of his eyes drawn down, with one whose face is radiant with smiles and happiness. The one is a veritable thunder cloud, while the other illuminates the whole assembly like a burst of sunshine. Thousands of people make themselves sick by bad diet and other violations of the laws of health, and then charge all the blame on the weather. The trouble is with the patient's internal atmosphere; a storm in the liver, a cyclone in the stomach, "malaria" in the bowels,—not with the weather ~~alone~~. "Never mind the weather" is a good maxim, but not easy for invalids to follow in all cases. Still, we must do the best we can to antagonize this potent cause of no small amount of disease and death.

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FOR COLD-SORES.—Sores of the lips, frequently called cold-sores, but properly known as *herpes*, may often be cured by the simple application of alcohol. As soon as these sores begin to make their appearance, bathe with ninety-per-cent alcohol several times daily. The addition of camphor-gum to the alcohol renders it somewhat more efficient. A one-half-per-cent solution of carbolic acid in alcohol, or a three-per-cent solution of resorcin in alcohol, is also an excellent application.

90-91

RELATION OF HUNGER TO INFECTION.—There is a popular notion to the effect that a person is more likely to take a contagious disease when the stomach is empty. Although this fact seems to be well established by experience, nevertheless it has never been established as a scientific fact until recently. Experiments which have lately been made upon pigeons, by two Italian physicians, demonstrate beyond any reasonable doubt that hunger is favorable to the activity of the infectious element, whatever it may be. Pigeons that had been starved, were found to be very susceptible to the contagion of anthrax, although when well fed, they are not at all subject to this disease. It thus appears that hunger in some way lessens the ability of the body to defend itself from the attack of disease germs. Possibly this may be in part due to the fact that when a person is hungry, there is no gastric juice in the stomach, so that the protecting influence of this digestive fluid is lost. Then, too, the lowering of the vital powers as the result of hunger, lessens the resistance of the cells of the body in general.

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FOR SWEATING FEET.—A frequent question asked is, "What shall I do for constant sweating of the soles of the feet?" A Russian physician recommends painting the soles with tincture of iodine. This remedy is not likely to do any harm, and is well worth a trial. It is stated that two or three applications will effect a cure in the majority of cases.

21-59

to much air

EATING AIR.—The natives of Hind<sup>o</sup>stan say, when they see a man going out to take a walk. "He goes forth *eating air*." This mode of expression seems to be as old as the Hind<sup>o</sup>ostance language. This is what we would commend for our correspondent who wants to know how to make weak lungs strong: ~~Walk~~. Take a walk every day in the open air. Rain or shine, walk out of doors, properly protected, of course, according to the requirements of the weather. The gypsies are said to have a fashion of "eating air," which consists in inhaling the lungs as full as possible, then beating the chest as long as the breath can be held. This practice is probably beneficial by distending the air-cells to the utmost capacity. It should not be employed violently, however, as the effect of too violent percussion of the chest, when distended, might be to overstretch the air-cells.

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76-78

ORIGIN OF HOT-WATER DRINKING.—The famous Dr. Sangrado, of whom the original was Dr. Philip Hecquet, who was born in the latter part of the 17th century, seems to have been the originator of hot-water drinking. Dr. Hecquet was a great advocate of bleeding and copious hot water drinking. He was also rigidly abstinent. For the last thirty years of his life, he neither ate meat nor drank wine.

### THE DISINHERITED.

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76-78

A PHILOSOPHER has said, "It is the greatest of all human felicities to be well born." Unfortunately, not all human beings enjoy this felicity. Indeed, it is yearly becoming more and more apparent that an increasing proportion of human beings are badly born. In every large city are to be found thousands who belong to what are known as the vicious, the criminal, or the indigent or pauper classes. For the most part, these persons are born into the condition in which they are destined to spend their lives, and are little more responsible for the unhappy situation in which they find themselves than are the deaf and dumb, the blind, or those who are in other respects congenitally deformed. The only difference between the infirmities from which these persons suffer and those with which the cripple, the blind, or the deaf are afflicted, is that their physical deficiencies are less conspicuous. They are, nevertheless, as real. For the most part their deformities consist in bad or abnormal construction of the brain, although a minute examination will reveal, in the majority of persons belonging to these inferior classes, external deformities of a very pronounced character.

Another class of deformities which may be recognized, perhaps more commonly among the so-called "upper" classes, include such congenital defects as flat or narrow chest, weakness of the heart, feeble digestive powers, a neurotic temperament, and various idiosyncracies of mind and body.

~~ents is as close as the likeness which can be traced in the external features.~~ Heredity is a force which operates in the most thoroughgoing manner. Every human being is the product of a principle which has been taking careful notes of the lives and habits, the neglects, the excesses, and the abuses of every crime against the body through all the generations from Adam down to the individual man in question.

Man's physical, mental, and moral character is as much a matter of heredity as is the capital of wealth with which he starts out in life. The man who lives the life of a spendthrift and dies bankrupt, leaves his children penniless. Sometimes it takes a series of generations to consume completely the accumulated earnings of preceding generations. So it is with bodily and mental health. The complete mental and physical bankruptcy which lands a man in the insane asylum or an almshouse infirmary, may be simply the result of two or three generations of sins against the body and the soul on the part of profligate ancestors. "The fathers eat sour grapes, and the children's teeth are set on edge."

It is high time that society gave more serious attention to this great class of bankrupts by heredity, from which springs the greater share of crimes and criminals, cranks, lunatics, fanatics, and imbeciles.

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CURE FOR CHILBLAINS.—Apply oil eucalyptus, painting it on with a camel's-hair brush. It relieves the pain, and effects a cure in a very short time.

17  
EXERCISE AFTER EATING.—It has long been a mooted question whether or not exercise should be taken directly after a meal. Experiments made long ago by English physiologists established that very violent exercise after eating prevents digestion altogether. But recently, Drs. Sarmont and Brunelle, two French physiologists, have shown that moderate exercise increases the secretion of gastric juice in the stomach, and hence is an aid to digestion in cases of persons suffering from hypopepsia. It is evident, however, that in cases of hyperpepsia, exercise should be avoided after meals. Exercise seemed to have no effect upon the length of time the food remains in the stomach, that is, it did not increase the strength nor the number of contractions of the stomach, notwithstanding the decided influence upon secretion.

18  
MALARIA AND INDIGESTION.—Dr. Paul de Groot, connected with the Belgian Congo Region, in a work relating to the hygiene of the Congo country, in which a careful study is made of the climate of that region, takes the ground that malaria often begins in that region with digestive disorders. Studies of this question, which have been made by various observers in recent times, have accumulated much evidence in support of the view that malaria is commonly introduced into the system through the alimentary canal, either by drinking water infected

with the parasites, or by receiving the parasites into the mouth through the inhalation of infected fogs. The giant cells exercise a protective influence through the action of phagocytes, a function which they exercise in a high degree. It seems very probable, indeed, that on the disablement of these cells through the toxic influence of the products of indigestion, the system loses its ability to defend itself against the parasitic action of malaria, and thus becomes subject to disease under conditions which would not produce the disease in a perfectly healthy person. Many physicians have noticed the relation between the liver and digestive disorders in malarial disease. This subject is one concerning which we shall doubtless know more a few years hence.

2.

POISONING BY TINNED MEATS.— The extensive use of tinned meats, such as corned beef, ox-tongue, etc., at the present time, renders it important that the public should be informed of the fact that such meats are not infrequently the cause of dangerously poisonous symptoms. In a case reported in a recent number of the *British Medical Journal*, five persons were made very sick by eating a portion of freshly opened tinned ox-tongue. Two of the persons barely tasted the meat, one ate a portion as large as a shilling, and two others only ate an omelet which had been divided by a fork which had previously been used in carving the tongue, and had not been washed. The symptoms were severe pain in the abdomen, uncontrollable vomiting and purging, and collapse. Two of the

persons were for some hours in great danger of death. One was unconscious for several hours. In the worse cases the patients were very ill for several days. The peculiarity of poisoning of this sort is that the poisonous effects are not apparent immediately, but only after there has been time for the development of the germs which have been swallowed, and the production of the ptomaines which are the immediate cause of the poisonous symptoms.

MUSCLE-FORMING FOOD.— ~~The best muscle-forming food for everybody is fruit.~~ This is the kind of food out of which the horse and the gorilla make their muscle. The gorilla is said to be the strongest animal on earth. He will take the barrel of a gun and bend it across his arm with perfect ease, or tie it into a knot in an instant. He can kill a hunter with a single blow of his fist. Two or three of them will leap on to the back of an elephant, and beat him to death with clubs. The gorilla lives on fruits. ~~Sometimes he will steal into a cornfield,~~ where they are roasting ears of corn, and carry off the corn when it is soft in the milk. He is also fond of melons.

It is interesting to watch gorillas when they are robbing an orchard. They form in a long line from the orchard out into the woods, some little distance apart, and send out sentinels to watch while the others steal the fruit. The one who gets up into the tree first will pick an apple and toss it to the next one, and he to the next one, and he to another one, just as firemen pass a pail of water from one to another. ~~These animals live upon fruits, and I think this is the secret of their great strength.~~ Then why should not man, the king of creation, the king of animals, live on an equally refined and elevated diet?

could doubtless  
this is the secret  
of his great strength

strong being

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THE FEEDING OF CHILDREN. — Let each child have its own spoon, cup, knife, fork, and other dishes. The uncleanly as well as dangerous custom of chewing the baby's food by the mother or nurse before giving it to the little child, is one which should not be tolerated for a moment. The combined mixture of pus from decayed teeth, oral catarrh, and suppurating gums, is in the highest degree unwholesome, not to speak of the tubercular bacilli and other disease germs which may be present in the secretions of the mouth.

Children should never be allowed to chew gum promiscuously, nor to put slate or lead pencils in the mouth.

The necessity for these cautions may be readily demonstrated. Suppose a family whose members all seem to be in the best of health. They are in the habit of using dishes promiscuously. One of the children complains of sore throat, and within a day or two it develops into malignant diphtheria. All those children who have been using the same spoon or other utensils used by the sick child, are infected, and thus the whole family may be exposed to that most dread disease.

11-182

DIET AND WORK.

A FEW years ago, Dr. Frankland, an eminent English chemist, made a very extended series of experiments for the purpose of determining the value of various articles of food in sustaining the strength during severe muscular effort. The following table prepared by him shows the amount of various articles of food required to enable a man to raise his own weight to a height of 10,000 feet, as in going up a mountain of that height, ~~showing~~ also the comparative cost of the several classes of food in England: —

15

The table should

	Price per lb. (in cts.)	oz. required.	Cost. (in cts.)
Oatmeal.....	5½	20.5	7
Flour.....	5½	21.0	7½
Peameal.....	6½	21.4	9
Bread.....	4	37.5	9½
Potatoes.....	2	81.1	10½
Rice.....	8	21.5	11
Cabbage.....	2	192.3	25½
Hard Boiled Eggs.....	13	35.3	30
Milk (per quart).....	10	128.3	32
Lean Beef.....	25	56.5	88

12-376

It will be observed that nearly three times as much lean beef as of oatmeal is required to enable a man to perform the same amount of labor, and the cost is more than twelve times as great. This fact ought to be a sufficient answer to those who argue against the employment of fruits and grains as an exclusive diet, that they are not sufficiently nourishing to sustain physical and mental vigor.

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FATAL SAUSAGE POISONING.— Since sausage is so frequently the cause of fatal poisoning, it is truly surprising that intelligent persons will continue the use of so questionable an article of diet. Doctors Mitchell and Wesener, of Chicago, recently reported two cases of fatal poisoning from the use of sausage, one, that of a little girl aged five, the other a boy aged three. The two children ate raw a quarter of a pound of Frankfort sausage. Within half an hour after eating the sausage, the children were taken sick, became unconscious, and were blue in the face. The mother and three other children were ~~also taken sick~~ at the same time, but these vomited and recovered. The two children, however, did not vomit, and died within three or four hours after partaking of the sausage.

5-379

*benzene*

24

THE ACTION OF ACIDS UPON DIGESTION.— The question is often asked, What harm is there in the use of vinegar and other acids of that sort?— Vinegar is a most pernicious acid. Sir William Roberts, of England, has shown by experimentation, that one part of vinegar in 5000 parts of digestive mixture delays starch digestion in the stomach. One part in 2000 increases the length of time three and one half times. In the proportion of one part to 1000 of digestive mixture, the time of digestion is eight times as long as normal, and in one to 500 there is no digestive action at all. A teaspoonful of vinegar at a meal would practically destroy starch digestion, as it would delay it thirty minutes, and by that time the gastric juice would have become so acid as to prevent further action.

7-59

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VAGARIES OF DIGESTION.— The stomachs of certain persons seem to be possessed of marked peculiarities, as the result of which certain articles of food which agree perfectly well with most people, give rise in them to very unpleasant symptoms, such as oppression or burning, headache, and occasionally slight fever. These symptoms sometimes occur as the result of eating strawberries or honey, ~~but~~ they are, however, more likely to arise from eating shellfish, lobsters, oysters, and clams. Some people cannot eat buckwheat, and there are cases in which even oatmeal produces a peculiar eruption of the skin. These instances are, however, very rare. The poisonous and sometimes fatal effects resulting from the use of oysters, are due to the constant presence in these bivalves of a poison discovered by Brieger ~~+~~ mitylotoxin.

10-58

*called*

affected; thus in renal insufficiency due to disease of the arteries, a malady which especially affects the old, it is necessary for us to have recourse to this regimen.

"As for myself, I have found in the vegetarian regimen my own cure, and am happy to be permitted to thus pay a debt of recognition in calling the attention of the American public to this vegetarian regimen, which is one of the most essential pillars in the system of hygienic therapeutics which I maintain."

28

APPLES FOR GOUT.— The famous Dr. John Hunter, one of the most eminent physicians of his time, and himself a sufferer from gout, found in apples a remedy for this very obstinate and distressing malady. He insisted that all his patients should discard wine and rare roast beef, and make free use of apples.

15-253

Doubtless an apple diet would be found as useful a preventative as a cure.

21

PROPER DIET FOR WEAK KIDNEYS.— By weakness of the kidneys ~~is~~ ~~not~~ ~~meaning~~ inability to retain the urine, or frequent urination, to which the term is frequently applied, but a condition of the kidneys in which they are partly disabled, and secrete an insufficient amount of urine. Prof. Dujardin-Beaumez

part long since

recently published, in a leading French medical journal, the following note upon the diet in cases of this sort:—

"Two principles should form the basis on which is built the dietary for patients suffering, not only from urinary insufficiency, as in albuminuric cases, but in all cases where the kidneys are diseased, or where they do not act properly: (1) To prevent, as far as possible, the formation of poisonous products or toxins in the system; (2) To reduce to a minimum the toxins which may exist in the food. Hence all forms of meat should be forbidden, especially game, which is apt to be tainted, for it is an error to suppose that the various sorts of meat do not contain ptomaines. For the same reason, mollusca, crustacea, the codfish, etc., should be interdicted. As to aliments which may be allowed, the first place should be given to eggs well cooked, as they have no influence upon the production of albuminuria. Then follow omelettes and starchy matters, as of potatoes and peas, also green vegetables, well cooked."

17-196

The vegetarian regimen does not follow, not all while the symptoms of the disease are <sup>active</sup> ~~present~~, but ~~initially~~

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## THE BEEF TEA DELUSION.

22

The late Dr. Austin Flint remarked on one occasion that thousands of patients have been starved to death while being fed on animal broths, beef tea, etc. No error could be greater than the notion very commonly held by the laity, and still quite too largely entertained by the members of the medical profession, that beef extracts, beef tea, bouillon, animal broths, etc., are peculiarly nourishing in character. We can adduce no better evidence to the contrary than is afforded by the following paragraphs from "Bunge's Physiological and Pathological Chemistry," one of our latest and most reliable authorities:—

37-195

"We must guard against supposing that meat bouillon possesses a strengthening and nourishing influence. In regard to this, the most delusive notions are entertained, not only by the general public, but also by medical men.

"Until quite recently the opinion was held that bouillon contained the most nutritive part of meat. There was a confused idea that a minute quantity of material—a plateful of bouillon can be made from a teaspoonful of meat-extract—could yield ~~an effectual source~~ of nourishment; that the extractives of meat were synonymous with concentrated food."

a large amount

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BEAN CHEESE.—A variety of cheese known as *tofu* is much used by the Japanese. It is made from the soja bean, which, after soaking for twelve hours in water, is ground to a uniform pulpy mass, then boiled for an hour in three times its quantity of water, and afterward filtered through a cloth. The milky liquid thus obtained is allowed to stand two or three days, when lactic acid develops, by which the vegetable casein is separated as in sour milk. Ten per cent. of concentrated brine is added by constant stirring, which causes a flocculent precipitate. This is separated by a cloth filter, and is formed into tablets by a slow pressure. *Tofu* is eaten in the form of soup and in many other ways. The solid nutriment which it contains amounts to only about ten per cent. Sometimes the greater part of the water is separated by freezing, and the block of frozen *tofu* afterward allowed to thaw in the sun. When prepared in this way, the proportion of solid nutriment, chiefly fat and vegetable casein, is nearly eighty per cent.

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~~270~~  
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23

*which furnishes a practical stand point from which to study the subject.*

*Rightly*

*by the same people*

*grow 5*

**Eccentricities in Diet.**— It is sometimes useful for those who imagine that the appetite is always a safe guide in matters of dietetics, to consider the ~~subject from the practical standpoint of a study of the~~ dietary of different nationalities. A traveler has taken pains to gather the following illustrations of the differences in taste manifested by different nations:—

“The preference of the Chinese for food that seems to our appetites absolutely disgusting, is well known. In Canton, rats sell for fifty cents a dozen, and dogs' hind quarters command a higher price than lamb or mutton. Fancy eating birds' nests worth thirty dollars a pound! This is what a mandarin revels in. The French have beguiled us into eating frogs' legs, which were once tabooed in this country, and we have even come to esteem diseased goose liver, in the form of *paté de foie gras*. The writer has met Brazilians who rave over boa-constrictor steaks, and count monkeys and parrots a very good meal. In the West Indies, baked snake is a common dish, as the reptiles abound, and it is a good way of getting rid of them. But when it comes to frying palm-worms in fat, one would think the stomach would rebel. It is not so, however, though by a strange inconsistency, stewed rabbit is looked upon with disgust. On the Pacific Coast the Digger Indians eat dried locusts, and in the Argentine Republic, skunk flesh is a dainty. Our own favorite bivalve, the oyster, is very disgusting to a Turk; while the devil-fish, eaten in Corsica, is equally so to us. We cannot understand, either, how the inhabitants of the West Indies and the Pacific Coast can eat lizard's eggs with a relish; still less, how the eggs of the turtle and alligator can become a favorite article of diet. The Brazilians eat ants, probably to get rid of them, for they literally infest the country, and ~~are of an~~ enormous size. It is easy to pick up a handful of ants almost anywhere, though the wary do not go about it in this way, as the pestiferous insects bite in a most vicious manner. A curry of ants' eggs is a great delicacy in Siam, and the Cingalese eat the bees whose honey they have stolen. The Chinese, ~~who seem to have stomachs like the ostrich,~~ eat the chrysalis of the silk-worm, after unwinding the cocoon. Spiders are used in New Caledonia as a kind of dessert, while caterpillars are also relished by the African bushmen.”

13

5-379

DOGS AND CONSUMPTION.—Dr. Megnin, of the Paris Academy of Science, asserts that lap-dogs are one of the great agencies in the spread of consumption or tuberculosis. Ladies who are in the habit of kissing their lap-dogs should remember this.

DRINKING-WATER A SOURCE OF MALARIAL DISEASE.

The well-known investigations of Laveran and his successors have very clearly established the fact that the real cause of malarial disease is not a miasm, as

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FIG. 1

was formerly supposed and as the name would indicate, but an animal parasite which by some means finds entrance into the blood, where it thrives and multiplies at the expense of the blood corpuscles. The accompanying cuts (Figs. 1 and 2) show some of these parasites in different stages of development.

How and where parasites develop outside of the body, and how they get access to the blood, are questions which have been studied with great interest by physicians in different parts of the world, particularly in malarious portions of Italy and in the vicinity of Rome and in Algeria. Recently interesting studies of the subject have been made in this country, particularly by Dr. Richard H. Lewis, secretary of the North Carolina Board of Health. Dr. Lewis has, by correspondence with a large number of physicians and laymen, obtained indubitable evidence, in North Carolina at least, that malarial disease is connected with the use of bad drinking-water, particularly surface water. It is the almost universal testimony of Dr. Lewis's correspondents that while using water from shallow wells, they suffered much from malarial disease, but on exchanging this for cistern water or water from good springs or deep driven wells, they have enjoyed almost absolute immunity from malarial fever.

Dr. Lewis has collected a large amount of testimony in support of his theory that malaria is usually contracted through the use of drinking-water. We quote some extracts from his interesting paper in the December number of the *Sanitarian*. The following is from Laveran:—

"1. There have been observed cases in which, in the same locality, persons living in identical condi-

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447

tions, but using drinking-water from different sources, the one group being attacked in a large proportion, while the other group of persons are scarcely affected at all.

"2. In certain otherwise unhealthy localities the paludal fevers have been seen to disappear by supplying pure drinking-water instead of the previously used stagnant waters.

"3. In localities otherwise healthy one can contract intermittent fever by drinking water from an

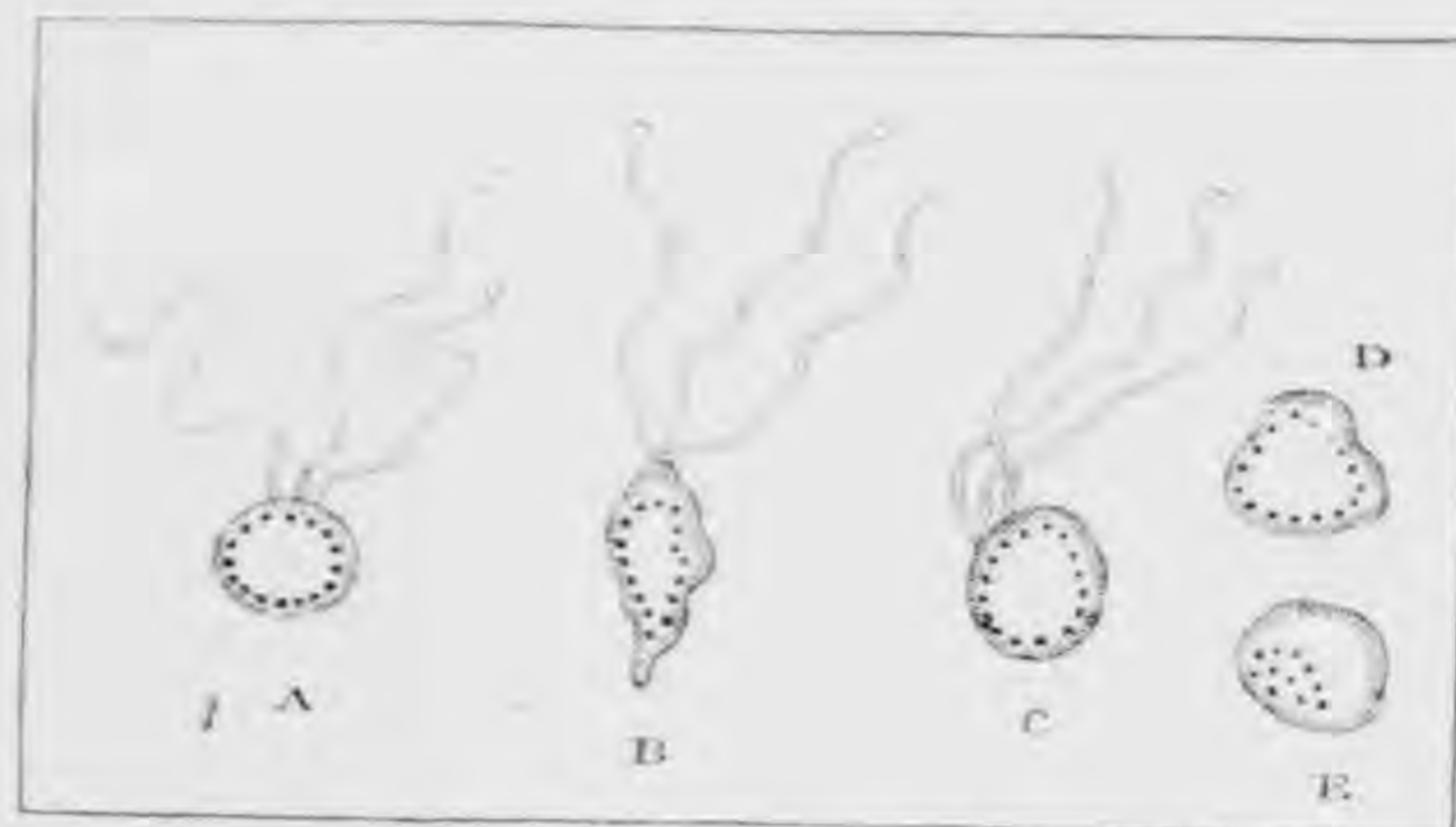


FIG. 1

unhealthy locality. The persons most affected are those who drink the water most freely.

"4. Travelers in malarial countries have found that on boiling their drinking water they escape the disease in a large proportion of cases."

The following instances are cited as illustrations of the contraction of disease through the use of drinking-water:—

"In 1884 a party of workmen sent to repair a bridge over the Chuka, drank of this stream, and out of thirty only three escaped fever, while several of them died."

"One hundred and twenty soldiers embarked in the 'Argo,' for transport from Bona, in Algiers, to Marseilles. During the voyage one hundred and eleven of them, thirteen of whom died, suffered from different forms of malarial fever. Two other vessels, carrying between them six hundred and eighty soldiers, also from Bona, and arriving at Marseilles the same day as the 'Argo,' had no case of illness at all, and the only ascertainable difference of circumstance between the troops in these ships and those in the 'Argo' was the difference of drinking-water. The latter were exceptionally supplied with water, which was said to have an unpleasant smell and taste, from a marsh near Bona; those on the other ships were supplied with good water. Finally the nine soldiers on the 'Argo' who escaped were said to have purchased wholesome water from the crew of that vessel."

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"In January, 1866, a company of forty healthy marines were sent to the navy yard of Pensacola, Fla. During the first year, frequent attacks of malaria began to show themselves among these men, which increased in number during the second year, and during the third year the disease became so prevalent that before August twenty five of the party were in the hospital at one time. During this year they were so broken down that they were all sent to Norfolk, Va., where they all recovered. These marines drank the water from a driven well at the yard. The officers and their families drank only from a cistern, and no case of malaria appeared among them, proving that the wells were probably the cause of the sickness among the marines."

Many ~~other~~ similar accounts have appeared in medical literature within the last few years. It is entirely possible that malaria may sometimes be communicated through the air. The spores of malarial parasites, as well as those of microbes and particles of dust, may be carried by fogs, and may be thus received into the body. But the evidence is rapidly accumulating that the most common source of malarial disease is to be found in the use of contaminated drinking-water.

29

FOR MOSQUITO BITE.—Numerous remedies have been prescribed for mosquito bite, but a German writer says that ordinary soap is as good as any of them. He always carries a small piece with him on his country excursions, and in case of a bite, makes a lather over the affected part, and allows it to dry on. The burning is at once relieved, and all pain disappears. Should it return, as sometimes happens, it is necessary to repeat the application.

7-59

TUBERCULOSIS AND BEDBUGS.—A European physician calls attention to the fact that consumption may be communicated by bedbugs. A young man slept in a bed which had been previously occupied by a consumptive, and contracted the disease. It was afterward found that he had been frequently bitten by bedbugs, which had evidently infested the bed during its use by its previous occupant. The bugs probably derived their germs from the sputa of the tuberculous patient, or from infected linen. It is entirely possible that fleas may operate in the same way. A knowledge of this fact ought to ~~give rise to~~ an active effort on the part of all householders for the extermination of these vermin.

14  
7-90  
*science*



BREATHING AND LIVER ACTION.— The circulation of the blood through the liver, and hence all the functions of the liver, are greatly aided by the action of the chest and diaphragm in breathing. When the chest wall is lifted outward in the act of inspiration, air is not only drawn into the chest, but blood is also drawn toward the heart. Deep breathing is thus a very important means of aiding both the stomach and the liver in their work.

5- 9-27

DISPOSAL OF SWEEPINGS AND OTHER HOUSEHOLD DIRT.— If the habit was formed of burning all the combustible household dirt and all rubbish of the backyard once or twice a year, our premises would be much cleaner and more pleasing to the eye. Old rags, paper, bones, dilapidated barrels, pails, tubs, and other organic material collect, and by becoming wet, decay and form a refuge for disease germs, to say nothing of worms, rats, mice, and other vermin. The household dirt swept out at the back door is blown in again by the next gust of wind from that direction. A green, nicely kept lawn, both back and front of a house, will do much to keep the house and basement clean. The short, fine, thick grass, especially if kept moist and growing, will entangle the street dirt and keep it from entering the dwelling. So a nice lawn is not only a source of pleasure to the eye, but is a hygienic agent not to be overlooked when we consider the ingredients of ordinary street dust, and think of taking in this foul compound in our food and drink, and wearing it in our clothing. Green trees and shrubs, if not too close together, or so near the dwelling as to shut out the sunlight, also serve the same purpose.

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11-185

WINTER SUFFOCATION.— "Barricaded against fresh air" is the condition of nine tenths of ~~all~~ the houses in <sup>all</sup> civilized lands at the present moment. Every crack and cranny, every knot-hole, and even the key-hole of the door, is stopped effectually against the entrance of God's life-giving oxygen. Is it any wonder that so many faces come out pale and sallow in the spring, and that early summer flowers blossom over so many newly made graves? "Starved to death for want of pure air," SUFFOCATED, might be truthfully written on thousands of tombstones, but most of them bear, instead, some pious cant about a "mysterious dispensation of Providence which has removed this loved one from our midst," when it is a suicide or a homicide,—a dispensation of ignorance and bad air.

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COLD FEET.— ~~At this~~ season of the year thousands of persons suffer almost constantly with cold feet. The chief causes are thin shoes or boots, neglect to protect the feet from dampness, sedentary habits, and diseases which disturb the circulation, such as dyspepsia, etc. ~~So much for the causes. What are the remedies? Here is one.~~ Change the stockings for clean ones daily, and bathe the feet every night with cold water, according to the following directions: Pour into a pail or foot bath-tub about a pint of water, or ~~sufficient~~ so that when the feet are placed in the water, it will rise about them to the extent of one-fourth or half an inch. Hold the feet in the water for about ten minutes, and then take out and rub dry and warm. In some cases it is better to bathe the feet with hot and cold water in alternation, applying the water with a sponge, or simply dipping the feet into pails of water of different temperatures, one as hot as can be borne, the other of the temperature of the surrounding air or even colder.

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12-379

If you ~~wish to~~ have warm feet, by all means avoid the common habit of toasting them over a stove or register. This of itself is a potent means of causing chronic cold ~~of the~~ feet.

would

TO REMOVE SUPERFLUOUS HAIR.— The best radical means for removal of superfluous hair is electrolysis applied by means of a fine needle to each hair follicle. The best means for temporary removal of the superfluous capillary growth, is barium sulphate, which may be obtained in the form of powder. It is used by mixing two parts of the powder to one part each of starch and oxide of zinc. Sufficient water is added to form a soft paste. This is spread upon the surface from which the hair is to be removed, and scraped off after ten minutes, when the skin will be found to be smooth.

13-347

TO DESTROY LICE.— An excellent remedy is a strong decoction of quassia, four ounces to the quart of water, to which an ounce of borax and four ounces of glycerine have been added. Thorough application of kerosene is also an excellent remedy. It should be left on for a few minutes, and then removed by means of a soap shampoo.

34

15-284

Body lice may be destroyed by the application of a solution of one part of corrosive sublimate in 500 parts of vinegar. This solution is a very deadly poison, and should not be applied to the body in general—only to the parts infected. The parts should be first washed with soap and water, then, after removing the soap, the solution should be applied. After an hour or two, the parts should be washed with warm water.

11  
Dilatation of the Stomach

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As digestion requires that food should be not only moistened but penetrated by the gastric juice, it is necessary that it should *not be fatty in character*. It is not the duty of the stomach to digest fat, and fats may prevent it from digesting that which it should digest, by preventing the solution of hydrochloric acid, which represents the gastric juice, from moistening, penetrating, and hydrating the food substances. It is important that fatty substances should be in a state of emulsion, as in milk.

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LONGEVITY IN PRUSSIA

THE German government has recently collected some interesting statistics relating to longevity in that country. From the facts collected it appears that in 1888 there were ninety-one persons in Prussia, who were over a hundred years old. Between 1864 and 1888, upwards of 7,000 persons over one hundred years of age died, and of these one hundred and fifty-five were more than 109 years old. A study of these statistics will develop a very interesting and significant fact. If between 1864 and 1888, 7,000 persons died at the age of over 100 years, the number of deaths of this age in each year may be ascertained by dividing 7,000 by 24. The result is nearly 300, which represents the minimum average number of persons of this age alive in each year between 1864 and 1888. This does not represent the total average number of persons alive in each year between those periods, since 155 persons died who were more than 109 years of age, and there must have been at least nine times that number who were over 100 years of age, as it is not at all unlikely that there were more deaths of persons at each age less than 109 and upwards of 100 than persons over 109. Multiplying 155 by 9, and dividing by 24, gives us 58, which added to 292 gives exactly 350 as the minimum average number of persons over 100 years of age alive each year between 1864 and 1888. In 1888, however, there were but 91 persons alive in Prussia who were over 100 years of age, indicating a very great decrease in longevity within twenty-four years.

17-152

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PAIN KILLERS

33

THE charlatan always finds a rich field for his exploits in quackery in the multiplicity of aches and pains suffered by human beings, especially in civilized countries, and does not hesitate to avail himself of his opportunities to the fullest extent.

The uneducated or unthinking person, when suffering pain, cares only for relief from pain, without consideration of the means by which the relief shall come, or of the relation of the remedy to the causes by which the pain may be produced. Pain is not in itself a disease, it is only a symptom. To relieve pain by the use of a narcotic of some sort, is simply

18-105

an obscuring of the indication which nature is holding out for the purpose of calling attention to some morbid condition which needs to be relieved, of which the pain is merely a sign, and not the thing itself. ~~We herewith present analyses of a large number of popular "pain-killers," which we have gathered from a variety of reliable sources.~~ Pain should be relieved by the removal of the cause, not by the "knock-down argument" of a narcotic. "Pain killers" are among the most pernicious of drugs, and often aggravate and perpetuate the very maladies for which they are used. In hundreds of instances the opium habit has been acquired by the use of these narcotic nostrums. Thousands of babies have been killed by the employment of these dangerous "quieting potions."

29

A SURE CURE FOR SEA-SICKNESS. — ~~At this season of the year, many persons are making plans for a trip across the ocean, and at the same time are making calculations on suffering during a greater part of the voyage, from sea-sickness, always the bane of ocean travel.~~ A fit of sea-sickness lasting from two or three days to a week is by no means refreshing in its effects upon an invalid who is traveling abroad for rest and

15-155

recuperation. A great variety of remedies have been tried for the relief of this most disagreeable malady. With one exception, however, none of these have proved efficacious; but Dr. Chapman, of London, has proposed a remedy which is at least so effective as a palliative that it may be said to be almost a panacea. The remedy is as simple as it is effectual. It consists in the application to the spine of a rubber bag filled with ice or ice-cold water. Every ocean traveler should carry with him a spinal ice-bag, which can be obtained from any dealer in rubber goods. Within a short time after the application, the nausea and vomiting ceases, and the victim of *mal de mer* falls asleep. No harm comes from the use of ice in this manner. The patient does not even suffer from chilliness or other disagreeable sensations. If the application of the bag directly to the skin is found to produce too intense sensation of cold, it should be covered with one thickness of flannel.

~~34-173~~

WORK AND LONGEVITY. — An English statistical report enumerated 33 persons upwards of 100 years of age alive in Great Britain in the year 1893. The oldest of these, as usual, was a woman; her age was 116. One of the most striking facts in relation to ~~these~~ centenarians is that they have lived lives of simplicity and industry. In commenting upon this fact, the London *Lancet* remarks:—

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35-70

"If in any direction it is allowable for competitors in the race of life to dispense with self-control, it would appear that they may to a great extent use this liberty with respect to physical and mental exertion.

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Nature has made large allowance for the inevitable necessity of labor, and has even practically in some cases sanctioned an overstrain of energy, provided that due care be taken to conserve the vital powers by temperance in other things."

It is not useful work, but worry, which kills men. Overwork of the stomach, liver, or kidneys is vastly more damaging to a man than overwork of the brain or muscles, since so long as the stomach is intact, overworked muscles may be easily repaired, and so long as the liver and kidneys retain their integrity, the consequences of excessive brain work are easily removed by the elimination of the resulting poisons from the body. Millions die from overwork, but it is overwork at the dinner table rather than in the field, the workshop, or the counting room. Hard work is healthful. The majority of men, and women ~~also for that matter,~~ are suffering, not from overwork, but from too light work. More work of some sort is required. It may be more mental activity or more muscular exercise. Evil results from work flow not from excessive work, but from the neglect to give each class of organs its due and proper amount of exercise.—

HYGIENE OF THE MOUTH.—Everybody ought to know that the mouth is a first-class breeding-place for germs. The coat on the tongue, the tartar which accumulates about the teeth, the yellow coating on the teeth, and the bad taste in the mouth, are all due to germs. In persons who breathe through the mouth the accumulation of germs upon and about the teeth is much greater than in those who carefully avoid mouth-breathing, for the reason that when the air is drawn in through the nose, the germs are filtered out, the outgoing breath being found to contain no germs.

Particles of food which accumulate between the teeth afford a fertile soil for the development of germs; hence the importance of cleanliness. The teeth should be thoroughly brushed and cleaned immediately on rising in the morning, just before retiring at night, and before and after each meal. Cleansing after the meal is quite as important as cleansing before the meal. Carious teeth should receive immediate attention, as tuberculosis and other diseases sometimes find entrance to the body through the medium of decayed teeth.

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POISONING FROM CASTOR BEANS.—It is perhaps not generally known that castor beans are extremely poisonous. A case recently occurred in which a young lady nearly died from eating a single bean.

19-103

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HOW NOT TO TAKE COLD. — At this season of the year, how to avoid taking cold is a most important practical question. Catarrh, whether nasal, pharyngeal, laryngeal, or pulmonary, generally finds its origin in a severe cold or a succession of colds.

The real cause of taking cold is the inability of the system to react after a chilling of the surface. Savages are practically as free from colds as are wild animals. A susceptibility to taking cold is one of the penalties, and a heavy one too, which we pay for wearing clothes and living in heated houses.

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Some years ago the writer spent a few days among the Yuma Indians, studying their habits. He found them living in a perfectly primitive state, the younger members of the tribe wearing no clothing at all, and the older ones wearing aprons, or "G" cloths. A few of the children had been gathered into a mission school, and while in the school, they wore clothing. There was a general prejudice against the school on the part of the older Indians, however, due to the fact that the children who attended school were less healthy than the others, and were beginning to suffer from catarrhs, sore throats, and various maladies previously unknown to them.

10-59

The celebrated African traveler Rholfs found the chieftain of a wild tribe suffering from a terrible nasal catarrh. He was the only member of the tribe who thus suffered, and was likewise the only one who wore shoes and stockings.

The German empiric, Pastor Kneipp, compels his patients to go both barefooted and bareheaded. An hour's tramping in the wet grass is one of his favorite prescriptions.

The only way to cure a propensity to take cold is by hardening the body. This will be best accomplished by wearing as little clothing as is consistent with comfort, sleeping under light covers at night, in a cool, well-ventilated room, and taking a cold bath followed by a vigorous rubbing, and, if necessary, the application of a little oil, every morning.

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TO BREAK UP A COLD. — ~~At this season of the year,~~ A cold is one of the most common of accidents. An ordinary cold is usually cured in from two to six weeks, but not infrequently a hard cold leaves behind it relics, recovery from which may require months or even years. Sometimes a fatal disease finds its beginning in a neglected cold. One of the best means of breaking up a cold, especially if taken by getting the feet wet, is to take a hot mustard footbath, which may be made by adding a tablespoonful of ground mustard to two gallons of water as hot as can be borne, in an ordinary footbath or a wooden pail. The bath should be continued fifteen to thirty minutes, or until the skin is well reddened and tingling. While taking the footbath, swallow one or two pints of hot water or hot tea of some sort, — catnip, wintergreen, cinnamon, or almost any herb tea will

answer the purpose. It is, of course, the hot water that produces the effect, so that it is a matter of small consequence what is used as flavoring.

After the footbath, dry the feet quickly, go to bed, and have applied over the part in which the cold seems settled, an ordinary towel wrung out of cold water, sufficiently dry so that it will not drip, and cover it with several thicknesses of flannel or sheet cotton, so as to keep it warm during the night.

If the seat of the cold seems to be in the lungs, the compress should be applied over the chest, and also the back of the shoulders. The compress should be large enough to cover the whole surface of the chest, that is, the whole of the upper part of the trunk, or that portion in which the ribs lie.

If the attack is a severe one, so that a serious illness is threatened, the patient should stay in bed for one or two days, or in bad cases, for a longer time, as may be indicated. The footbath and the hot drink should be repeated each day until the patient is relieved, and the cold compress should be renewed night and morning.

In case the compress becomes cold during the night, it should be covered with oil muslin or rubber cloth, so as to prevent evaporation. If the bowels are inactive, empty them by means of a large colocyler of hot water, as hot as can be borne. The diet should be sparing; it should consist of fruits and grains. Hot water should be taken plentifully. At least two or three quarts should be taken in the course of twenty-four hours.

# THE HOME GYMNASIUM

## INCORRECT ATTITUDES IN SITTING, AND THE RESULTING EVILS.

BY J. H. KELLOGG, M. D.

THE habitual attitudes assumed by an individual are as truly a mold which determines the shape and

(Fig. 1) presents the outline of the figure of a young woman in whom double curvature of the spine existed as the result of a wrong position in sitting and standing. Fig. 2 shows how curvature is readily



FIG. 1.



FIG. 2.

symmetry or asymmetry of the individual as is the bottle for the cucumber made to grow inside of it.

This is especially true of young persons when engaged in study at school or employed as accountants, in sewing, or in other occupations which necessitate the maintenance of a nearly uniform attitude for some hours daily.

The bones of young persons are flexible, hence easily yield to a continuous strain placed upon them. The same is still more true of other structures. The neglect to recognize this fact is so nearly universal that among persons of sedentary habits very few are free from deformities of some kind.



FIG. 3.

Among the most common of these deformities is curvature of the spine. The accompanying figure



FIG. 4.



FIG. 5.

produced by a wrong position of sitting at a desk or table.

A difference in the level of the two shoulders is



character, and never think of inquiring how much they are worth. We meet with such now and then, who at eighty retain something of their youthful freshness of feeling and warmth of heart.

If there was a wolf constantly following any of us

**THE OLD WORLD'S OLD FOLKS.**—A German statistician has studied the census returns of Europe to learn a few things about the centenarians of the Old World. He has found, ~~for instance~~, that high civilization does not favor the greatest length of life. The German empire, with 55,000,000 population, has but 78 subjects who are more than one hundred years old. France, with fewer than 40,000,000, has 213 persons who have passed their hundredth birthday. England has 146; Ireland, 578; Scotland, 46; Denmark, 2; Belgium, 5; Sweden, 10; and Norway, with 2,000,000 inhabitants, 23. Switzerland does not boast a single centenarian, but Spain, with about 18,000,000 population, has 401.

The most amazing figures found by the German statistician, says the *New York Sun*, came from that troublesome and turbulent region known as the Balkan Peninsula. Serbia has 575 persons who are more than one hundred years old; Roumania, 1084; and Bulgaria, 3883. In other words, Bulgaria has a centenarian to every thousand inhabitants, and thus holds the international record for old inhabitants. In 1892 alone there died in Bulgaria 350 persons of more than one hundred years of age. In the Balkan peninsula, moreover, a person is not regarded as on the verge of the grave the moment he becomes a centenarian. For instance, in Serbia there were, in 1890, some 290 persons between 106 and 115 years, 123 between 115 and 125, and 18 between 126 and 135. Three were between 135 and 140.

Who is the oldest person in the world? The German statistician does not credit the recent story about a Russian 160 years old. Russia has no census, he says, and except in cases of special official investigation the figures of ages in Russia must be mistrusted. The oldest man in the world is then, in his opinion, Bruno Cotrim, a negro born in Africa, and now resident in Rio Janeiro. Cotrim is 150 years old. Next to him comes probably a retired Moscow cabman, named Kustrim, who is 140. The statistician says the oldest woman in the world is 130 years old, but neglects to give her name or address, possibly out of courtesy; or perhaps in view of the extraordinary figures which came to his hand from the Balkans, he thought a subject only 130 years old was hardly worthy of particular mention.—*Scientific American*.

to worry out our lives, would we not at once try to have it destroyed? The same course should be pursued with regard to the many little wolves,—the cares and trials of life which strangle our happiness and destroy our health.—*Journal of Hygiene*.

**KEEPING YOUNG.**—It is well, from time to time' to look over the prime requirements for keeping the body long in its youthful state of bouyancy. Sleeping enough should head the list. Evenings should in the main be spent in simple and quiet ways, and so that when nature's invitation comes, one can accept promptly. When fairly slept out and awake, rise at once. The body loses tone by unnecessary repose. In the next place, be chary of all stimulants. Give them a little investigation, and they will appear less and less profitable, as you reflect on their borrowing-but-not-returning action. The third essential is that a fair amount of time be spent in exercise and in the open air. Those whose work is indoors often need to study their affairs and habits in this respect.

As for work, to many the advice seems of no avail that they should work enough but not too much; because they conceive that their duties call for certain things that must be done anyhow. The truth is that most can be accomplished by temperate work. Frequent changes in the sort of work done help the body immensely in achieving the maximum that it can do cheerfully. Many who have carried their youth into an active old age call this their secret. Such changes bring now one and then another power or function of the body into play. While one is active, the others not only rest, but get some sort of sustenance which they need from the by-products of work in the organ that is busy with the one activity. There are certain subtle reactions that come to pass in each organ of the body, through the agency of the nervous system, as a result of action in the other organs. Now the advantages of change of work are more evident. So, a bookkeeper in a store who now and then takes a hand at unloading goods has a better chance for health than one who sticks to the books.

The other factors in personal hygiene, of course, all come in the problem of keeping young. The deliberate cultivation of the habit of taking things cheerfully is to be mentioned finally, though not of least importance. That has to do with nerves, organs, and the man himself. As Robert Louis Stevenson so well said: "Cheerfulness and gentleness, these are the prime virtues."—*C. W. Lyman, M. D., in the Voice*.

## EXERCISE PURIFIES THE BODY.\*

BY J. W. KELLOGG, M. D.

We all know what happens to a stagnant pool when there is an absence of exercise or movement in the water; it becomes covered with slime, and gives off offensive odors. But let a running stream be turned into the stagnant pool, and it carries away the slime and filth, and makes the water pure, and the pool soon becomes a pellucid lake instead of a stagnant frog-pond.

In the body which is not subjected to exercise there is the same accumulation of unwholesome things and the same giving out of unwholesome emanations as in the case of the stagnant pool. To illustrate: When a horse has been accustomed to plenty of exercise, and then travels or works until he sweats, the perspiration is clear and does not leave a stain. But if he has stood in the stable all winter, when he begins to work there is a thick, sticky gum mixed with the perspiration, which is quite difficult to curry out of his hair. Do you ask, What is that gummy substance that is mingled with the perspiration? It is matter which has been distilled from the horse,—a collection of impurities which have accumulated during the idleness of the animal; and before it was in the hair of the horse, it was in his body—in every gland, cell, and nerve-fiber.

The very same thing is true of the man of sedentary habits. If he sweats, this mucilaginous, sticky substance comes out upon the skin, because it is in all his tissues. Even in the brain there are poisonous substances which should have been carried off by muscular action; indeed, there is an accumulation of organic dirt in the whole body. That is

the reason why, when a person has been sitting in his room for a long time, having taken no exercise, his face becomes sallow and his eyes yellow. Organic dirt has accumulated in the eye under the transparent membrane, and makes a dingy sclerotica. This dingy appearance of the sclerotica is a significant thing to the physician; it means not only that the eye is dingy, but that the muscles, nerves, glands, and everything connected with the digestive organs are affected; the whole body is clogged with impurities.

Now exercise is what is needed to rid the system of these impurities. Exercise causes the muscles to rub against each other, constituting a sort of inward currying; it jostles and stirs up everything in the body that is stagnant. If there is any part of the body that is not exercised, the same thing occurs there which happens when a stream becomes obstructed. Wherever there is a sheltered nook or an obstruction of any kind in the current, it creates a little eddy, which keeps whirling round and round, and retains in the vicinity of the obstruction the chips, sticks, and any debris which may have been thrown into the stream. Thus, if there is any part of the body which is not exercised, the effete matter and debris of the body accumulates there.

The right kind and amount of exercise taken every day makes the heart work; it makes the lungs work; it makes the whole body work so vigorously that it fairly steams with perspiration, and the impurities within are forced through every part of the body into the various excretory channels. The body should be stirred up in this way every day, so that there will

\*From a lecture delivered before the patients of the Hattie Ross Sanitarium.

be no chance for impurities to collect, as in a stream rushing down a mountainside there is no chance for stagnation.

The same thing is as true of the dog as of the horse: When he is young and active, his perspiration is pure and comparatively free from offensive odors, so that he can be tolerated in the house, and even taken up into the lap. But a dog which has become old and inactive cannot be allowed in the house. One dog, by reason of lack of exercise, carries a mass of impurities within its body; while the other keeps his skin and breath pure by his activity. Exercise is just as essential to the attainment of this end in human beings as in the lower animals.

Do you ask how it is that exercise secures this result — how it accomplishes the cleansing of the body, the blood, the muscles, and the tissues? The heart, beating from sixty to one hundred and fifty times a minute, sends a current of blood through the brain, muscles, and tissues of the body, washing out and purifying them; and this purification of the body is brought about not only by the increased activity of the blood produced by exercise, but by increased lung action, by which an abundance of oxygen is brought into the body. Dr. Brooks has shown by experiments that a person

breathes in seven times as much oxygen when running as when lying on the back, and this sevenfold quantity of oxygen burns up the impurities of the system. A great fire in a city has one good effect — it burns up accumulated impurities. Now that is what a "fever," as it is called, does when it attacks the human body; it is like a fire, because it sweeps away the impurities of the body. But when one keeps his system clean and pure, there is nothing there for a fever to feed on; hence he is seldom attacked by it.

The person whose system is filled with poisons is apt to be in a depressed state of mind; but when exercise has brought in sufficient oxygen to burn up all this waste matter, the brain is cleared, and the spirits brighten.

The frog is a thorough pessimist. All his life he does nothing but sit and groan and croak; but the birds which sing in the tree-tops are always active, and will easily keep up with the fastest railroad train, singing as they fly. If people would imitate the birds rather than the frogs, they would soon find their lugubrious thoughts vanishing, and good cheer taking their place. Indeed, there is everything to encourage people to persevere in habits of exercise and industry.

## THE IMPORTANCE OF PERFECT POISE.

One very important artistic reason for raising the chest is found in the improved hang of draperies and the increased dramatic expression given to the entire dress. While the chest remains depressed and inactive, the lines of the figure suggest decreased vitality, and the dress partakes of the general effect. The moment, however, that the chest becomes firm and active, leading as it were all the other vital organs, draperies depended from

the shoulder and bust, and lines radiating downward, take an individuality and grace that are surprising to one who has not investigated the law of cause and effect in physical development and dress.

I dwell upon this point because all my experience emphasizes the necessity of securing the poise of the body, and a vital chest is the starting-point in physical culture and the art of personal adornment.

No matter how one may stand naturally, correct poise can be learned. By re-



FIG. 1.

peated contractions of the muscles one can acquire a posture that at first seems impossible. Any change for the better demands constant thought and attention. In the matter of chest-raising and poise of the body, concentration upon the object to be attained is imperative. I have known people who would for a few moments daily (at night, perhaps, after removing heavy clothing that had depressed the chest and waist muscles all day) practise chest-raising exercises, and complain at the end of three or six months that they could never learn the art or acquire the necessary muscular strength for perfect poise of the body, simply because the work of a few moments daily did not counteract the evil of hours of false poise and dress.

Perfect poise of the body can be acquired and established as a permanent

habit in six months, sometimes in less time, if the body be given absolute freedom, relieved from restriction of the muscles, and the effort kept up hour by hour while at other tasks.

I remember some of my own difficulties in establishing a correct poise. For several years at a time, whatever I might be doing, raising my chest would continually suggest itself in a vague way without really being a matter of active consciousness; then I would suddenly become absorbed in my work, and down would go my chest from the force of old habit. From this point full consciousness would return after a time, with a renewed determination to keep my chest well up without a break. Thus by degrees the lapses became less and less frequent, and the habit was established which to-day is so much a part of my



FIG. 2.

vital existence that to stand or sit with depressed chest would cost me an effort

quite equal to any I ever made to raise the chest and bring the vital organs into normal position.

It is not alone increased beauty of carriage, but actual increase of health that is gained with increased radiation and expression of body and draperies as well. No matter how beautiful one's dress,

woman and her clothes when the woman herself is properly developed, so that different parts of the physical system are free and graceful, and the lines of her dress adapted to easy and natural articulation of the different parts.

When one has acquired a correct poise, the body suggests strength, power, self-



FIG. 3.



FIG. 4.

from the point of fabric, color, and workmanship, if the body lacks vitality and magnetic radiation, the dress will lack expression; because one must be more than a tailor's dummy to bring out the best points of even the most beautiful and well-considered gown. It is the woman who gives expression to the dress, not the dress that gives expression to the woman.

We say of a dress, it is becoming or unbecoming when the color suits eyes, hair, complexion, and brings out one's best tints, but we have yet to learn the unity that may be established between a

command, grace, and culture. Each muscle and group of muscles obeys the sovereign will in a well-trained body.

I do not wish to be understood as embracing entire physical education in the one acquirement of perfect bodily poise, but I do assert that no exercise of any other part can be effectively acquired until perfect poise has been gained. The chest and vital parts are the central points around which all the other members of the body group themselves. Once we gain perfect control of the centers of life, the chest and vital organs contained in the thoracic and abdominal cavities, all

of which are affected by and assist in the work of perfect poise, we can easily learn to direct the life forces from the centers into the branches, and relate all parts harmoniously. To establish a law of equilibrium and harmony we must first concede and encourage the authority and supremacy of the natural rules of the body.

With perfect poise, deep, full breathing becomes possible, and the energy of the viscera is quickened; more and better blood is manufactured, the processes of digestion are stimulated, and the balance between the supply and waste in bodily power is regulated and preserved because all of the vital parts are in position to perform their functions properly. When the vital organs are lowered, and crowded upon each other, the vital tone must be lowered of necessity: indeed, I am certain that many of the most common and annoying ailments of the body can be relieved and often entirely cured by acquiring perfect bodily poise.

I have already stated that I have found concentrating the mind upon raising the chest to be the best means of acquiring poise; I will, however, give the technical exercise generally accepted by all good teachers of physical development for overcoming the depressed position of the chest, and acquiring the perfectly correct position of the head, neck, torso, legs, and feet:—

Placing the heels together, with the toes

at a slightly outward angle (Fig. 1.) bring the body forward until the weight falls directly upon the broadest part of the balls of the feet (Fig. 2.) thus calling for conscious muscular effort on the part of the legs to preserve the body from pitching forward. Then with the arms falling easily at the sides, concentrate the mind upon raising the very center of the chest as far as possible toward the chin without throwing either the head or shoulders backward; thus the head and neck will be brought into position (Fig. 3). Lower and raise the chest in this way several times until the muscles over the vital organs of the abdominal cavity and those controlling the chest feel free and flexible; then resolutely hold the chest in that position, not by the aid of the breath, as some attempt to do in the beginning, but by the muscles alone, and rise to upright position (Fig. 4).

Very likely the muscles of the legs and the back and the chest will ache at first, but there is no reason for diminution of enthusiasm in the exercise; for this sign is hopeful, and proves that muscles that have hitherto remained inactive and flaccid are responding to intelligent direction. The same kind of ache assails any muscle of the body when it is set to work for the first time. The ache only proves the inactivity of the muscle, and is not a sign that harm is being done, as some seem to suppose.—*Jenness Miller Monthly.*

## SWIMMING IN THE GERMAN ARMY.

FROM the time of Frederick the Great, drill has always been the strong point of the Prussian army; and since the union of the German-speaking states, the armies of the various kingdoms and principalities which form the empire now ruled by William II have advanced by rapid strides, until it is beyond doubt that for

perfection of drill they are unsurpassed by any troops in the world. The work which this state of perfection entails on the individual soldier is very great. Every private has his copiously illustrated "Drill Book," teaching him the theory of all steps and exercises, the practise of which he acquires under tuition

on the exercise place and in the gymnasium for several hours each morning.

One of the most useful, as it certainly is one of the most interesting, of all the exercises in the German army is the swimming and diving drill as it is practised at the military swimming-baths during the summer months. It is compulsory only on the pioneers, but privates of all arms are encouraged to practise it by small money prizes and prospective promotion. The diving from a considerable height is best worth watching. The men taking part in it are clothed in uniforms of the oldest and least valuable description, and accoutered with "dummy" kits of precisely similar size and weight to their ordinary equipments. They are furnished with model guns and bayonets of

wood, the points of the latter terminating, as may be seen, in wooden knobs. Under the direction of the military swimming master, the men in rotation mount the steps leading to the diving platform, and at the word of command each takes "a header down below." After a more or less prolonged interval, the pioneer private "bobs up serenely," and generally (contrary to the expectation of the uninitiated stranger), without having lost his helmet or rifle, and without having disarranged his accouterments, strikes out across the bath for the landing-stage. The pioneers are also instructed in the towing of piles, stakes, barks of timber, and trunks of trees into position for bridge construction.—*The Gymnasium (London, England)*.

**The Lady Cyclist.**—The following excerpt from the *Queen* is instructive: "We are glad to see that Dr. Schofield attacks the tight corset as being dangerous for cycling, in this month's *Humanitarian*. 'It is found,' he says, 'if a lady rides a mile at top speed in fairly tight corsets, and again in loose gymnastic dress, that in the former she will breathe nearly three times as fast, while her heart will beat twenty beats a minute more; the increased strain imposed by corsets, therefore, obviously falls mainly upon the lungs. This is no small danger, and for ladies to cycle with 19 inch waists is not a credit to their common sense.'"

We should think not, and yet many women will endanger their lives before they will even acknowledge to themselves that their stays are too tight. It is an extraordinary craze, but bicycling is doing much to kill it, for there are limits even to a woman's endurance when a taste of freedom begins to work against vanity and convention. The bicycle will be a potent factor in dress reform. In

one case we know of, the rider found after a few months' practise that her ordinary stays were unbearable, owing to the development of lungs and waist muscles, and she had to get a pair two inches larger. This was a case where tight stays had never been worn. What would be the expansion of those who deliberately lace tightly?

Let us hope that the reaction against this gigantic folly is not far distant. An important point noted by Dr. Schofield is that bicycling is a most valuable counterpoise to brain strain. So many women are now taking to intellectual pursuits—either from choice or necessity—that something of the sort was absolutely needed to preserve the balance of mind and body. Dr. Schofield thinks that 'every rational exercise for women is a crying necessity in these days when their much-despised frontal lobes are undergoing a forcing process never before attempted.' He is one of those who thinks that lawn tennis was invented just in time to save large numbers of women from de-

*Balance and Symmetry*

ANOTHER way in which exercise is beneficial, is in promoting bodily symmetry. This is illustrated in the average savage. Entirely free from all conventional trammels, he is a fine specimen of a well developed man. He stands erect, his figure is symmetrical, his limbs are finely rounded, his shoulders are square, there is a graceful curve in his spine, and there is a general expression of strength in his whole figure and bearing. The Yuma Indians, the most primitive of all the Indian tribes of North America, furnish many grand specimens of the human figure. I shall never forget how I was startled when one of them suddenly sprang out in front of me as I was walking one day by a thicket in their reservation near old Fort Yuma. I did not know but he was going to scalp me, but as he stood before me with a form like an Apollo, broad shoulders, deep chest, and rounded limbs, I envied him. He would certainly have been a good model for a sculptor.

It is not true, however, that all savages have a finely developed physique. The Patagonian sitting on his horse looks like a giant; but when he stands on the ground, his gigantic appearance disappears in consequence of the disproportionate shortness of his legs, which are small and undeveloped in comparison with the rest of his body. This is because he lives mostly on horseback, and has very little use for the muscles of his legs. The blacksmith affords an almost equally striking illustration. Day after day he swings his heavy hammer with his right arm until it becomes disproportionately developed, while his



left arm is disproportionately small. As a result of the excessive development of the muscles of the right side, the spine of the blacksmith often becomes curved toward the opposite side.

The purpose of exercise is to develop every group of muscles in the body, so that the skeleton may be held erect, supported equally on every side, like the masts and spars of a full-rigged ship.

Another way by which exercise promotes symmetry is by the proper distribution of fatty tissues. An enormous accumulation of fat in a particular part of the body is evidence that that part has been idle, it has not been doing its duty.

This matter of symmetry is a very important one, because when we have established external symmetry, we have also established internal symmetry. Whenever there is external deformity of any kind, as a curved spine, a flattened chest, projecting abdomen, there is an internal deformity corresponding to the external deformity; this internal deformity, this lack of internal symmetry, is a matter of vastly greater significance than the external deviation from the normal condition. People are very much troubled about external deformities, but they seldom think of the internal deformity. A deviation of the spine toward the right side means a shortening of the muscles of the left side; and a deviation of the spine toward the left side means a shortening of the muscles of the right side. A flat chest means a compression of the lungs; a protruding abdomen means a compression of the stomach, liver, kidneys, etc., and

perhaps prolapse of all the organs of the abdomen and pelvis and an abnormal strain upon the sympathetic nerves and nerve centers. So these external deformities indicate corresponding internal deformities, and are evidences of internal disease. Thousands of persons are suffering from these deformities, external and internal, although they may be unconscious of their existence. I have made thousands of observations in reference to these deformities, and have proven the relation between external and internal deformities.

Another of the general advantages of exercise is, that it preserves the suppleness of the body, the elasticity of the muscles, and the flexibility of the joints, tendons, and ligaments. If the muscles of a certain part of the body are not used in such a manner as to stretch them, they become shortened, and after a time all use of them beyond the habitual extent becomes impossible. If the arm is kept flexed for a long time, it becomes impossible to straighten it, because the muscles of the inner surface of the arm have become shortened from not being duly stretched.

Nature abhors idleness, and punishes the idle organ by complete extinction or partial obliteration; so if a muscle is not used to its full capacity, if it is not stretched to its full length, nature shortens it. This shortening may be so permanent in character as to be irremedial. One can almost tell the different occupations of the persons he meets, by the way in which they carry themselves. For example, the blacksmith, the cabinet-maker, and many other mechanics who use their hands chiefly in their work, walk with half-flexed arms, elbowing their way along the street. The farmer from his habit of bending forward to his work and sitting in a relaxed position, as he may be often seen resting with his elbows upon his knees, becomes round-shouldered. This deformity in the case of the farmer may be partly due also to the

shortening of the muscles of the chest by which the shoulders are drawn forward.

The different positions assumed are due to the fact that the muscles which have been flexed the most have become shortened, and the muscles which have been constantly on the stretch have become lengthened. Now in order that the body should be kept symmetrical, such exercises should be taken as will keep the muscles at the proper length. Much of the deformity of old age is due to unequal exercise.

But exercise also keeps the joints flexible. Notice the young child. It is not uncommon to see a child lying on its back and putting its great toe up to its mouth, or holding its foot up by the half hour where it can watch and study it. There is no adult, unless he has kept himself under training, who could keep his legs in such a position for so long a time; because the muscles on the back of the thigh have become too short to permit the leg to come forward, and the muscles in front are so weak that they cannot contract enough to draw the leg up. Now by proper exercise, beginning at an early age, the muscles can be kept so active, so strong, and so elastic that the whole body can be kept under control; not only the muscles, but the joints as well. When the joints are not flexed to their fullest extent, when they are not moved just as far as they are capable of being moved, it is frequently the case that the articulating surface over which the bones glide becomes restricted. And not only this, but the extensible tissues upon which the latitude of movement depends, become rigid; calcareous substances are deposited in the ligaments, so that they become stiff and rigid, and lose their natural flexibility; and the consequence is, the limb is restrained in its movements. Now, by active daily exercise, by constant and full use of the muscles and the joints, these hardening and ossifying processes can be prevented.

Galley 93.—Kellogg.

*Exercise 1.* While standing in position, take ten deep breaths, filling the lungs as full as possible, raising the chest high, and drawing the abdominal muscles in. Try to make each breath a little deeper than the preceding one if possible. Slowly count four while breathing in, and the same number while breathing out.

*Exercise 2.* While keeping the head, shoulders, and hips in contact with the wall, rise upon the toes as high as possible, keeping the heels close together. Slowly return to position. Repeat the exercise ten or fifteen times, rising quickly and sinking slowly. Take a deep breath while rising, and exhale while sinking back to position. Count one while rising and breathing in, and three while sinking and breathing out. Keep the muscles tense during the whole exercise.

*Exercise 3.* Standing in position, heels, hips, shoulders, and head against the wall, roll the head backward as far as possible, allowing the chest at the same time to move forward, but keeping the heels and hips firmly against the wall. Return to position. Repeat this movement five to fifteen times, breathing in while the head is slowly moving backward, and breathing out while the head moves slowly forward. Count four while moving the head backward, and the same number while returning to position.

*Exercise 4.* Repeat No. 3. at the same time rising upon the toes, keeping the hips against the wall. The effect will be to push the chest forward and upward, and to correct posterior spinal curvature. Breathe slowly in during the upward movement while counting four, and exhale while returning to position during the same time. This is a capital exercise when properly executed, bringing the body into perfect poise, and completely correcting roundness of the shoulders and flatness of chest.

*Exercise 5.* This exercise may be easily taken after the preceding have been well learned. It aids in attaining the correct position in standing and maintaining it. Standing against the wall, raise the heels as far as possible, allowing the head to roll backward, and pushing the chest forward as directed in the preceding movement (4). Before returning to position, while the heels are still raised, and the chest held exactly in the position to which it is raised by the movement, bring the head forward into the natural position, holding the chin well in. Now, without relaxing the muscles of the trunk, let the heels sink, and remain a moment in position. It will be noticed that the heels and hips are in contact with the wall, while the head and shoulders are held several inches in front of it. Now step out from the wall and walk about the room for a few minutes, maintaining the position of the chest, and allowing the arms to swing naturally.

Relaxing the muscles slightly to avoid stiffness of movement, one will find himself in exactly the correct position, as is shown in the cut. It is only necessary to maintain this position constantly in standing, walking, and sitting to entirely correct in a short time the deformity in a person whose shoulders are very round, and whose chest is very flat, provided the parts have not become rigid. The outlines shown in the accompanying plate show the figure of a young man before and after the taking of this exercise.

## Exercises to Strengthen the Back.

Other exercises are of value in strengthening the muscles of the back, the weakness of which is the chief cause of this deformity. The following are to be especially recommended, because they can be effectually executed without the aid of a teacher.

*Exercise 6.* Lie flat upon the back upon the floor on a rug, or upon a hard mat or mattress. Raise the chest, pushing it up as high as possible. This is best done by rolling the head under until the eyes are directed toward the wall behind, making an effort to see the floor if possible, by rolling the eyes upward as in the ordinary act of looking upward. Hold the chest in position while slowly counting four, then return slowly to position. The breath should be drawn in while the chest is forced upward, held while counting four, and slowly expelled while the body is returning to position. Rest, breathing once or twice, then repeat the exercise until it has been taken ten to twenty times.

*Exercise 7.* Lying on the face with the arms extended by the sides, raise the head backward as far as possible. Try to see as much of the ceiling of the room as possible. While holding this position, count eight; then return to resting position. After taking a few deep breaths, repeat the movements, gradually increasing the number of counts until the head can be held well backward while slowly counting twenty-five or more. Repeat the exercise five to twenty times.

*Exercise 8.* Lying on the face with the arms extended by the sides, flex both legs backward, pushing the feet up as high as possible. Count as before.

*Exercise 9.* Raise the head backward, and flex the legs as much as possible. Make an effort to approach the head and the feet as near together as possible, counting as before.

*Exercise 10.* Sitting in a chair, place the hands against the back of the neck. Roll the head backward so as to look up at the ceiling, and at the same time bend forward, endeavoring to keep the eyes upon the ceiling as long as possible. Hollow the back well. After placing the hands in position, before starting the movement, fill the lungs as full as possible, and hold the breath while bending forward, during four counts. Then breathe out while returning to position in the same time.

*Exercise 11.* Sitting with the hands upon the hips, push the shoulders to one side, keeping them level. This movement will be accompanied by a rolling movement of the hips upon the seat. The movement should be first to one side and then to the other, the shoulders being moved to each side as far as possible. The effect will be to cause vigorous contraction of the muscles of the trunk. The vigor of the exercise may be increased by placing the hands at the back of the neck. The movement should be executed while slowly counting four for the movement in each direction. Repeat four to ten times.

Galley 94.—Kellogg.

*Exercise 12.* Standing with the heels together and the toes well separated, extend the arms sidewise. Describe a small circle with the arms while holding them as rigid as possible (see cut). The circle movement should be brief, quite vigorous, and repeated five to twenty times.

*Exercise 13.* Standing, place the hands upon the hips behind with the thumbs out. Bend the head and trunk backward as far as possible, allowing the hands to slip down upon the thighs during the backward movement. In returning to position, stop before the original standing position is reached, place the hands firmly against the thighs for support, drawing in the chin (see cut). This exercise may be practiced when a wall is not convenient, or when one has by exercise against the wall become thoroughly familiar with the correct position.

*Exercise 14.* Standing in a doorway, the feet firmly braced upon the door sill, midway between the posts, place the hands upon the doorposts as high as possible above the head. Now rise upon the toes, and sway forward, allowing the hands to slide upward, and pushing the chest forward as far as possible, while the chin is well drawn in. Rise quickly to this position, taking a deep breath at the same time; hold the breath while counting four, and then sink back to the starting point while breathing out in four counts. This is a very excellent exercise for expanding the chest and for improving the figure.

Club swinging, dumbbell exercises, and all gymnastic exercises in which the arms are brought into active movement, are helpful in correcting flat chest and round shoulders.

Swimming exercises are of the highest value in the treatment of this deformity. There is no better means of expanding the chest.

A word further with reference to sitting. It is important to assume, when first sitting down, an erect and correct position, and then to maintain it. The body should be placed in the seat in such a way that the hips will be braced firmly against the back of the seat. The shoulders should come in contact with the back of the seat, but the central portion of the back should not come in contact with the back of the seat unless it has a considerable forward curve. If this position becomes tiresome because the muscles have not yet been properly trained, persons sitting at work or studying may place a pillow or cushion at the small of the back for support. This will prevent the assuming of the extremely bad position which results when the spinal muscles are relaxed and the trunk allowed to bend into the curved position into which gravity naturally draws it.

Round-shouldered or flat-chested persons should avoid the sitting position when too tired to sit erect. The standing position may be assumed for rest; or if too tired to stand, lie down upon the floor or some other flat, hard surface, with the body extended full length upon the back, and no support under the head. In this position, the muscles are relieved of the weight of the bones and other organs, and are able to rest, while their position is such that resulting deformity is prevented. A small, hard pillow may be placed under the shoulders to lift the chest forward.

down than to relax in a sitting position. Habitual sitting

It is doubtful whether chairs are not on the whole an injury to health. When one is tired, it is far better to lie in a relaxed position as unquestionably the cause of many grave disorders of the internal organs, as well as ugly deformities, which, though curable in childhood and youth, are almost incurable in adults who have attained middle age.

### Lateral Curvature of the Spine

These curvatures are not curable when they have existed for many years, and have become rigid; but in young persons they may always be greatly improved, and many times entirely corrected. If they have existed but a short time, complete recovery may be obtained by simple exercises, which can be taken at home as well as in an institution. Serious cases of course require the care of a skilled physician.

Lateral curvature of the spine is usually indicated by the appearance of the shoulders and the hips. For example, if there is a curvature toward the left side, the right shoulder will be lower than the left, the right shoulder blade more prominent, and the right hip will appear higher or larger than that of the left side. These curvatures are due to general weakness or uneven development of the muscles of the back. The exercises prescribed for round shoulders are all applicable to cases of lateral curvature, whether affecting the right side or the left side. In addition, a few special exercises are valuable, among the best of which are the following:—

*Exercise 15.* Sitting in a chair, grasp the seat with the hand on the side of the high shoulder. Pull downward with as much force as possible, while reaching the other arm as high as possible straight up over the head. Repeat this exercise at the rate of about six times a minute, making ten to twenty counts during the exercise. Care should be taken to sit in a correct position during the exercise, the chest being held well forward and the chin drawn in (see cut). Endeavor to throw the chief weight of the body upon the hip corresponding to the low shoulder. By this means the low shoulder will be pulled up, the high shoulder pulled down, and the curvature temporarily strengthened. Repeat the exercise three or four times daily.

*Exercise 16.* Attach a pulley to the ceiling. Pass a window cord over it, and tie a large pail to one end. Tie several knots in the other end of the cord to aid the hand in grasping it. Have on hand a supply of stones or pieces of iron sufficient to permit a regulation of the weight from five to twenty-five pounds. Under the pulley, a foot or two to one side, attach to the floor another strong, knotted cord.

Standing in correct position directly under the pulley, grasp the rope at a height which will render it taut with the hand of the low side, with the other hand grasp the rope attached to the floor, and pull hard upon it, while at the same time lifting the weight with the hand of the low side. Beginning with a small weight, five or ten pounds, the weight should be gradually increased from day to day until twenty-five and even fifty pounds can be lifted. The exercise may be continued for five to ten minutes, the weight being lifted at intervals of five to ten seconds.

Galley 95.—Kellogg.

*Exercise 17.* Sitting with the hands upon the hips, practice Exercise 11, for five minutes. Then push the shoulders over as far as possible toward the low-shoulder side of the body, and hold the trunk in this position while breathing deeply ten to twenty times. Return to position, and resume the exercise. Repeat three or four times, or until the muscles are slightly fatigued.

*Exercise 18.* Lying upon the side on the floor or upon a hard couch with the high-shoulder side uppermost, flex the trunk toward the upper side as far as possible.

*Exercise 19.* Stand with the side of the high shoulder against a table. Place the hand of the same side upon the head. Reaching the other arm upward as high as possible, bend toward the table, taking care to hold the chest well forward and the chin drawn in. Repeat the movement several times while slowly counting four and breathing deeply.

*Exercise 20.* Practice daily lifting a weight by means of a pulley. The weight should be gradually increased until the weight of the entire body can be lifted. This exercise should be practiced for five to ten minutes two or three times a day.

When the weight can be easily lifted, overhead exercises for the arms, in which the body is lifted, may be practiced with advantage, such as swinging on rings, exercising on the overhead ladder, climbing a rope, etc.

All exercises which bring the muscles of the arms and trunk into full play are useful in correcting spinal deformities. Chopping, plowing, and other farm exercises are highly to be recommended. It is important, however, to remember that while engaged in exercises of this sort, or in any kind of muscular labor, the body must be continually held as nearly as possible in proper position. If this is not done, the effect of the exercise is to increase the deformity rather than to diminish it.

When the curvature is flexible, so that it is still possible for the trunk to be made straight, it is well for the patient to practice sitting with the weight of the body chiefly resting upon the hip of the low side. The raising of the opposite hip by pushing the trunk over toward the low-shoulder side, raises the shoulder, and corrects the curvature.



## Exercises for Developing the Abdominal Muscles.

Exercises for developing the abdominal muscles are best taken in the horizontal position. The exercises should begin with breathing movements in which the lungs should be fully inflated. In breathing out, the abdominal muscles should be well drawn in. One to three deep breaths should be taken after each movement before the next is made. In the following table, the exercises are made progressive:—

*Exercise 21.* Standing against a smooth, vertical wall, with the hips, the heels, the shoulders, and the head touching the wall, the arms stretched well downward by the side, the thumbs turned outward (see cut), and the chin drawn in, take several deep breaths, raising the chest well forward, while holding the body close to the wall at each point. Now roll the head backward, allowing the chest and the shoulders to move forward, while keeping the hips and the heels close to the wall. The effect will be to expand the chest, and correct any tendency which may exist to posterior spinal curvature or round shoulders. Repeat the backward bending of the head several times, making the movement slowly and steadily, breathing in while the head is moving backward, and breathing out while it returns to position.

*Exercise 22.* Sit in a rather low chair, with the trunk held well erect, the chin drawn in, the feet placed squarely on the floor and separated to the distance of one and a half or two feet. Placing the hands upon the hips, bend the head backward until the eyes rest upon the ceiling overhead; then, while keeping the head in this position, and the eyes looking upward as much as possible, bend the body forward. In taking this movement, the body should be bent only at the hips, and should be slowly carried as far forward as possible, then returned to position. This is a capital movement for strengthening the muscles of the trunk, and for the correction of spinal curvature, flat and hollow chest, and round shoulders.

*Exercise 23.* Take a kneeling position upon the floor, thighs and trunk being held perpendicular as nearly as possible. Place the hands upon the hips. Bend the head backward, and continue the movement until the trunk is strongly bent.

## Stretching Movements.

*Exercise 24.* Standing, reach the right hand upward above the head as high as possible. At the same time stretch the left arm downward as far as possible, making both the arms rigid, and endeavoring to make the distance between the tips of the fingers as great as possible.

*Exercise 25.* The reverse, reaching downward with the right arm, and upward with the left arm.

*Exercise 26.* Reach both arms sidewise, stretching as far as possible in opposite directions.

*Exercise 27.* Standing on one foot, reach one foot backward, and the opposite arm upward and forward, stretching both limbs as far as possible.

*Exercise 28.* The reverse.

*Exercise 29.* Standing facing the wall, the arms stretched above the head and resting upon the wall, rise upon the toes, stretching upward so as to reach the highest point possible with the tips of the fingers.

In addition, the following special exercises may be advantageously practiced, especially by those whose abdominal muscles have been weakened by sedentary habits and by improper dress. In preparation for these exercises, the patient should lie down upon the back on a bed or couch.

*Exercise 30.* With the legs extended, raise both limbs together as high as possible.

*Exercise 31.* Raise the head forward as high as possible without the assistance of the arms.

*Exercise 32.* Raise the legs upward and the head forward as far as possible at the same time.

Each of these exercises may be repeated from five to twenty times. Swimming, horseback riding, and rowing are excellent exercises for developing the muscles of the trunk. Patients who are too feeble to raise the legs when extended may flex the knees sufficiently to make it possible to raise the legs to a vertical position, gradually extending the legs more and more day by day, as the strength increases.

#### Exercises To Promote General Health and Development.

As before remarked, there is nothing better than labor for promoting muscular development and securing the advantages which come from exercise. But care should be taken continually to keep as nearly as possible in a correct poise. Ignorance, carelessness, or weariness often leads a person to assume awkward and unhealthy positions while engaged in work, which, in consequence of the irregular muscular development thereby induced, become fixed deformities. It should also be remarked that some employments give undue exercise to special muscles, and this leads to deformities. A carpenter, blacksmith, or cabinetmaker may be generally known from other artisans by the way in which they carry their arms. The strongly developed flexor muscles overbalance the extensors so that the arms are constantly bent when at rest as well as at work.

For children, out-of-door play, light work, assisting in cultivating small fruits, doing chores, and similar occupations are the very best kinds of employment. Elderly people require a considerable amount of exercise, but should carefully avoid violent exercise of all sorts. They should especially be careful not to become greatly overtaxed, or not to become greatly out of breath. The chest wall being rigid, the lungs cannot expand as in youth, and the heart may also be easily overworked. Elderly people who are accustomed to exercise do not so quickly experience a sensation of fatigue because of diminished nervous sensibility. They are consequently very liable to overwork, not being aware of the fact until a day or two later, when the symptoms of secondary fatigue appear. It is very important that elderly people should understand this fact, which applies to mental as well as physical work. An elderly man may be able to compete with a young man in a contest without apparent injury at the time, but will later appear while the young man will experience no injury, though at the time greatly exhausted.

Women as a class suffer more than do men in consequence of lack of exercise. Their exercises must be less violent than those of men, as they possess but half the muscular strength, and are less accustomed to vigorous muscular exertion. Breathing exercises are especially important for women and aged persons.

Running exercises are not to be recommended for adult women or for persons past middle age. Boys and girls of twelve to eighteen years of age may run until quite fatigued without injury. Their hearts and lungs are sound and not easily damaged. Adults, unless from youth accustomed to running, most content themselves with a very slow pace, and should avoid exercising until extreme breathlessness is produced. The pulse and the respiration should return within a few minutes to the normal rate. When the pulse remains quick for half an hour or more after exercising, this fact is evidence that the exercise has been too violent, and must not be repeated until the individual has been properly trained for it.

Elevation of temperature, as shown by the thermometer, after moderate exercise, as a walk of a mile or two, is a symptom which should receive immediate attention, as it indicates a possible beginning of tuberculosis of the lungs. Exercise should never be taken by a person who has fever. Persons who are just recovering from an attack of typhoid or other acute febrile disease should begin exercising very carefully indeed, as there is great danger of producing a relapse. Even sitting up will cause an elevation of temperature in a recent fever convalescent.

## The Amount of Exercise Required

A working man, as we have learned, now perform work equivalent to lifting nine hundred tons a yard high in a day. It is not probable, however, that so much work as this is required for the maintenance of health. But it has been calculated that at least one-sixth of this amount of labor should be done by the average man in order to maintain proper vigor and activity of lungs, heart, and of the various functions which depend upon the action of muscles. It should be remembered, however, that the strength, health, and vigor of the internal muscles, those of the stomach, intestine, and bladder, as well as those of the heart, depend upon the strength of the external muscles. When the external voluntary muscles are weak, the internal muscles become weak also. There is known to be an association through the nerves of the muscles of the abdomen with those of the stomach, such as accounts for those affections. In the examination of hundreds of patients, the author has observed that those patients who have extremely dilated stomachs have extremely weak abdominal muscles. The maintenance of strong and vigorous external voluntary muscles must then be regarded as directly related to the health of the important organs of the trunk upon which maintenance of life primarily and immediately depends.

Exercise may be classified as gentle, moderate, and violent. Gentle exercise is that which does not produce either fatigue or breathlessness. Moderate exercise produces fatigue when sufficiently long continued, but not breathlessness. Violent exercise produces breathlessness, which is one form of irritation; and if continued for any length of time, produces exhaustion. Gentle exercise is adapted to invalids and very feeble persons. Violent exercise is permissible only to young persons and adults who have been accustomed to vigorous exercise all their lives. Moderate exercise is the sort which is especially indicated for health in all classes. It must not be considered, however, that exercises are harmful that cause a person to breathe deeply. Deep breathing is one of the most beneficial effects derived from the exercise.

**Comparison of the Work Done in Taking Exercise.**

Ordinary slow walking involves very little muscular exertion for a person in ordinary health. When the rate of walking is increased to five or six miles per hour, the amount of muscular work involved is considerable. Walking at the rate of three miles an hour is equivalent to lifting the body perpendicularly through one twentieth of the distance walked. For example, if a person walks one mile at the rate named, the amount of work done would be equivalent to lifting the body perpendicularly through a distance of 264 feet ( $5280 \div 20 = 264$ ). If the distance traveled has been along a rising surface, the elevation attained must be added to the work done. For example, if a person in traveling a mile has ascended a hill one thousand feet high, the total amount of work done would be equivalent to lifting the body 1,000 plus 264 feet, or 1,264 feet. Suppose the person's weight to be 150 pounds, the amount of work done would be 1,264 times 150, or 189,600 foot pounds, or nearly the same amount of work which would be done by walking five miles on a level surface.

If a hill or a mountain is not available, ordinary stairs may be utilized most advantageously. In going up stairs one is obliged to lift the body through the distance from the lower floor to the floor above. Suppose the distance to be ten feet, and one's weight to be one hundred and seventy pounds. Going from the lower story to the upper would involve an amount of work equivalent to lifting a little more than one ton a foot high. To do a day's work, that is, to lift one hundred and fifty tons, the person would have to ascend the stairs about one hundred and fifty times, taking no account of the small amount of work involved in descending the stairs.

The work can be accomplished, if desired, by means of exercises which can be readily taken in one's own room: as, for example, in such exercise as standing erect and alternately raising and lowering the heels, or flexing and extending the knees, or supporting the body upon the hands between two chairs or other supports, and letting the body down as low as possible, and then raising it to position.—the so-called "dipping" movement. In the last-named exercise the work is done by the arms.

To do one hundred and fifty foot-tons of work, a man weighing one hundred and fifty pounds would have to walk forty thousand feet, or about seven and one half miles, at the rate of three miles per hour ( $300,000 \div 150 \times 20 = 40,000$ ). The same man practicing heel raising at the rate of one hundred movements a minute, for sixteen minutes, rising two inches each time, would do as much work as in walking a mile ( $150 \times 16 \times 100 = 40,000$ ).

He would have to continue the exercise for two hours to lift his one hundred and fifty foot-tons. As this would make the legs do all the work, it would be better to divide the work between the arms and the legs. This may be accomplished by making the arms assist, by resting the hands upon the backs of two chairs, the foot of the bed, a table, or any other convenient support, and making a downward

push with the arms each time the heels are raised.

A larger amount of work may be done in the same time by lifting a pair of iron dumbbells with the arms at the same time the heel-raising movements are executed. For example, a person weighing one hundred and fifty pounds, holding in his hands a pair of dumbbells weighing twenty-five pounds each, making the total weight lifted two hundred pounds, raising himself two inches thirty times a minute, would do work amounting to 1,000 foot-pounds each minute, or 60,000 foot-pounds in an hour.

If at each movement a pair of dumbbells weighing ten pounds each are raised one foot, the additional work thus done would amount to 24,000 foot-pounds for the hands. The combined work of the arms and legs would be thirty-nine foot-pounds for each movement ( $10 \times 2 = 20 + 12 = 39$ ). It is only necessary to divide the total work to be done, 300,000 foot-pounds, by 39 to determine the number of times the movement must be executed ( $300,000 \div 39 = 7,700$ ). At the rate of twenty movements a minute, the work could be done in a little less than six and a half hours.

By combining knee-flexing movements with the arm-flexing movements and the heel-raising movements, the required work can be accomplished in a shorter time, although the greater length of time required for the execution of the movement lessens the advantage. For example, a person weighing one hundred and fifty pounds, first raising his heels, then bending his knees, and returning to position, raising and lowering his body about fourteen inches in so doing, would perform work equivalent to lifting his entire body one foot in the same length of time. Executing these movements at the rate of sixteen times a minute for two hours and five minutes, would be equivalent to walking eight miles, or a day's work of one hundred and fifty foot-tons, for a person weighing one hundred and fifty pounds.

## THE BRAIN AND THE NERVES.

THE brain and the nerves constitute the means through which man the creature comes closely in touch with God the Creator. The brain and the nerves together constitute the seat of the mind, the consciousness, the will, the thinking, feeling, governing organs.

The brain and nerves are commonly described separately as independent organs, but in reality they are one. The thinking and feeling organ, as the whole together might be called, centers in the cranial cavity, but occupies the whole body. The smallest brain conceivable is a minute mass of transparent material, of irregular shape, and so small that several hundred ranged in line would make a row only an inch long. The scientific name of such a structure is a nerve cell, or neuron.

Galley 93.—Kellogg

*Exercise 1.* While standing in position, take ten deep breaths, filling the lungs as full as possible, raising the chest high, and drawing the abdominal muscles in. Try to make each breath a little deeper than the preceding one if possible. Slowly count four while breathing in, and the same number while breathing out.

*Exercise 2.* While keeping the head, shoulders, and hips in contact with the wall, rise upon the toes as high as possible, keeping the heels close together. Slowly return to position. Repeat the exercise ten or fifteen times, rising quickly and sinking slowly. Take a deep breath while rising, and exhale while sinking back to position. Count one while rising and breathing in, and three while sinking and breathing out. Keep the muscles tense during the whole exercise.

*Exercise 3.* Standing in position, heels, hips, shoulders, and head against the wall, roll the head backward as far as possible, allowing the chest at the same time to move forward, but keeping the heels and hips firmly against the wall. Return to position. Repeat this movement five to fifteen times, breathing in while the head is slowly moving backward, and breathing out while the head moves slowly forward. Count four while moving the head backward, and the same number while returning to position.

*Exercise 4.* Repeat No. 3, at the same time rising upon the toes, keeping the hips against the wall. The effect will be to push the chest forward and upward, and to correct posterior spinal curvature. Breathe slowly in during the upward movement while counting four, and exhale while returning to position during the same time. This is a capital exercise when properly executed, bringing the body into perfect poise, and completely correcting roundness of the shoulders and flatness of chest.

*Exercise 5.* This exercise may be easily taken after the preceding have been well learned. It aids in attaining the correct position in standing and maintaining it. Standing against the wall, raise the heels as far as possible, allowing the head to roll backward, and pushing the chest forward as directed in the preceding movement (4). Before returning to position, while the heels are still raised, and the chest held exactly in the position to which it is raised by the movement, bring the head forward into the natural position, holding the chin well in. Now, without relaxing the muscles of the trunk, let the heels sink, and remain a moment in position. It will be noticed that the heels and hips are in contact with the wall, while the head and shoulders are held several inches in front of it. Now step out from the wall and walk about the room for a few minutes, maintaining the position of the chest, and allowing the arms to swing naturally.

Relaxing the muscles slightly to avoid stiffness of movement, one will find himself in exactly the correct position, as is shown in the cut. It is only necessary to maintain this position constantly in standing, walking, and sitting to entirely correct in a short time the deformity in a person whose shoulders are very round, and whose chest is very flat, provided the parts have not become rigid. The outlines shown in the accompanying plate show the figure of a young man before and after the taking of this exercise.

#### **Exercises to Strengthen the Back.**

Other exercises are of value in strengthening the muscles of the back, the weakness of which is the chief cause of this deformity. The following are to be especially recommended, because they can be effectually executed without the aid of a teacher.

*Exercise 6.* Lie flat upon the back upon the floor on a rug, or upon a hard mat or mattress. Raise the chest, pushing it up as high as possible. This is best done by rolling the head under until the eyes are directed toward the wall behind, making an effort to see the floor if possible, by rolling the eyes upward as in the ordinary act of looking upward. Hold the chest in position while slowly counting four, then return slowly to position. The breath should be drawn in while the chest is forced upward, held while counting four, and slowly expelled while the body is returning to position. Rest, breathing once or twice, then repeat the exercise until it has been taken ten to twenty times.

93

*Exercise 7.* Lying on the face with the arms extended by the sides, raise the head backward as far as possible. Try to see as much of the ceiling of the room as possible. While holding this position, count eight; then return to resting position. After taking a few deep breaths, repeat the movements, gradually increasing the number of counts until the head can be held well backward while slowly counting twenty-five or more. Repeat the exercise five to twenty times.

*Exercise 8.* Lying on the face with the arms extended by the sides, flex both legs backward, pushing the feet up as high as possible. Count as before.

*Exercise 9.* Raise the head backward, and flex the legs as much as possible. Make an effort to approach the head and the feet as near together as possible, counting as before.

*Exercise 10.* Sitting in a chair, place the hands against the back of the neck. Roll the head backward so as to look up at the ceiling, and at the same time bend forward, endeavoring to keep the eyes upon the ceiling as long as possible. Hollow the back well. After placing the hands in position, before starting the movement, fill the lungs as full as possible, and hold the breath while bending forward, during four counts. Then breathe out while returning to position in the same time.

*Exercise 11.* Sitting with the hands upon the hips, push the shoulders to one side, keeping them level. This movement will be accompanied by a rolling movement of the hips upon the seat. The movement should be first to one side and then to the other, the shoulders being moved to each side as far as possible. The effect will be to cause vigorous contraction of the muscles of the trunk. The vigor of the exercise may be increased by placing the hands at the back of the neck. The movement should be executed while slowly counting four for the movement in each direction. Repeat four to ten times.



Galley 94.—Kellogg.

*Exercise 12.* Standing with the heels together and the toes well separated, extend the arms sidewise. Describe a small circle with the arms while holding them as rigid as possible (see cut). The circle movement should be brief, quite vigorous, and repeated five to twenty times.

*Exercise 13.* Standing, place the hands upon the hips behind with the thumbs out. Bend the head and trunk backward as far as possible, allowing the hands to slip down upon the thighs during the backward movement. In returning to position, stop before the original standing position is reached, place the hands firmly against the thighs for support, drawing in the chin (see cut). This exercise may be practiced when a wall is not convenient, or when one has by exercise against the wall become thoroughly familiar with the correct position.

*Exercise 14.* Standing in a doorway, the feet firmly braced upon the door sill, midway between the posts, place the hands upon the doorposts as high as possible above the head. Now rise upon the toes, and sway forward, allowing the hands to slide upward, and pushing the chest forward as far as possible, while the chin is well drawn in. Rise quickly to this position, taking a deep breath at the same time; hold the breath while counting four, and then sink back to the starting point while breathing out in four counts. This is a very excellent exercise for expanding the chest and for improving the figure.

Club swinging, dumbbell exercises, and all gymnastic exercises in which the arms are brought into active movement, are helpful in correcting flat chest and round shoulders.

Swimming exercises are of the highest value in the treatment of this deformity. There is no better means of expanding the chest.

A word further with reference to sitting. It is important to assume, when first sitting down, an erect and correct position, and then to maintain it. The body should be placed in the seat in such a way that the hips will be braced firmly against the back of the seat. The shoulders should come in contact with the back of the seat, but the central portion of the back should not come in contact with the back of the seat unless it has a considerable forward curve. If this position becomes tiresome because the muscles have not yet been properly trained, persons sitting at work or studying may place a pillow or cushion at the small of the back for support. This will prevent the assuming of the extremely bad position which results when the spinal muscles are relaxed and the trunk allowed to bend into the curved position into which gravity naturally draws it.

Round-shouldered or flat-chested persons should avoid the sitting position when too tired to sit erect. The standing position may be assumed for rest; or if too tired to stand, lie down upon the floor or some other flat, hard surface, with the body extended full length upon the back, and no support under the head. In this position, the muscles are relieved of the weight of the bones and other organs, and are able to rest, while their position is such that resulting deformity is prevented. A small, hard pillow may be placed under the shoulders to lift the chest forward.

It is better to relax in a sitting position. Habitual sitting

It is doubtful whether chairs are not on the whole an injury to health. When one is tired, it is far better to lie in a relaxed position is unquestionably the cause of many grave disorders of the internal organs, as well as ugly deformities, which, though curable in childhood and youth, are almost incurable in adults who have attained middle age.

#### **Lateral Curvature of the Spine.**

These curvatures are not curable when they have existed for many years, and have become rigid; but in young persons they may always be greatly improved, and many times entirely corrected. If they have existed but a short time, complete recovery may be obtained by simple exercises, which can be taken at home as well as in an institution. Serious cases of course require the care of a skilled physician.

Lateral curvature of the spine is usually indicated by the appearance of the shoulders and the hips. For example, if there is a curvature toward the left side, the right shoulder will be lower than the left, the right shoulder blade more prominent, and the right hip will appear higher or larger than that of the left side. These curvatures are due to general weakness or uneven development of the muscles of the back. The exercises prescribed for round shoulders are all applicable to cases of lateral curvature, whether affecting the right side or the left side. In addition, a few special exercises are valuable, among the best of which are the following:—

*Exercise 15.* Sitting in a chair, grasp the seat with the hand on the side of the high shoulder. Pull downward with as much force as possible, while reaching the other arm as high as possible straight up over the head. Repeat this exercise at the rate of about six times a minute, making ten to twenty counts during the exercise. Care should be taken to sit in a correct position during the exercise, the chest being held well forward and the chin drawn in (see cut). Endeavor to throw the chief weight of the body upon the hip corresponding to the low shoulder. By this means the low shoulder will be pulled up, the high shoulder pulled down, and the curvature temporarily strengthened. Repeat the exercise three or four times daily.

*Exercise 16.* Attach a pulley to the ceiling. Pass a window cord over it, and tie a large pail to one end. Tie several knots in the other end of the cord to aid the hand in grasping it. Have on hand a supply of stones or pieces of iron sufficient to permit a regulation of the weight from five to twenty-five pounds. Under the pulley, a foot or two to one side, attach to the floor another strong, knotted cord.

Standing in correct position directly under the pulley, grasp the rope at a height which will render it taut with the hand of the low side, with the other hand grasp the rope attached to the floor, and pull hard upon it, while at the same time lifting the weight with the hand of the low side. Beginning with a small weight, five or ten pounds, the weight should be gradually increased from day to day until twenty-five and even fifty pounds can be lifted. The exercise may be continued for five to ten minutes, the weight being lifted at intervals of five to ten seconds.

Galley 95.—Kellogg.

*Exercise 17.* Sitting with the hands upon the hips, practice Exercise 11, for five minutes. Then push the shoulders over as far as possible toward the low-shoulder side of the body, and hold the trunk in this position while breathing deeply ten to twenty times. Return to position, and resume the exercise. Repeat three or four times, or until the muscles are slightly fatigued.

*Exercise 18.* Lying upon the side on the floor or upon a hard couch with the high-shoulder side uppermost, flex the trunk toward the upper side as far as possible.

*Exercise 19.* Stand with the side of the high shoulder against a table. Place the hand of the same side upon the head. Reaching the other arm upward as high as possible, bend toward the table, taking care to hold the chest well forward and the chin drawn in. Repeat the movement several times while slowly counting four and breathing deeply.

*Exercise 20.* Practice daily lifting a weight by means of a pulley. The weight should be gradually increased until the weight of the entire body can be lifted. This exercise should be practiced for five to ten minutes two or three times a day.

When the weight can be easily lifted, overhead exercises for the arms, in which the body is lifted, may be practiced with advantage, such as swinging on rings, exercising on the overhead ladder, climbing a rope, etc.

All exercises which bring the muscles of the arms and trunk into full play are useful in correcting spinal deformities. Chopping, plowing, and other farm exercises are highly to be recommended. It is important, however, to remember that while engaged in exercises of this sort, or in any kind of muscular labor, the body must be continually held as nearly as possible in proper position. If this is not done, the effect of the exercise is to increase the deformity rather than to diminish it.

When the curvature is flexible, so that it is still possible for the trunk to be made straight, it is well for the patient to practice sitting with the weight of the body chiefly resting upon the hip of the low side. The raising of the opposite hip by pushing the trunk over toward the low-shoulder side, raises the shoulder, and corrects the curvature.

#### **Exercises for Developing the Abdominal Muscles.**

Exercises for developing the abdominal muscles are best taken in the horizontal position. The exercises should begin with breathing movements in which the lungs should be fully inflated. In breathing out, the abdominal muscles should be well drawn in. One to three deep breaths should be taken after each movement before the next is made. In the following table, the exercises are made progressive:—

*Exercise 21.* Standing against a smooth, vertical wall, with the hips, the heels, the shoulders, and the head touching the wall, the arms stretched well downward by the side, the thumbs turned outward (see cut), and the chin drawn in, take several deep breaths, raising the chest well forward, while holding the body close to the wall at each point. Now roll the head backward, allowing the chest and the shoulders to move forward, while keeping the hips and the heels close to the wall. The effect will be to expand the chest, and correct any tendency which may exist to posterior spinal curvature or round shoulders. Repeat the backward bending of the head several times, making the movement slowly and steadily, breathing in while the head is moving backward, and breathing out while it returns to position.

*Exercise 22.* Sit in a rather low chair, with the trunk held well erect, the chin drawn in, the feet placed squarely on the floor and separated to the distance of one and a half or two feet. Placing the hands upon the hips, bend the head backward until the eyes rest upon the ceiling overhead; then, while keeping the head in this position, and the eyes looking upward as much as possible, bend the body forward. In taking this movement, the body should be bent only at the hips, and should be slowly carried as far forward as possible, then returned to position. This is a capital movement for strengthening the muscles of the trunk, and for the correction of spinal curvature, flat and hollow chest, and round shoulders.

Galley 90.—Kellogg.

Each of these exercises may be repeated from five to twenty times. Swimming, horseback riding, and rowing are excellent exercises for developing the muscles of the trunk. Patients who are too feeble to raise the legs when extended may flex the knees sufficiently to make it possible to raise the legs to a vertical position, gradually extending the legs more and more day by day as the strength increases.

#### **Exercises To Promote General Health and Development.**

As before remarked, there is nothing better than labor for promoting muscular development and securing the advantages which come from exercise. But care should be taken continually to keep as nearly as possible in a correct poise. Ignorance, carelessness, or weariness often leads a person to assume awkward and unhealthful positions while engaged in work, which, in consequence of the irregular muscular development thereby induced, become fixed deformities. It should also be remarked that some employments give undue exercise to special muscles, and this leads to deformities. A carpenter, blacksmith, or cabinetmaker may be generally known from other artisans by the way in which they carry their arms. The strongly developed flexor muscles overbalance the extensors so that the arms are constantly bent when at rest as well as at work.

For children, out-of-door play, light work, assisting in cultivating small fruits, doing chores, and similar occupations are the very best kinds of employment. Elderly people require a considerable amount of exercise, but should carefully avoid violent exercise of all sorts. They should especially be careful not to become greatly overtaxed, or not to become greatly out of breath. The chest wall being rigid, the lungs cannot expand as in youth, and the heart may also be easily overworked. Elderly people who are accustomed to exercise do not so quickly experience a sensation of fatigue because of diminished nervous sensibility. They are consequently very liable to overwork, not being aware of the fact until a day or two later, when the symptoms of secondary fatigue appear. It is very important that elderly people should understand this fact, which applies to mental as well as physical work. An elderly man may be able to compete with a young man in exertion without apparent injury at the time, but will later suffer, while the young man

will experience no injury, though at the time greatly exhausted.

Women as a class suffer more than do men in consequence of lack of exercise. Their exercises must be less violent than those of men, as they have but half the muscular strength, and are less accustomed to vigorous muscular exertion. Breathing exercises are especially important for women and aged persons.

Running exercises are not to be recommended for adult women or for persons past middle age. Boys and girls of twelve to eighteen years of age may run until quite fatigued without injury. Their hearts and lungs are sound and not easily damaged. Adults, unless from youth accustomed to running, must content themselves with a very slow pace, and should avoid exercising until extreme breathlessness is produced. The pulse and the respiration should return within a few minutes to the normal rate. When the pulse remains quick for half an hour or more after exercising, this fact is evidence that the exercise has been too violent, and must not be repeated until the individual has been properly trained for it.

Elevation of temperature, as shown by the thermometer, after moderate exercise, as a walk of a mile or two, is a symptom which should receive immediate attention, as it indicates a possible beginning of tuberculosis of the lungs. Exercise should never be taken by a person who has fever. Persons who are just recovering from an attack of typhoid or other acute febrile disease should begin exercising very carefully indeed, as there is great danger of producing a relapse. Even sitting up will cause an elevation of temperature in a recent fever convalescent.

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He would have to continue the exercise for two hours to lift his one hundred and fifty foot-tons. As this would make the legs do all the work, it would be better to divide the work between the arms and the legs. This may be accomplished by making the arms assist, by resting the hands upon the backs of two chairs, the foot of the bed, a table, or any other convenient support, and making a downward push with the arms each time the heels are raised.

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For example, a person weighing one hundred and fifty pounds, holding in his hands a pair of dumbbells weighing twenty-five pounds each, making the total weight lifted two hundred pounds, raising himself two inches thirty times a minute, would do work amounting to 1,000 foot-pounds each minute, or 60,000 foot-pounds in an hour.

If at each movement a pair of dumbbells weighing ten pounds each are raised one foot, the additional work thus done would amount to 21,600 foot-pounds for the hands. The combined work of the arms and legs would be thirty-nine foot-pounds for each movement ( $162 \div 6 + 12 = 39$ ). It is only necessary to divide the total work to be done, 300,000 foot-pounds, by 39 to determine the number of times the movement must be executed ( $300,000 \div 39 = 7,700$ ). At the rate of twenty movements a minute, the work could be done in a little less than six and a half hours.

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of persons who have never cultivated a correct poise.

4. The head should be held well back upon the shoulders, the chin must be slightly drawn in, and the shoulders well braced back, but not in a strained

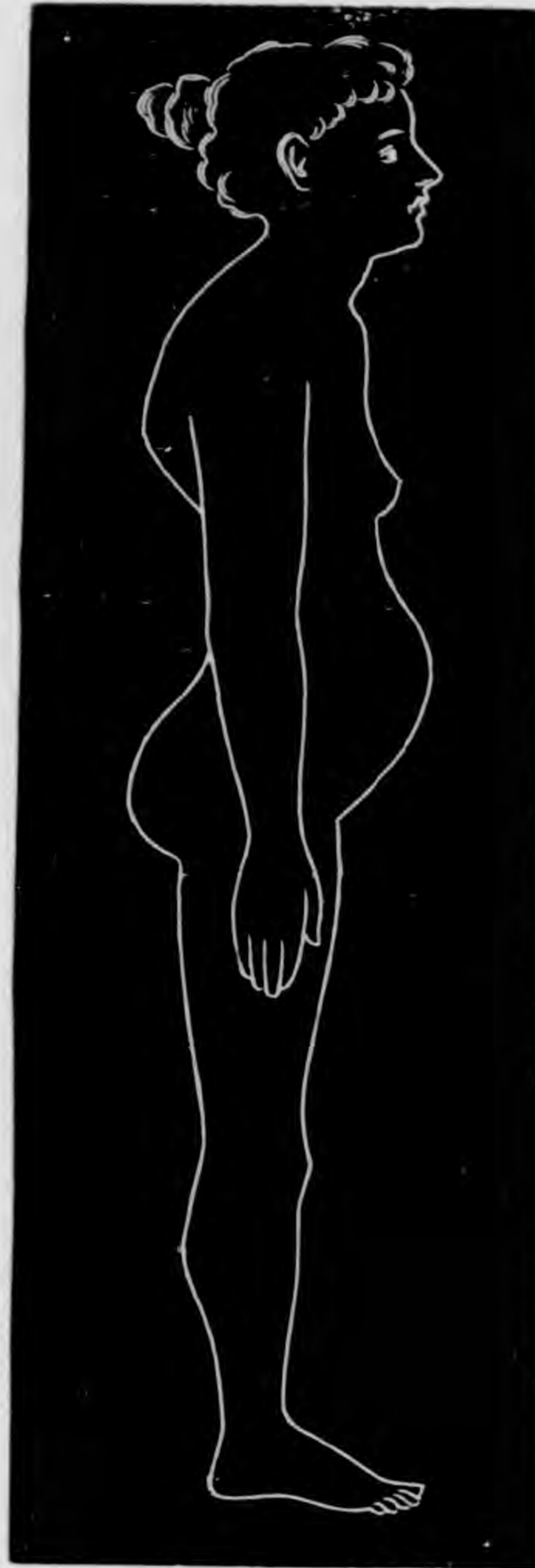


FIG. 4.—INCORRECT STANDING POSITION.  
[WEIGHT ON HEELS.]

position. The arms should be allowed to hang easily at the side, and the shoulders should not be elevated.

When a person has assumed the correct poise, a vertical line passing from the top of the head just in front of the ear, lengthwise of the body, will fall at the ball of the foot. This line, it will be noticed, passes not over the shoulder, but just in front of it.

what we believe to be correct ideas upon the subject, we reproduce a portion of an article published in this department a few years ago, which, with accompanying cuts, we trust will make the matter sufficiently clear to be readily understood.

1. The weight of the body should rest upon the balls of the feet, rather than upon the heels. Heel standing is a very prevalent habit, and one which is productive of much mischief. Fig. 2 represents correct standing, while Figs. 3 and 4 show the attitude taken by persons in heel-standing. Of course Figs. 3 and 4 are somewhat exaggerated examples, but all were taken from life. The writer has met hundreds of cases in which the poise of the body and the resulting bodily deformity were fully as great as are here represented.

2. The muscles of the legs must be made firm or rigid, and the hips well set back. Observe that in Fig. 2 the shoulders are forward of the hips, while in Figs. 3 and 4 the shoulders project backward beyond the hips. It is impossible to hold the body in a proper poise when the shoulders are even with, or behind, the hips, for the reason

that the head must be thrown forward and the chest flattened, in order to distribute the weight of the body in such a way as to preserve the equilibrium. There must of course be an equal mass of the body

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## HOW TO STAND CORRECTLY.

We have been led to say a word upon this subject in consequence of having recently encountered, in the works of several authors who have written upon different phases of the subject of physical culture, directions for taking a correct standing position which impress us as being decidedly at variance with correct principles and with what one sees in nature. The erroneous teaching which we have most frequently encountered has been instruction to find a correct standing poise by standing with the toes, chest, chin, and nose simultaneously touching the wall, or a perpendicular surface.

To enable the reader to see how absurd this instruction is, I have made a cut of a person putting himself in a standing poise by following the directions given. A mere glance at the cut is sufficient to show that the position is an awkward one, and one in which the muscles are strained, not in bringing the several parts of the body into symmetrical relation with one another, but in pulling the body out of shape. We can scarcely imagine a more awkward position than the one here represented. (See Fig. 1.)

In order to give our readers



FIG. 1

## EXERCISE AND SYMMETRY.

EXERCISE brings into active play the muscles which control the chest. Every time we breathe we move the ribs; and at the same time the cartilages by which the ribs are attached to the spine behind and to the sternum in front are also stretched and bent. Now if these movements are neglected, and we depend entirely for breath upon the movements of the diaphragm,—and there are a great many persons who do depend entirely upon the diaphragm,—we are never able fully to distend the chest, because, as the result of the neglect of movement, the cartilages have become hardened, and the joints are no longer flexible—they have lost their power to bend and stretch; the chest has become rigid.

Such a person cannot increase the size of his chest to any great degree. It is only by stretching the diaphragm down as far as possible that he is able to increase the capacity of his chest at all. His breathing capacity is thus limited, and he easily gets out of breath. This is one reason why an old person cannot run well.

Another point worthy of consideration is the effect of exercise upon the joints of the spine. As already stated, each joint of the vertebral column contains a fibro-cartilaginous body between the bodies of the vertebræ, the purpose of which is to render the vertebral column flexible. By means of these ingeniously constructed joints we can bend the body in every direction. Now suppose we do not bend the trunk in every possible direction many times a day, or often enough to keep these joints flexible, what will be the result?—These cartilages which lie between the vertebræ, and which form about one fourth

of the entire vertebral column, will become, in time, inflexible and rigid. The ligaments also which bind the vertebræ together will lose their flexibility, and thus the ability to bend the spine will be lost. Further than this, the muscles which support the spine, being attached to the ribs and to the spines of the vertebræ, become rigid and shortened when they are not stretched by frequent backward-bendings, side-bendings, forward-bendings, etc. This is the reason why we find most old people unable to bend the trunk freely. How many persons even among those of middle age, are able to bend forward and touch the floor without bending the knees? You ask an old gentleman to touch the floor, bending only at the

hips; and if he succeeds in getting over far enough to reach the floor, he does wonderfully well. Why is this?—It is because of the consolidation of the spinal column. If this same old gentleman had begun thirty or forty years ago to take regular exercise of this kind, he would not have lost his ability to bend the spine. At the age of fifty or sixty, or even at forty-five, a person whose spine has become rigid from lack of exercise, will not be likely to improve in this direction so as to be able to touch the floor without bending the knees, unless unusually well preserved.

But you say, "What harm if a man cannot touch the floor without bending his knees? Isn't he just as well off physically as the man who can do so?" By no means. This stiffness of the spine, especially in the lower regions, always involves a corresponding weakness of the abdominal muscles. When the spine is as rigid as a jury mast, the body is held erect with little muscular effort. It is thus not necessary for the muscles to be in constant play to keep the body balanced. This is a great disadvantage, since the muscles which hold the body erect, balancing the chest and shoulders upon the pelvis, by the same effort and at the same time perform a most useful office in holding the liver, spleen, stomach, bowels, and other important internal organs in position. Thus when these muscles become weakened through disuse, we have, as the result, a relaxation of the abdominal walls and a prolapse of the abdominal contents,—the spleen, pancreas, liver, stomach, etc. It is thus apparent that there is a great significance in this rigidity of the back — it always means a weak, relaxed condition of the abdominal muscles; and this means weakness, disease, nervousness, in fact an endless multitude of maladies.

Thus we see that it is of vast importance that the elasticity of the joints and cartilages of the spine should be maintained. This can only be done by proper exercise begun in childhood and continued through life.

It is important that the youthful flexibility of all the joints and muscles should be preserved; and this may be done by constant exercise. The marvelous performances of acrobats have given rise to the idea that these men are double-jointed. This is, of course, not true. They have simply preserved the flexibility of their joints by constant training. The acrobat is



put in training when he is a small boy. Professional acrobats usually have one or two small boys with them who participate in some of their performances. These small boys are the apprentices of the acrobats. The acrobat begins his professional work at the age of eight or ten; it is too late if he waits till he is twenty-five or thirty years old. The story is told of Pompey, the famous Roman general, that he had so maintained the elasticity and strength of his muscles by continuous exercise that he could run, leap, and carry heavy burdens equal to the most robust of his soldiers. Hufeland tells of a remarkable dancer, Galeria Copiola, an Italian woman, who made her first appearance on the stage as a professional dancer at the age of ninety, and who appeared before Augustus in that capacity some years later. Just think of a *danseuse* one hundred years old!

Another advantage of exercise,—general, regular, systematic exercise,—is found in the fact that it counteracts the deforming tendency of occupations and bad positions. As the result of the bad position usually assumed in sitting, especially in a rocking-chair, the chest falls in, and posterior curvature of the spine is produced. Half an hour's daily ~~work in~~ a gymnasium will bring back the shoulders, restore the natural curve to the spine, and bring the chest forward and the hips back into a normal, symmetrical position. The daily use of such exercises will largely counteract the effects of bad positions. ~~A person whose occupation causes a certain set of muscles to be constantly employed should take general, systematic gymnastics to counteract the deforming tendency of his occupation. Every occupation, no matter what it is, and though it may supply an ample opportunity for muscular work, if it requires the long-continued use of particular sets of muscles, has a tendency to develop deformity, because the muscles which have been in constant use have become too strong for the rest of the body, and so pull the skeleton into some misshapen position. We must counteract this tendency by the development of those muscles which are not used in the daily occupation. Spinal curvatures and posterior and lateral curvatures, coming from bad positions, are all curable by proper exercise if begun in time.~~

practice of posture  
exercises

# THE HOME GYMNASIUM

## HOW TO STAND CORRECTLY.

BY J. H. KELLOGG, M. D.

We have been led to say a word upon this subject in consequence of having recently encountered the works of several authors who have written upon different phases of the subject of physical culture, directions for taking a correct standing position which impress us as being decidedly at variance with correct principles and with what one sees in nature. The erroneous teaching which we have most frequently encountered has been instruction to find a correct standing poise by standing with the toes, chest, chin, and nose simultaneously touching the wall, or a perpendicular surface.

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In order to give our readers



FIG. 1

what we believe to be correct ideas upon the subject, we reproduce a portion of an article published in this department a few years ago, which, with accompanying cuts, we trust will make the matter sufficiently clear to be readily understood.

1. The weight of the body should rest upon the balls of the feet, rather than upon the heels. Heel standing is a very prevalent habit, and one which is productive of much mischief. Fig. 2 represents correct standing, while Figs. 3 and 4 show the attitude taken by persons in heel-standing. Of course Figs. 3 and 4 are somewhat exaggerated examples, but all were taken from life. The writer has met hundreds of cases in which the poise of the body and the resulting bodily deformity were fully as great as are here represented.

2. The muscles of the legs must be made firm or rigid, and the hips well set back. Observe that in Fig. 2 the shoulders are forward of the hips, while in Figs. 3 and 4 the shoulders project backward beyond the hips. It is impossible to hold the body in a proper poise when the shoulders are even with, or behind, the hips, for the reason

## THE JOYS OF VEGETARIANISM.

THE following letter was addressed to the editors of the *Outlook*:—

"In connection with the awakening interest in vegetarianism, a curious point in my own experience comes to mind. Though scarcely myself carrying out the full idea of the system, inasmuch as fish and eggs form an important part of my diet, the fact occasions surprise that neither the excessive heat of summer nor the extreme cold of winter is realized to the same degree as when animal food is eaten. Meat, as we all know, has the tendency to produce inflammation in the system; consequently, it is quite apparent why the heat of summer should be oppressive and debilitating, but why the cold of winter should be less keenly felt is something for which to account is difficult. Indeed, so entirely would this appear to be a matter of the imagination that one might hesitate even to speak of it were it not that the experience has been shared by many.

"One hesitates also, even in behalf of a reform, at making so bold an assertion as to declare that

human life is prolonged by abstinence from animal food; but there can be no doubt that the period of keen enjoyment—the heyday of life—is greatly lengthened by following the vegetarian idea, experience proving as it does that the body nourished without meat retains its original proportions, its suppleness and elasticity. No vegetarian was ever known to suffer from obesity. If a beautiful woman at forty is obliged to give up dancing, to give up tennis, to give up walking, because she weighs one hundred and sixty pounds, is life the same thing to her that it would be without this burden of weight? Is it not a pity to sit down in the very prime and beauty of one's existence to question whether life is worth living? The sitting down, and the lugubrious thought, to say nothing of the meat constantly eaten, only add to the cause of the troubles; the fast-increasing *avoir-dupois* not only making pleasure a thing of the past, but causing the object of life, in its full achievement of good, to become an impossibility."

THE TEACHING OF PRACTICAL HYGIENE IN COMMON SCHOOLS.—In a paper on "Hygienic Education," read by Dr. Leslie Mackenzie before the Sanitary Congress recently held at Edinburgh, Scotland, he suggests as a means of disseminating sanitary knowledge, that county medical officers should make it part of their duty to organize hygienic instruction throughout their counties; or to make themselves responsible for its initiation; and that this instruction should primarily have reference to the classes who are directly connected with the construction of dwellings, including water and sewerage systems. Dr. Mackenzie would also substitute the teaching of practical hygiene in common schools, for some of the subjects at present taught. Commenting on this, the editor of the *Sanitary Record*, London (Eng.), thus observes:—

"Probably the solution of the problem is to be sought in the introduction of simple but well-selected lessons on hygiene into the ordinary reading-books that are used in schools.

"A carefully-graduated series of such lessons, in all the different classes, from the lower standards upward—lessons showing the absolute necessity of wholesome nourishment, of pure air, and therefore of personal and domestic cleanliness—would have the effect of instructing the children from their

earliest school-days, and almost without their knowing it, in all the more important principles of sanitary science. The application of these would give the children a new interest in the common affairs of home life; and when those who are now at school take their place in due time in the management of municipal and county affairs, they would come to the discharge of their duties with minds already instructed regarding many of the matters that would then claim their attention. The teaching of the authorities who administer our sanitary laws is, no doubt, at present, felt often to be exceedingly desirable; but it seems beginning at the wrong end. Young folks are the proper subjects of systematic instruction. But the truth is that all the agencies are necessary that we can put into operation. Hygienic lessons at school, popular lectures by medical officers and others, conferences for the discussion of sanitary questions, and the dissemination of a knowledge of the laws of health by journals devoted to the subject,—these are all needful, and they are all playing their part in the solution of the great hygienic problem."

Look to your health; if you have it, praise God, and value it next to a good conscience.—*Frank Walton.*

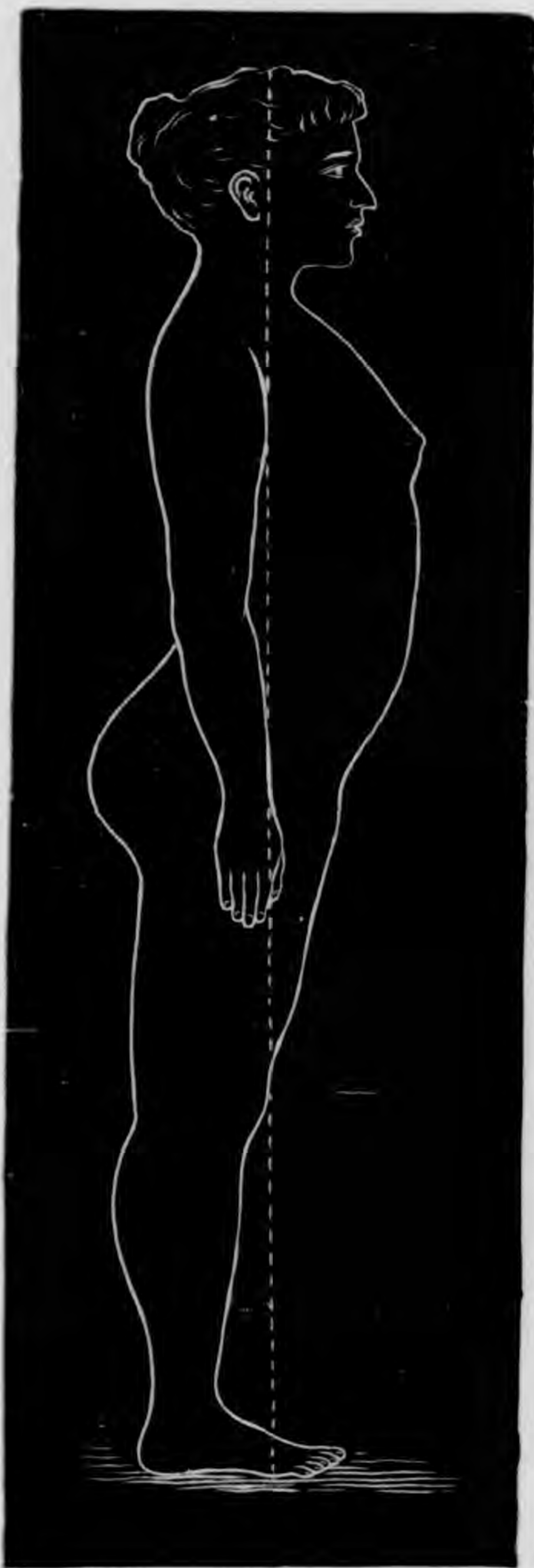


FIG. 2. CORRECT STANDING POSITION.  
(WEIGHT ON BALLS OF FEET.)

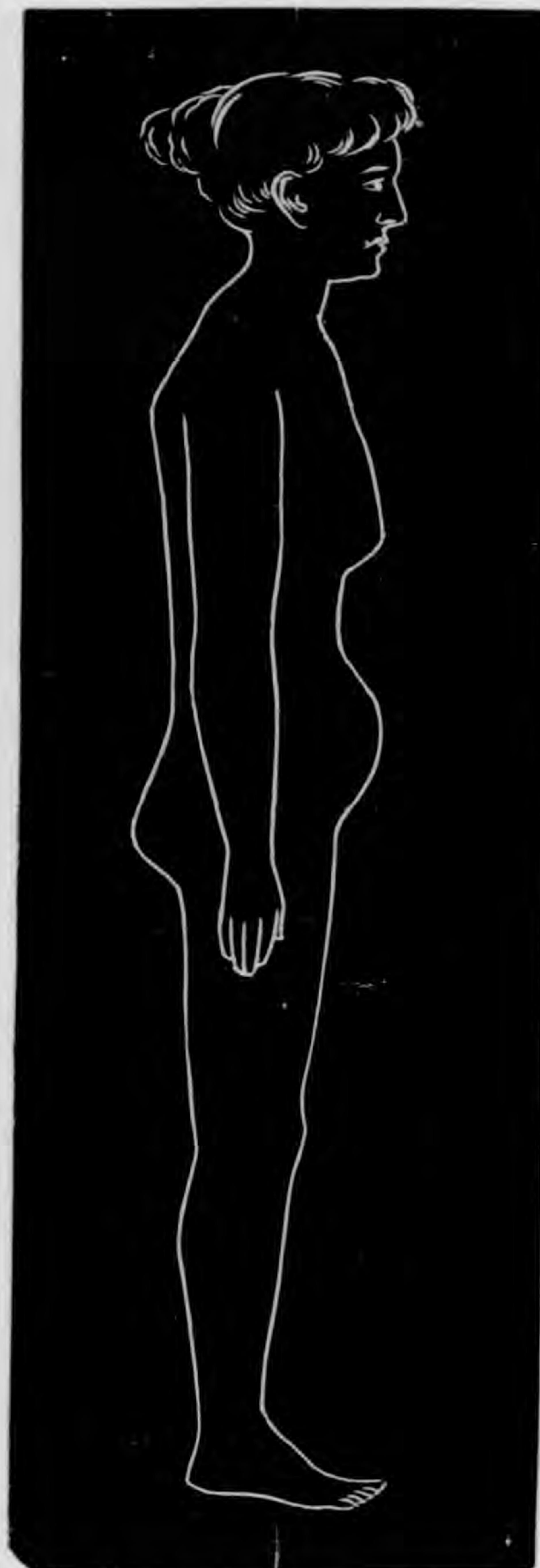


FIG. 3. INCORRECT STANDING POSITION.  
TRUNK MUSCLES RELAXED.  
(WEIGHT ON HEELS.)

on either side of the line which marks the center of gravity.

3. With the hips well held back, the chest can be thrown up strongly in front, and held as shown in Fig. 2. The abdomen should be at the same time well drawn in, so as to overcome the tendency to abnormal protrusion which is observable in the majority

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Two Remedies

USEFUL MEDICINAL AGENTS.

In this chapter we shall not undertake to give a complete list of all the varied drugs employed by physicians of various medical schools, but shall mention only such medicinal agents as have a known and certain value and such as may be safely employed at home.

We must not omit to say at the outset that drugs rarely cure except in the case of remedies which are employed for the destruction of parasites. The only real physician is Nature. Drugs, like other remedial agents are useful only when they can in some way aid Nature in her healing work. The reader should also be reminded that in the majority of those cases in which drugs are required in disease the services of a physician are essential. Powerful drugs should never be employed except by a physician, who, knowing the properties of the drug and its possibilities for harm as well as for good, can ~~xx~~ instantly regulate the doses to the requirements of the individual and who will also wisely determine when the use of the remedy should be discontinued. Much harm also results from too long continued use of a remedy which not infrequently renders invaluable service as a temporary ~~xxxx~~ palliative for some distressing symptom, which, however, may be aggravated by an overuse or too long use of the remedy.

VEGETABLE ACIDS.--Some of the vegetable acids, particularly those derived from fruits are very valuable as foods and sometimes are useful in the treatment of disease. Citric acid is especially useful. The acid of the tamarind, of limes, oranges, grapes, apples and other fruits are also ~~xxxxxx~~ of service. They are excellent appetizers, and, added to water, may be usefull employed as diluents especially in the treatment of fevers in which large quantities of water must be swallowed for the purpose of freeing the body of disturbing poisons.

—Vegetable acids have been a valuable means of preventing scurvy, which they are also useful in curing.

The vegetable acids are not equally useful however. The acidity of the rhubarb or pieplant has been shown by a chemical examination to be due to the presence of oxalic acid, a poisonous substance. The substance, in very small quantity prevents the action of saliva upon starch, hence it interferences with digestion. It is of no use as a food, and after the use of rhubarb it can always be found in the urine. In an investigation undertaken by the author a number of years ago for the purpose of determining the dietary properties of rhubarb oxalic acid was found in the urine of each of 30 persons who had partaken of ~~it~~ it the day before. Experience has shown that the free use of lemons is of advantage in malarial fevers.

IODOPFORM.--This useful drug, prepared from iodine, is of

great service in the treatment of ulcers . A ointment consisting of of one part of iodoform to 6 or 7 parts of vaseline may often exercise a most beneficent influence upon chronic ulcers of the leg and other parts of the body.

ARISTOL.--

~~(See New Remedies p. 1585 a.)~~

**Aristol.**— This drug, similar to iodoform in character, is an excellent antiseptic, and may replace iodoform for most of the uses for which it is valuable. It may be used as a dry powder for insufflation in œzema; is an excellent application for chronic ulcers, upon which the powder should be dusted thickly. It is especially useful in varicose ulcers and in suppurating wounds of all sorts. It is almost odorless, and is entirely free from the disgusting odor of iodoform.



TANNIC AND GALLIC ACIDS.--

(See Home Hand Book New Ed. portions marked on p. 772, 3,  
and add)

BISMUTH.-- (775 a. and add)

**Bismuth**, by which is understood the sub-nitrate or sub-carbonate, is much used in vomiting due to an irritable condition of the stomach in neuralgia and cancer of the stomach, in pyrosis, or water-brash, in acute and chronic diarrhea, and in various other complaints. Though often used in very large doses with apparently no injurious effect, the use of this drug is sometimes followed by the most poisonous and even fatal results, which are supposed to be due to the compounds of arsenic which it is very apt to contain.

Of the other metallic astringents, *sulphate of copper* and *nitrate of silver* are the most useful. They may frequently be employed with signal service in the treatment of chronic and obstinate ulcerated surfaces.

The subnitrate of bismuth when used for relief of ulcer of the stomach or for hypopepsia, should be taken in 15 to 20 grain doses before eating. It has a slightly constipating tendency, and turns the stools very black,--in fact it sometimes gives unnecessary alarm on the part of the patient. The black color is due to the action of the sulphurous gases generated in the colon by the bismuth forming the black sulphite of bismuth

Combined with vaseline in proportion of one part to three of vaseline, the subnitrate forms an excellent ointment for burns. It should be spread thickly over the burnt part; it adheres well and is exceedingly soothing and protecting besides being slightly antiseptic. Combined with sulphur, one part of subnitrate of bismuth to three parts of sulphur, bismuth forms an excellent antiseptic powder for dressing wounds. Dry subnitrate or subcarbonate of bismuth may be used to great advantage for raw and irritated surfaces.

MUSTARD FLOUR.--Mustard is sometimes used as an emetic. A heaping dessert spoonful dissolved in a half pint of warm water repeated in ten to 15 minutes is a pretty certain emetic, but it is seldom used for this purpose nowadays, as the stomach tube has taken the place of all emetics, being so much more rapid and certain in its effects, and also more agreeable.

Mustard may also be used advantageously for increasing the stimulating effects of poultices and compresses, being used in

water employed in moistening the clothes in a proportion of a heaping tablespoonful to the quart. The mustard should be enclosed in a bag and allowed to infuse ~~xxx~~ in water for 15 to 20 minutes.

MANNA.--

(Home H. B. p. 77, a.)

**Creosote.**— This well-known drug has within the last few years acquired a well-deserved reputation as a remedy in tuberculosis, or consumption of the lungs. Pure beechwood creosote (carbolic acid cannot be used as a substitute, as it is poisonous in doses in which creosote may be safely used) should be used in doses of ten to thirty minims, or from one-sixth to one-half a dram. Being somewhat irritating to the stomach, it should be administered only by enema and on alternate days. It must be mixed in a suitable emulsion. We have used the following formula for a number of years, with good results :—

<b>R</b>	Oil of sweet almonds,	3 oz.	
	Beechwood creosote,	1 dram.	
	Menthol,	8 gr.	
	Yolks of four eggs.		<b>M.</b>

Beat well together and add distilled water sufficient to make 30 ounces

Each ounce of this mixture contains two minims of creosote. The beginning dose should be four ounces, and should be administered every other night, gradually increasing the dose by one or two ounces each time until the patient takes ten or twelve ounces of the mixture. It should not be administered more frequently than every other day. The best time for administration is after retiring. The urine should be carefully watched. If it assumes a smoky appearance, the remedy should be discontinued for a time.

Creosote may also be used by inhalation. It may be best employed with the Perfection Vaporizer (see page 1594). It may be used in combination with benzoin, oil of cinnamon, oil of wintergreen, or oil of eucalyptus.

Note for ESSENTIAL OILS.--

The Perfection Vaporizer ( p.1594, 5.)

**Boric or Boracic Acid.**— This substance is sold as a fine white powder. In a dilute solution (four grains to the ounce) it is an excellent remedy for irritation of the eyelids, or what is commonly termed mucous conjunctivitis. It should be used freely several times a day. Its great value, however, is in the treatment of suppuration of the middle ear. The ear should be thoroughly washed out, and then carefully dried with a bit of absorbent cotton applied with the end of a toothpick, and the canal packed full of the dry, powdered boric acid, or with a mixture consisting of equal parts of boric acid and subnitrate of bismuth. Boric acid mixed with twice its weight of carbonate of zinc is valuable as a dry powder in acute eczema and other irritations of the skin.

An excellent remedy for fetid perspiration and oily skin is the following:—

℞	Boric acid,	4 drm.	
	Distilled extract of hamamelis,	1 pt.	M.

**Boro-Glyceride.**— Two parts of boric acid boiled with three parts glycerine until chemical combination takes place. The mixture is then diluted with an equal quantity of glycerine. It is an excellent remedy for sunburn and for chronic eczema of the hands and soles of the feet, and for other parts in which the skin is thickened by eczema.

**Essential Oils.**— It has been long known that the essential oils are possessed of antiseptic properties. The most valuable are oil of cinnamon, oil of wintergreen, and oil of eucalyptus. The antiseptic properties of these oils may be utilized in a number of ways, particularly by inhalation, for the treatment of disease of the nose, throat, and lungs, and, in dilute solutions, for disinfection of the mouth. Cinnamon probably possesses antiseptic properties in the highest degree of any of the essential oils. Either of the others mentioned may be used for the nose, throat, and lungs by means of the Perfection Vaporizer.

On pages 1594 and 1595 will be found a description of the Perfection Vaporizer, with a number of formulæ for the use of essential oils.

The effects of these remedies are, first, to discourage the growth of germs in the respiratory passages. This is exceedingly advantageous, for the reason that it is now known that chronic diseases of the nose and throat are chiefly due to the action of microbes. The second effect from the use of these oils is to promote the free flow of serum, which

serves to cleanse the nasal surface, and also destroys the microbes growing upon it.

In the absence of any better preparation, an antiseptic lotion may be improvised by adding a few drops of essence of cinnamon to a half glass of water. Mix well and apply freely with a toothbrush after first thoroughly cleansing the mouth in the ordinary way.

**The Perfection Vaporizer.**—This instrument consists of a glass bottle, with the interior of which three tubes communicate. One of these is connected with an atomizing bulb, whereby a fine spray or vapor may be produced within the bottle. By the use of suitable solutions, the instrument may be used either with or without the employment of the atomizing bulb, as it is both a volatilizer and a nebulizer. It is the most efficient instrument with which we are acquainted, for the treatment of diseases of the nose, throat, and lungs. It is especially useful in the application of volatile oils and other antiseptic remedies. Diseases of the nose, throat, and lungs are now known to be chiefly due to the development of germs in these regions. By the use of antiseptic remedies, the growth of the germs may be checked, and by the stimulation of the vital activity produced by the remedies, they may in time be destroyed, and thus a cure may be accomplished. The instrument can be used in the treatment of

the nose, the throat, the lungs, and the ears. The following formulæ have been found to be particularly valuable:—

For use without the atomizing bulb, we recommend the following, the first one mentioned (B. C. M. E. W. Solution) being most generally useful:—

**B. C. M. E. W. SOLUTION.**

<b>B</b>	Compound Tr. Benzoin,	drms. 6.	
	Oil Cinnamon, Oil Wintergreen, Oil		
	Eucalyptus, Menthol Crystals, each	drms. 1.	
	Alcohol,	drms. 45.	M.

An excellent remedy for acute cold in the nose or throat, also chronic catarrh of the lungs and throat.

**B. C. M. E. W. and CREOSOTE SOLUTION.**

<b>B</b>	B. C. M. E. W. Solution,	ozs. 3.	
	Beechwood Creosote, pure,	drms. 3.	M.

Excellent in cases of consumption, and in tonsillitis and bronchial catarrh with fetid breath.

**FOR NEBULIZATION, WITH THE ATOMIZING BULB.**

The following have been tried in many cases, and have been found very successful:—

**M. E. W. C. A. SOLUTION.**

<b>B</b>	Menthol (crystals),	grs. 40.	
	Oil Eucalyptus,	m. 40.	
	Oil Wintergreen,	m. 15.	
	Oil Cinnamon,	m. 10.	
	Alboline (liquid vaseline),	ozs. 4.	M.

Especially useful in cases of chronic nasal catarrh.

**BENZOIN and CREOSOTE SOLUTION.**

<b>B</b>	Beechwood Creosote,	drms. 1.	
	Benzoin Solution,	ozs. 4.	M.

Excellent for use in cases of chronic bronchial catarrh and lung consumption accompanied by profuse expectoration.

**BENZOIN SOLUTION.**

<b>B</b>	Oil Scotch Pine,	m. 20.	
	Oil Cinnamon,	m. 40.	
	Oil Wintergreen,	m. 20.	
	Oil Eucalyptus,	drms. 1.	
	Menthol Crystals,	grs. 20.	
	Compound Tr. Benzoin,	ozs. 4.	M.

To be used several times daily in cases of bronchial catarrh and asthma.

**MENTHOL and CAMPHOR.**

<b>B</b>	Menthol,	grs. 40.	
	Camphor Gum,	grs. 40.	
	Alboline,	ozs. 4.	M.

Very valuable in cases of acute "cold in the head."



**Cascara Sagrada.**—The fluid extract of this herb, a native of California, is one of the most valuable drugs for use in chronic inactivity of the bowels. It is not by any means a panacea, but, for temporary use, is preferable to many of the older and more drastic drugs. It should be used in doses of from ten to twenty minims of the fluid extract. A dose may be taken at night and another before breakfast in a little water. The ordinary fluid extract is very bitter. Several preparations are made which retain the activity of the drug without the bitterness.

**Iodized Starch.**—This is a valuable remedy in cases of intestinal catarrh affecting the lower bowels. It may be used in doses of a half dram dissolved in a pint of warm water. It is useful as an intestinal disinfectant when used in this manner. Iodized starch contains five per cent of iodine.

**Glyceride of Starch.**—This preparation is a solution of starch in glycerine containing ten per cent of starch. It is an excellent emulsion for application to the skin. It is a little too irritating for raw surfaces. It may be used for chilblains, sunburn, chapped hands, and all cases of slight irritation of the skin.

**Menthol.**—This is one of the most valuable of the new remedies. It is a sort of camphor made from peppermint. Menthol was first imported from China, but is now made in large quantities in this country. It is a valuable antiseptic and anodyne. Dissolved in alcohol, it is a most excellent liniment. The following is a useful formula :—

R	Menthol crystals,	oz. 2,	
	Alcohol,	pt. 1.	M.

For relief of acute cold in the head, there is probably no remedy of greater value than menthol. The best mode of using it is in connection with the essential oils,—eucalyptus, cinnamon, and wintergreen,—by means of a Perfection Vaporizer. An excellent formula is given on page 1595.

**Animal Extracts.**—The possible utility of animal extracts as remedies for disease was first brought to the notice of the profession by Professor Brown-Sequard, of Paris. The writer was a visitor to the laboratory of the renowned professor in Paris, at the time that he was making his earliest experiments in this direction. Since the first experiments of Brown-Sequard, in which extracts of the sexual glands were made, extracts have been made of the brain, thyroid gland, and of various other tissues, and their use is claimed to be effective, but it must be acknowledged that as yet the value of these extracts has not been established upon a sound basis. Certain parties in this country have placed themselves in the category of quacks by making extracts of the stomach, intestines, liver, and almost every structure of the body, and widely advertising them with most extravagant and fallacious representations in the public prints. In the opinion of the writer, the preparations last referred to are worthless, and probably little value attaches to animal extracts of any sort.

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**Malt Extract.**— There are two principal classes of malt extracts, the fermented and the unfermented. The fermented extracts of malt contain little or no sugar or maltose, and have in their composition about four or five per cent of alcohol. Some possess more alcohol than this, and are practically no more than concentrated lager beer. These malt extracts are not to be recommended.

The saccharine extracts of malt are, however, valuable. They are usually of a dark-brown color, and have the consistency of syrup or honey. They have a sweet, slightly bitter taste, the sweetness being due to the maltose which they contain. They also contain diastase, a starch-digesting principle. Used in doses of one or two tablespoonfuls after each meal, these malt extracts are often very useful in cases of indigestion, particularly in those cases in which the stomach digestion of starch is imperfectly performed. It seems hardly probable that the benefit derived from malt extracts is due to the diastase which they contain, as the activity of malt in digesting starch is but little greater than that of saliva, and a little more chewing of the food would consequently be quite as useful as the taking of a considerable quantity of malt extract. It seems quite probable that the maltose, as well as the diastase, may have some value in aiding or regulating the digestive process as yet not fully understood. It is doubtless a peptogen of great value.

**Papoid and Bromaline.**— These are two digestive principles which, like pepsin, are capable of dissolving meat, boiled white of egg, and other albuminoid substances. They differ from pepsin, however, in that they are of vegetable origin, and are active in a neutral or alkaline as well as in an acid medium, whereas pepsin acts only in an acid medium. They are to be highly recommended as substitutes for pepsin, the action of which is frequently accompanied by the formation of a poisonous substance known as pepto-toxine.

**Grindelia.**— The fluid extract of this plant, a native of California, is of great value in cases of poisoning by poison oak or ivy. The parts should first be bathed with soda solution (a dram of soda to a pint of water with ten drops of carbolic acid), to which a few drops of carbolic acid should be added; then cloths wet in a solution of the fluid extract of grindelia with four or five ounces of water, should be applied over the inflamed parts. It is also highly recommended as a palliative in cases of asthma. Fifteen or twenty drops are taken every hour or two until the paroxysm ceases.

**Ichthyol.**— This is a tarry preparation made by the distillation of fossil fishes found in the Tyrol. It is valuable in many skin diseases, particularly in eczema, psoriasis, chilblains, and burns, for which it should be used in a ten per cent ointment, or one part ichthyol to one part vaseline or lanolin. It is also valuable for enlarged lymphatic glands. It should be used as an ointment, ichthyol constituting one-fifth of the preparation.

For irritable rectum and hemorrhoids we have found it also a very valuable remedy. We most frequently use it by painting a little pure ichthyol upon the affected parts. It is slightly anodyne, and quickly relieves a painful and swollen hemorrhoid when used in this way.

**Tuberculin.**— A few years ago Professor Koch discovered the remarkable fact that guinea-pigs may be rendered proof against the germs of tuberculosis by repeatedly injecting them first with small then with larger doses of the poison produced by the tubercle bacilli, the germ of consumption. The name *tuberculin* has been given to this poison. It was at first supposed that it would prove effective in the cure of consumption, and certainly a number of persons appeared to be benefited by its use. More mature experience, however, has led to its abandonment, and it is now rarely employed. It is valuable, however, as a means of determining the presence of tubercular disease, and for this purpose it is very largely employed in the examination of dairy cattle. If tuberculosis is present in the animal, an injection of tuberculin produces a very marked rise of temperature within a very few hours.

**Diphtheria Antitoxin.**— Almost simultaneously the German bacteriologist, Behring, and a French physician, Roux, made the remarkable discovery that the serum of the blood of an animal which had been rendered proof against diphtheria by injection with the poison produced by the diphtheria germ, may be used not only as a means of preventing the disease in human beings and other animals, but also as a means of cure after infection. The theory is that there is produced in the blood of a person or an animal suffering from diphtheria a substance which neutralizes the poison of the disease. Horses are used as a source for the serum. The protection is said to last for five or six months. Many

favorable results from the use of diphtheria antitoxin have been reported, but it must be held that this remedy is still under trial.

A similar remedy has recently been proposed for tubercular disease of the lungs, or consumption. The value of this remedy is still more questionable.

**Dermatol.**— This remedy, also known as subgallate of bismuth, is an antiseptic and astringent. It is valuable in the treatment of skin diseases and ulcers, being dusted upon the affected parts. It is also useful as an intestinal antiseptic in doses of five to ten grains after each meal. In cases of hyperpepsia it may be used in the same doses before eating. We have found this remedy valuable, but it does not seem to be possessed of properties equal to charcoal in the form of tablets.

**Antiseptic Charcoal Tablets.**— Charcoal tablets are not a panacea, but they have proven to be the most valuable remedy we possess for morbid conditions depending upon fermentation or decomposition of food in the stomach and intestines. They consist of a special form of vegetable charcoal, much superior to willow, freshly prepared, to which is added sulphur and subgallate of bismuth, a valuable intestinal antiseptic, and maltose, a valuable peptogen. They render invaluable aid in the treatment of cases presenting the following symptoms of disturbed digestion: Acidity, eructations of gas, heartburn, biliousness, sick headache, nervous headache, bad taste in the mouth, coated tongue, and constipation. Persons suffering from dilatation of the stomach need to make constant use of an intestinal antiseptic of some sort. The antiseptics entering into the composition of charcoal tablets are the only ones with which we are acquainted that may be continually used without injury. Antiseptic Charcoal Tablets are manufactured by the Modern Medicine Company, Battle Creek, Mich.

**Antiseptic Charcoal Powder.**— The following mixture is a good antiseptic for use when the charcoal tablets cannot be obtained. It has the disadvantage, however, that it is very disagreeable to take:—

<b>R</b>	Wheat charcoal,*	4 parts.	
	Sulphur,	1 part.	
	Subgallate of bismuth,	½ part.	<b>M.</b>

Mix thoroughly. The dose is a heaping teaspoonful after each meal. In taking, the powder should be placed in a glass, a little water added, sufficient to make a thick paste, then an additional amount of water stirred in so it can be readily swallowed.

\* Ordinary willow charcoal is much less effective than the freshly prepared charcoal furnished by the Modern Medicine Co., Battle Creek, Mich.

#### **Antiseptic Lotion for the Stomach.—**

<b>R</b>	Bicarbonate of soda,	3 ozs.	
	Sodium Sulphite,	1 oz.	
	Chloride of sodium,	1 oz.	<b>M.</b>

Add one heaping teaspoonful of this powder to two pints of water. In washing the stomach by means of the stomach-tube, the water employed should be as nearly as possible the temperature of the body.

Lactic acid (Appendix p.1535 d 7.)

Sulphate of copper (Appendix, 1535 c 7)

Creosote (Appendix 1535.)

Also portions marked on pages 1537, 8, 9, 1590, 1, 2 a, 3.)

**Lactic Acid.**— This organic acid is naturally produced by the fermentation of milk, in which sugar of milk, or lactose, is decomposed, producing lactic acid. According to the experiments of Hayem and Winter, of Paris, which we also have verified in the Physiological Laboratory of the Battle Creek (Mich.) Sanitarium, lactic acid is useful as an aid to digestion. We have found it most useful in those cases in which there is failure of the digestive fluids to completely and perfectly convert the nitrogenous elements of the food. It may be taken in doses of fifteen or twenty drops, properly diluted with water. It should be taken immediately after eating. In the green diarrhea of children, it is also very useful. Administer every hour, a teaspoonful of a solution made by mixing one teaspoonful of lactic acid in a tumblerful of water sweetened with a little sugar or honey. Recent experiments have shown that lactic acid is a germicide, and that it is useful in destroying the germs in the stomach and intestines.

Kumyzoon affords a most excellent means, probably the best of all, for administering lactic acid. Kumyzoon is similar to kumyss, differing only in that it is made from sterilized milk and contains no sugar. It is made by means of a special ferment, and not by the addition of yeast and sugar, as in kumyss. Cottage cheese also contains lactic acid, and is wholesome if care is taken to boil the sour milk in converting it into cheese.

**Sulphate of Copper.**— All the metallic salts possess valuable properties as germicides; but sulphate of copper is one of the most useful of all. It should be used in the proportion of one ounce to the gallon of water. It also possesses valuable properties as a deodorant. It should be remembered that all salts of copper are poisonous. The solution must be used very freely to secure satisfactory results.

ANTISEPTIC DRESSING.-- (1596 App. 2 )

**Antiseptic Dressings.**— Non-infected wounds, whether surgical or accidental, heal without suppuration when dressed aseptically or antiseptically. Dry sulphur, or a mixture of three parts of dry sulphur with one of subnitrate of bismuth, applied freely to a wound after closing the skin, covered with a dry cheese-cloth or bandage, we have found an excellent antiseptic dressing. Iodoform may also be usefully employed in the same way ; also cheese-cloth saturated with iodoform. Cheese-cloth boiled for half an hour in a 1-2500 solution of corrosive sublimate, or a 1-200 solution of sulphate of copper, is an excellent antiseptic dressing.

Soap, Turpentine Enema, and Saline Laxatives, (Page 1597)

Anti-petic dentifrice, 1594.

**Soap-Turpentine Enema.**— To a quart of soapsuds, using at least one large heaping tablespoonful of shaved yellow soap, adding a teaspoonful of turpentine. Mix thoroughly and administer at once. This is to be used

in cases in which the ordinary enema and other means employed do not induce efficient evacuation of the bowels.

**Saline Laxatives.**— A saline laxative may be sometimes usefully employed in thoroughly cleansing the alimentary canal in preparation for a surgical operation, in conjunction with the warm-water enema or the colocolyter. We have found the following formulæ most valuable for this purpose :—

1. *Aqua Salina.*— Sod. sulph., oz. 12 ; mag. sulph., dr. 4 ; sod. chlor., dr. 2 ; aquæ, pt. 8. M.

Dose : One-fourth to two-thirds of a glassful of this solution diluted with a glassful of water, should be taken in the morning, before breakfast. In cases of extreme constipation, an equal quantity may be taken on retiring at night. This remedy is fully as efficacious, as a laxative, as any of the laxative mineral waters, for which it is a perfect substitute.

2. *Seltzer.*— Mag. sulph., 12 parts ; acid tartaric, 41.5 parts ; sod. bicarb, 46.5 parts. M.

Dose : Two to four heaping teaspoonfuls dissolved in cold water, to be taken before breakfast.

3. *Saline Clyster.*— Sulphate of magnesia, one tablespoonful ; glycerine, one tablespoonful ; boiling water, two tablespoonfuls. M.

The above quantity is the proper amount for a single enema. It is to be used only in cases in which the bowels cannot be induced to move by the ordinary enema. The solution should be introduced by means of a large catheter or rectal tube passed as far into the bowel as possible.

**Antiseptic Dentifrice.**—Modern researches have shown that nearly all diseases of the mouth, as well as a large share of the diseases of the stomach, are due to the action of germs which find lodgment there. The mouth is peculiarly exposed to the attacks of germs, as it is located at the very entrance of the body, and a portion, at least, of the respired air passes through it, the germs finding lodgment about the tongue, cheeks, between the teeth, and elsewhere. The mucus secreted by the glands of the mucous membrane lining the mouth, is to some degree antiseptic in character, and possesses germicidal, or germ-destroying, properties to some extent. When the mouth is kept clean, this disinfecting mucus is capable of thoroughly protecting the structures of this portion of the body against the attacks of microbes; but when particles of food are left to lodge between the teeth, the germs, finding abundant soil in which to grow and multiply, become so numerous that the poisonous substances which they produce neutralize the antiseptic mucus so that it becomes powerless for protection.

Meat, of all other articles of food, is most injurious in this manner, for the reason that its fibers readily lodge between the teeth and are not easily removed, and for the further reason that it furnishes a kind of soil in which germs grow with the greatest rapidity and with the most virulent properties.

It is thus apparent that thorough cleanliness of the teeth and mouth is one of the most important hygienic measures. This fact becomes still more apparent when we remember that the act of eating or drinking, and the frequently repeated act of swallowing to clear the throat from mucus, a practice which cannot be too much deprecated, are the means of carrying down into the stomach any microbes which may be present in the mouth. There are certain microbes, also, which seem to have their habitat in the mouth, particularly those of diphtheria, pneumonia, and consumption. It is not known that these germs propagate outside of the human body, except under artificial conditions. They find ready lodgment in the mouth, and are often present there in persons apparently enjoying perfect health, waiting the opportunity when a severe cold or some

other depressing agent shall, by reducing the resistance of the body, enable them to obtain a stronger foothold and to manifest their presence by the characteristic symptoms of diphtheria, pneumonia, or some form of tubercular disease.

The hygiene of the mouth requires thorough cleansing of the teeth and throat before and after each meal. It is well to use some mild antiseptic for the purpose. Cinnamon is one of the best which can be employed for this purpose. Many of the tooth lotions and powders advertised and sold are more or less injurious to the teeth, some are worthless, and a number contain soap and other objectionable substances. The best means of cleansing the teeth with which we are acquainted, is the Antiseptic Dentifrice prepared by the Modern Medicine Company, Battle Creek, Mich. The basis of this preparation is the extract of the bark of the famous soap tree of South America, one of the most remarkable cleansing agents known. The antiseptic properties of the dentifrice are due to the pure cinnamon oil which is added. These substances are combined with very fine precipitated chalk, making a detergent paste which is most effective in its cleansing action. Directions for the use of the dentifrice accompany each package.

Rinsing the mouth thoroughly with simple water, and the vigorous use of the brush, are alone sufficient to render great service in washing away bits of food and masses of growing microbes; but an antiseptic dentifrice is necessary for thorough cleansing. In the absence of anything better, a little cinnamon essence may be added to the water used for cleansing the mouth and throat; a teaspoonful to the glass of water, well mixed, is the proper proportion.



FLUID EXTRACT OF WITCHHASSEL.--This remedy combined with cacao butter in the form of suppositories is very useful in the treatment of ~~hemorrhoids~~ hemorrhoids. distilled extract of witch hasel may also be used for the same purpose. It should be applied diluted with an equal quantity of water to the hemorrhoids all exposed after movement of the bowels.

VEGETABLE OILS.--

(Page 1575 H.H.B.)

4 B. W.  
ELECTRICITY AS A COMPLEMENT TO HYDRO-  
THERAPY IN THE TREATMENT OF  
CHRONIC DISEASES

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(Paper read before the American Electro-Therapeutic Association, Washington, D. C., Sept. 26, 1900.)

While electricity is recognized as one of the most remarkable and powerful of all the forces of nature, and while laboratory experiment and clinical observation have demonstrated beyond chance for cavil its great potency as a therapeutic agent, all attempts to secure for it the standing of a universal remedy, an agent capable of accomplishing all that needs to be done for the sick man in the way of remedial effort, have signally failed. It may be further added perhaps without injustice that the efforts of some enthusiasts to find in electricity a panacea for all human ailments has been a fruitful cause of prejudice, and the failure of this agent to accomplish all that has been claimed for it in the hands of those who have been led to make a trial of it, has led a vast number of physicians to return to the empirical, irrational, and artificial methods, the legacy which has come down to us from the infantile days of our beneficent art, or which were engrafted upon it during the ages when all the arts and sciences were stifled by the universal prevalence of superstition and intellectual darkness,—methods which still cling to us like the barnacles upon the bottom of an ocean steamer, and hinder our advancement toward the goal of all scientific progress in medicine,—the attainment of a system of dealing with the sick in which every measure employed and every application shall have for its basis a thoroughly rational and physiological foundation. No medical practice can properly claim to be strictly rational which is not at the same time physiological. Those measures which accomplish so-called therapeutic results by means of toxic effects are pathological rather than physiological agents, and with the onward march of laboratory research, clinical observation, and physiological and pathological knowledge must in time be wholly eliminated from our therapeutic armamentarium. The writer has for more than twenty-five years given special and earnest study to the practical application of physiological agents of all sorts in the treatment of disease. Water, gymnastics, massage, manual and mechanical exercise, heat, sunlight, diet, and other agents, as well as electricity in its various forms, have been carefully studied and utilized in the treatment of all forms of acute and chronic disorders. Relying upon none of these agents as a cure-all, the effort has been made so to combine them all as to secure for each the greatest possible efficiency, utilizing each one for those things to which it is best adapted, and applying two or more in succession or simultaneously in such a way as to enable the effects of each one to supplement or complement the effects of each other one. Special studies have been given to the utilization of water and electricity in this way, for the reason that these two agents have been the object of more exact scientific study and research than any other of the agents employed in

the any other physiological therapeutics.

The purpose of this paper is to record some of the practical deductions and observations which I have made, not for the purpose of depreciating the value of electricity, but for the purpose of understanding, if possible, its utility by enlarging its sphere of usefulness and increasing its efficiency. I may be permitted to say that I fear many in the profession make a mistake in yielding to the general tendency to specialize in narrow medical lines. The chronic invalid rarely has a fair chance unless he can have brought to bear upon his case simultaneously all the various physiological agents which are indicated. To undertake to cure a chronic dyspeptic by diet alone, or water alone, or by electricity or exercise alone, or by any other single agent, is very much like trying to raise a big city block with one jack-screw. All the lifting agencies possible must be set at work to get these chronic sufferers out of their pathological ruts.

It requires but a very superficial study of the subject of hydrotherapy to show the remarkable similarity between its method of effecting results and that of electricity. The most important results of each are attained through their influence upon the nervous system, as the therapeutic effects of water, as well as those of electricity, are based upon its physiological effects.

A brief summary of the physiological effects of water upon the body may be interesting:—

The researches of Schüller, Vinaj, Winternitz, and others have shown that prolonged, moderately cold applications to the surface produce prolonged contraction and decongestion of internal vascular areas reflexly connected with the cutaneous area acted upon. Local cold applications in this respect differ from general cold applications, which cause dilatation of the visceral and cerebral vessels by mechanical displacement of the blood resulting from the contraction of the surface vessels.

Warm applications, that is, a temperature of  $92^{\circ}$ – $98^{\circ}$ , on the other hand, cause immediate contraction of the vessels of the interior of the body corresponding with dilatation of the cutaneous vessels.

Every portion of the cutaneous surface is reflexly associated with some internal vascular area, the conditions of which may be controlled by the application to the associated cutaneous area of thermic or other agents capable of producing vascular changes; for example, any agent which causes contraction of the cutaneous vessels will cause a corresponding contraction of the associated visceral vascular area, this being also true respecting vasodilatation.

From clinical observations which I have made, and from the study of practical electrotherapy in connection with hydriatry, or rational hydrotherapy, I am fully convinced that many of the effects of percutaneous applications of electricity are produced by the same means that many hydriatic effects are obtained; *viz.*, through reflex influence propagated from the skin to the spinal cord through the sensory nerves, and sent out from the spine as motor influences, carried along through the non-medullated vasoconstricting fibers of the sympathetic and the medullated inhibitory fibers which pass directly from the vasomotor centers of the cord to their distribution in the vessels. In other words, I believe that the condition of anelectrotonus or catelectrotonus, as the case may be, established in the cutaneous vessels, is propagated through the reflex arc and referred to the associated internal vascular area. It seems to me that this view alone affords a rational explanation of the influence of percutaneous applications of galvanism upon internal congestions. We know that uterine congestion may be relieved by electrical applications of various sorts. A galvanic current of twenty to forty milliamperes, applied, the cathodal trunk over the epigastric region, the anode over the lumbar region, produces decided effects in relieving uterine and ovarian congestion. Yet the location of these organs is such as to bring them practically to the neutral point between the two poles, and hence outside the sphere of influence of either the cathode or the anode. It is true that by increasing the strength of the current the neutral point may be moved nearer to the anode, while decreasing the current moves the neutral point nearer the cathode, thus bringing in either case a larger area under the influence of the opposite pole, and knowing this fact and taking advantage of it, we may bring under the influence of either pole desired, structures not too far removed from the surface. But in the case of organs located approximately in the center of the body or far beneath the surface, as the case of the uterus, the ovaries, the abdominal viscera in general, and the spinal cord, it is evident that we are powerless to produce in them an electrotonic condition of any considerable degree of intensity. In the case of the pelvic organs, likewise in the case of the stomach, we are able to produce either anelectrotonus or catelectrotonus, as we may desire, by means of suitable electrodes; but in the case of the spinal cord, the sympathetic ganglia, most of the abdominal viscera, and indeed we may say nearly all the deeply seated structures of the body, we are unable to produce electrotonic states, for the reason that the action of the electrical currents when applied to the body is always confined to the immediate vicinity of the electrodes. As the current leaves the electrodes, it spreads out, utilizing the whole body as a conductor, instead of passing from one electrode to the other, as might be supposed by one not familiar with the laws of electrophysics.

These and other considerations have fully persuaded me that in explaining the effects of percutaneous applications of electricity, we must keep in mind the interesting anatomical and physiological

relationships which form the basis of a large share of the applications of water in rational hydrotherapy.

The researches of Brown-Sequard, Charcot, Winternitz, Bene-Bardi, Fleury, and other hydropaths have established a distinct reflex relationship between the following-named external and internal regions respectively:—

Scalp and skin covering the neck, upper part of back, and face, with the brain.

The precordial region, with the heart.

The skin covering the chest, with the lungs.

The middle dorsal region and epigastric region, with the stomach.

The lower third of the sternum and lumbar region, with the kidneys.

Skin overlying the liver and spleen, with these organs.

The umbilical region, with the intestines and sympathetic ganglia.

The epigastric, the lower lumbar and sacral region, the inner surface of the thighs, and the feet, with the uterus and ovaries.

In general, the skin overlying an internal organ is reflexly associated with it. This is the reason why percutaneous applications of electricity made over an organ usually affect it, and not altogether because the electrical current is passed through the organ.

For nearly twenty years I have made use of this principle in the application of electricity, especially in the treatment of genito-urinary diseases, and have seen excellent results from the application. For example, in applications intended to influence the genital glands and associated organs,—the uterus, ovaries, and tubes in women, the testicles and prostate in men,—I have found it distinctly advantageous to make applications to the inner surface of the thighs and perineum as well as to the epigastric and lumbar regions. I was first led to do this because of the anatomical relations of the nerve supply of these regions, before the reflex relationship between cutaneous and visceral vascular areas was so thoroughly understood as at present. I have also for many years utilized anodic applications of the galvanic current to the face as a means of relieving coryza, and have often seen a patient relieved of headache, presumably congestive in character, by applications of this current.

Granting the truth of the above statements respecting the mode of action of percutaneous applications of electricity upon visceral circles, it needs no lengthy argument to show the great advantage of combining electrical and hydriatric applications in a great variety of morbid conditions.

According to my personal experience, two general rules may be established for applications of this sort:—

1. The movement of blood and accelerated functional activity of an internal organ may be induced by a short vigorous cold application in combination with cathodic application of the galvanic. This electrical application may be either simultaneous or may immediately follow the cold application. Bipolar, faradic, or sinusoidal currents may also be applied with advantage, but the effect is less distinct than that of the galvanic current. The electrical application should be as strong as the patient can bear without pain.

2. The movement of the blood, congestion, and undue functional activity of an internal organ, may be diminished by a prolonged moderately cold application, ( $60^{\circ}$ – $70^{\circ}$ , from thirty minutes to several hours) combined with the simultaneous anodic application of the galvanic current of moderate strength.

By the application of these principles, results which appear really marvelous to one not familiar with applications of this sort may be obtained in cases of congestion of the brains, lungs, liver, uterus, ovaries, likewise in atonic conditions of the stomach, bowels, in amenorrhea and hypopepsia.

In applications for the relief of pain, in which electricity so often renders most valuable service, the association of heat is an exceedingly valuable measure. When the pain is neuralgic in character, the strong application of the sinusoidal or faradic current, combined with a fomentation at a temperature high enough to produce slight pain when first applied, continued for fifteen or twenty minutes, gives very positive and gratifying results. The current should be as strong as the patient will bear. When the pain is due to congestion or inflammation, an anodic application of the galvanic current should be employed instead of an induction current. The application should be prolonged and not so strong as to produce decided sensation.

Anodic galvanic applications may likewise be associated with cold as an analgesic measure.

In cases of cardiac insufficiency in which the application of electricity may be thought useful measures, advantage may be obtained by the application, two or three times daily, of a cold compress for forty to sixty minutes, over the anterior surface of the chest. Slowing of the pulse and an increase in arterial tension, as indicated by sygmographic tracing, has indicated at once the therapeutic power of this simple application.

Cases of atony of the bladder and inactivity of the bowels, due to dilatation of the colon, the cold douche to the feet and over the lumbar, umbilical, and hypogastric regions, in combination with faradic and sinusoidal applications to the rectum and abdominal walls, achieve prompt success in many most obstinate cases which have failed to yield to other

measures. Cold douches applied to the parts named may also be used to advantage in combination with the galvanic current applied simultaneously with the abdominal and lumbar. The strength of the current should be 60 to 80 milliamperes, the application being made by means of a smoothly fitting electrode.

In cases of apepsia and hypopepsia in which hydrochloric acid is absent or greatly deficient in quantity, most excellent results may be obtained by the application of the cathodic galvanic or the sinusoidal current applied to the epigastrium in combination with the ice-bag for half an hour before each meal.

Painful congestion is relieved by very hot fomentations applied for half an hour after a meal in combination with the faradic or sinusoidal current of moderate strength.

Very short, very hot applications over the liver ( $130^{\circ}$ - $140^{\circ}$ , for five to eight minutes), combined with prolonged anodic galvanic application, act powerfully in relieving hepatic congestion.

A very hot fomentation over the lumbar region, combined with anodic galvanic application to the same parts and to the lower third of the sternum, is indicated in renal congestion.

The hemostatic effects obtainable by hydriatric applications in combination with the galvanic current I have found of invaluable service in hemorrhage due to ovarian congestion, intrauterine vegetations, and intrauterine and submucous and intestinal fibroids of the uterus. In cases in which persistent hemorrhage follows the employment of electrolysis the cold pelvic pack, and the hot vaginal douche in many cases render continuation of the treatment possible when otherwise its interruption would be necessary.

In amenorrhea the effects of cathodic, and anodic, or sinusoidal applications to the uterus are greatly increased by short cold applications to the lumbar region, the inner surface of the thighs, and the feet.

In applications of electricity to paralyzed and paretic muscles the effects of the electrical application may be greatly increased by the previous application of cold water in the form of the ordinary cold douche, the percussion douche, the Scotch douche, or cold friction, or by the heating compress. The marked increase of muscular irritability produced by hydriatric applications of this sort increases the susceptibility of muscle to the influence of the electrical current, whether the galvanic, faradic, or sinusoidal current be employed.

For the relief of pain in neuralgic joints, hot applications followed by the sinusoidal or the galvanic current are a most useful measure in cases in which joints are not painful or stiffened or thickened by inflammatory products. The alternate hot and cold douches and other exciting hydriatric measures may

with much advantage be employed in connection with cataphoresis. I have found this combination exceedingly useful in treating many cases of this sort.

In chronic congestion of the pelvic and abdominal viscera, the good effects obtained from local electrical applications, either internal or percutaneous, may be continued and intensified by the use of the heating compress, consisting of a towel wrung dry out of very cold water, placed over the parts and covered with several thicknesses of flannel sufficient to maintain the heat produced by reaction, but without excessive accumulation of heat.

Faradic, sinusoidal, and cathodic galvanic applications may be employed in connection with the revulsive douche and other revulsive applications in all cases in which pain is not a marked feature, but in which the purpose is to produce strong circulatory reaction. When pain is present, the faradic or sinusoidal current should not be employed, and the anode of the galvanic current should be employed instead of the cathode.

The form of revulsive applications referred to consists of a prolonged hot application followed by an exceedingly short cold application. The respective times of the applications may be: hot, five to fifteen minutes; cold fifteen to thirty seconds. If compresses are employed, three to five minutes for the hot douche, followed by a cold douche of four to ten seconds.

For general hypnotic effects applicable to nearly all cases of insomnia, a neutral bath, that is, a bath at a temperature of 92°-96°, for thirty to forty minutes, or a douche with little pressure at the same temperature, with a duration of one to five minutes, almost invariably succeeds in securing sound sleep without the use of hypnotic drugs of any sort, especially when combined with the static insulation and breeze to the head and spine, or the galvanic application to the inferior cervical sympathetic and solar plexuses, the anode being placed at the neck. This application rarely fails to secure sleep, provided proper attention is given to the diet and other matters of hygiene.

The neutral full bath, combined with the galvanic, faradic, or sinusoidal current, is perhaps the most powerful of all hypnotic measures. I have employed this bath with success for nearly twenty-five years, and it has rendered valuable service, not only in relieving insomnia, but in helping patients through the trying hours which immediately follow the withdrawal of opium, cocain, and other drugs, in the treatment of various forms of drug addiction.

The faradic, sinusoidal, and static of high frequency currents are all of a tonic character, stimulating metabolism, arousing the nerve centers, and directly exciting the brain and all portions of the central nervous system.

Short applications of cold water, especially when accompanied by strong mechanical effects, as in the cold douche, are the most powerful of all known tonics. By combination of the cold douche with the faradic and sinusoidal electrical currents, the tonic effects of each measure are intensified. The electrical application should be made immediately after the douche, or soon after the douche.



when reaction is well established.

The most powerful of all tonic applications of water is the percussion douche. Applied to the spine especially, this powerful hydriatric procedure awakens the whole nervous system in a most remarkable manner, and prepares it to receive the greatest possible benefit from applications of electricity which may follow, such as general faradization, general applications of the sinusoidal current, the static charge, etc.

It requires but a cursory review of these physiological effects to note the remarkable parallelism between the effects of hydriatric applications and the effects produced by electricity. With equal readiness it may be seen how by the simultaneous or successive use of electricity and water, if applied with scientific precision, these two potent agents may be able to render mutual aid in a great variety of conditions.

Special note may be made of the following points in which such a useful association is suggested: Water moistens the skin, and thus increases conductivity. Hot applications cause immediate dilatation of the blood vessels, increasing the vascularity of the skin, and thus also increasing its electrical conductivity, while cold water causes at first a constriction of the small vessels, lessening the blood supply of the skin, diminishing its conductivity for both heat and electricity. In the reaction which follows, however, the amount of blood in the skin is greatly increased, thereby lessening its resistance. Both very cold and very hot applications to the skin diminish nerve sensibility, and thereby lessen their susceptibility to electrical effects. Anemia of the skin, on the other hand, increases sensibility, while saturation of the skin with moisture diminishes irritability and nerve sensibility.

Steiner showed that temperatures below  $59^{\circ}$  and above  $77^{\circ}$  lessened the velocity with which nerve impulses are conducted, while Hermann has shown that the application of cold diminishes notably the phenomena of electrotonus. Heat, being primarily excitant, produces effects analogous to the cathode, while cold, being primarily sedative, produces effects anodic in character. Neutral applications are likewise sedative, thus resembling the anode in their effects. Short cold applications, because of the reactionary excitation produced, occasion effects resembling the cathode's influence of the galvanic current or the excitation of the faradic, while the atonic reaction which follows a prolonged hot application results in sedative effects similar to some of the anode.

I might enlarge at considerable length upon the subject I have introduced, but have, I think, described a sufficient number of applications to illustrate the principles which it was my purpose and object to set forth. I am especially interested in the development of that portion of our so-called medical science which alone rests upon a sound and rational basis, namely, physiological therapeutics. It is this interest which leads me to wish to continue as a member of this society, and I trust that some time not too distant in the future we may have in this country a medical association which shall be devoted not alone to the application of a single remedial agent, but which shall study to elucidate the principles and methods relating to all classes of physiological remedial agents, chief among which will be found electricity, water, light in its larger sense, and all physical agents capable of influencing the human organism.

#### Babinski's Toe Phenomenon.—

M. M. Raymond Cestan and Louis Le Sourd, in the *Gazette des Hôpitaux*, Nov. 23, 1899, give a very accurate account of this phenomenon and its value as a diagnostic sign. The phenomenon is this, that in a normal condition of the brain and lateral tracts of the cord, a pricking of the plantar integument induces a flexion of the toes, especially the great toes, upon the metatarsal bones. In cases of hemiplegia, or monoplegia of the leg dependent upon an organic affection of the central nervous system, when the plantar integument is pricked, the toes perform an extension movement on the metatarsal bones. This statement has been called in question by some; and it is to make the importance of the phenomenon that the authors conducted their extensive researches at the Salpêtrière and the Hospital de Paris. This toe phenomenon is never found in the normal adult. This is the testimony of Babinski, Gasne, and the authors after years of research among those affected with all sorts of nervous diseases. In seventy-five cases of hemiplegia it was present in seventy, and the toes immovable in five; in thirty-five cases of spasmodic paraplegia, it was present in all; in insular sclerosis it was found in nineteen out of twenty, and the toes were immovable to stimulation in the remaining case; in syringomyelia it was present in six out of six; in Friedreich's it was detected in ten out of ten; in thirteen cases of epilepsy it was found in two, and in these there was organic disease in the brain. In hysteria, neurasthenia, general paralysis, polyneuritis, paralysis agitans, myopathies, and atrophic paralyzes there never was present the extension of the toes on the metatarsus. This goes to prove that the toe phenomenon of extension is of the utmost value in diagnosing organic disease of the brain in the motor regions and of the motor tracts in the cord. In order to reveal the sign to best advantage, the patient lies on the side, the thigh flexed on the body, the leg on the thigh, and the foot on the leg, with the eyes closed. The foot resting on its outer border is tested by gently pricking the sole of the foot when the toes, especially the great toe, slowly extend in motor and spastic paralyzes, and flex, or remain unmoved, in functional nervous diseases, or in paralyzes with atrophies, *Canadian*

or most reflexes, as tabes.—*Canadian Practitioner and Review*, April, 1900.

**Induction of Artificial Hyperemia for Therapeutic Purposes.**—Bier (*Munch. med. Woch.*, 1900, 8, 1598-1694) points out that the essential difference between active and passive hyperemia, whether the hyperemia be arterial or venous, is that passive hyperemia leads to the proliferation of the connective tissue of the affected region; but there is an important distinction to be drawn between the use of arterial and venous hyperemia for therapeutical purposes. To induce arterial hyperemia, Bier employs a wooden box adapted to inclose the affected part and fitted with a tube to conduct into the box, air heated by a spirit lamp. The temperature is in this way raised to 100° or 150° C. The thumb and fingers, if not affected, are protected by cotton wool. Much benefit is obtained in this manner in chronic articular rheumatism and in stiffness of the joints due to past tuberculous disease, but active hyperemia is contraindicated while such disease is in progress. Venous hyperemia is induced in the usual way by an elastic band which does not interfere with the supply of arterial blood; it is used in pseudo-arthritis and tuberculous disease of the joints, and also, alternately with arterial hyperemia, in chronic arthritic rheumatism. By relieving the affected part from atmospheric pressure, a mixed hyperemia may be brought about; for small areas a cupping glass may be employed; for a limb, one of Junod's boots, from which the air can be partially removed by a suction pump. Bier has not yet succeeded in devising apparatus to suit the several joints, though he thinks this is the most effective method for chronic articular rheumatism.—*British Medical Journal*, March 3.

**Concerning the Diagnosis of Rabies.**—Dr. G. Daddi (*Rivista Critica di Clinica Medica*, April 7, 1900) emphasizes the importance of making an early diagnosis of rabies, and comes to the following conclusions regarding the best means of diagnosis: (1) That histological examination is the best method of determining whether or not an animal that gives suspicious signs is hydrophobic. This is determined by the complex of alterations that is found in the brain, the cerebellum, the spinal cord, and the ganglia of the spinal nerves. The peculiar changes described by Van Gehuchten and Nelis in these ganglia may be of great assistance in diagnosis. (2) That a negative result is of greater absolute value than a positive. A normal nervous system can not be present in a hydrophobic animal. Such examinations are more conveniently conducted during the cold season than during the summer, for putrefaction changes the aspect of the tissues, especially those of the nervous system.—*New York Medical Journal*.

I would always rather hear that a sick person had slept than that he had taken regularly the prescribed medicine during the sleeping hours.—*Sir Benjamin W. Richardson*.

# SUNLIGHT

JOHN HARVEY KELLOGG, M. D., L. L. D., F. R. C. S.



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# SUNLIGHT

JOHN HARVEY KELLOGG, M. D., F. R. C. S.

**T**HE civilized races are dying for lack of sunlight.

In nearly every civilized land, that leprosy-like disease, tuberculosis, has become so universal that one out of every ten falls victim to the foul infection. Hospitals for cripples are multiplying in our cities, and are filled with beds on which are languishing thousands of little ones with wan faces and contorted limbs, reeking with horrible sores, children being tortured to death with bone tuberculosis that is a consequence of living in sunless homes.

One out of twenty dies of cancer. A hundred other house diseases are carrying us off at the rate of a million and a half a year in this country alone. The average length of human life is probably only half of what it should be. And this terrible sacrifice of health and happiness is, in part at least, due to lack of sunlight.

With windows opaque to some of the sun's rays, we exclude their healing power from our homes—lest they warp our high-priced furniture and fade the color of our rugs and carpets. And all the time this lack of sunlight is fading the color from our cheeks, is blanching the very blood in our veins, and in many other ways is so handicapping us in the race of life that the Old-Man-with-the-Sickle will catch us long before we reach our proper goal.

Recently sunlight has been shown to be equally as valuable for the treatment of lung tuberculosis as for the treatment of tuberculosis of the bones, skin and other structures. Rollier of Switzerland has established a school in the sun for boys and girls of tuberculosis tendencies. The children spend nearly all the time in the open air, and with very little clothing even in the wintertime. The use of light is being introduced rapidly into tuberculosis sanatoria in various parts of this country and of the world.

In 1897 Finsen, the Danish physician, established in Copenhagen a "Light Institute" for treating patients suffering from lupus or skin tuberculosis. Two years later I visited the Institute, and witnessed the remarkable results that were obtained. The streets in the vicinity of the Institute almost swarmed with people who had lost ears and noses through tuberculous disease, or whose faces bore huge sores that had resisted every other mode of treatment. In the Institute we were shown scores of persons whose once ghastly features had been restored to healthy comeliness by the miracle-working sunlight.

Dr. Reyn, superintendent of this Finsen Light Institute, recently made a visit to this country, and showed before a large audience at the Battle Creek sanitarium and in other places scores of pictures illustrating the mar-

velous healing power of light. Faces so frightfully defaced as to have lost all human semblance were shown so perfectly restored, by the skillful application of light therapy, that scarcely a trace of impairment in symmetry was detected.

## II

But most important of all is the use of light in the prevention of disease. More than almost any other agent, light promotes that primitive toughness of fiber that our prehistoric ancestors possessed, and that is still possessed by the gorilla and by the wild savages who have not yet experienced contaminating contact with civilization.

The late Dr. Akeley, of the American Museum of Natural History, told me that although he examined with the minutest care the bodies of the various gorillas that he secured in tropical Africa, both externally and internally, he was never able to find a single parasite of any sort. These clean-living animals, bathed in the sunlight, nourished upon bamboo shoots and berries, live upon a physiological plane so high that no parasitic enemy can live in contact with them.

Some of the unclothed tribes of Central Africa, who live on a diet similar to that of the gorilla, and with their naked bodies bathed in the glowing rays of a tropical sun, are equally free from parasitic diseases, and are possessed of a resistance so high that cancer, one of the scourges of all civilized lands, is unknown among them, and such a thing as death from appendicitis was never heard of. The dark skins of these savages have a

lustre and silken feel that no cosmetic could improve, and the tide of life runs so high in their lithe bodies that there is no end to their endurance. The men run with government dispatches sixty miles a day, day after day, for hundreds of miles, and the women think nothing of carrying great loads upon their heads for long distances, at the rate of thirty miles a day.

Dr. Roger, an eminent French physician, many years ago made an interesting experiment, which demonstrated in a very striking manner the importance of sunlight as a stimulus of vital activity. Everybody knows that life is supported by the oxygen that we take in at each breath. The intake of oxygen, is, in part, consumed in the body in maintaining the vital fires. The oxygen combines with carbon, producing carbon dioxide, the  $\text{CO}_2$  of the chemist. At each breath we take in about four cubic inches of oxygen, of which one is consumed, or converted into  $\text{CO}_2$ , so that the outgoing breath contains but three cubic inches of oxygen, with one of carbon dioxide.

When the body is very active, the vital fires are accelerated and the amount of  $\text{CO}_2$  is increased. When the vital activities are slowed down, as during the inactivity of sleep or in some forms of disease, the amount of carbon dioxide is lessened. By means of proper instruments, it is easy to determine the amount of carbon dioxide produced per minute, and by comparing this with the normal standard, we are able to ascertain whether or not the bodily activities are as vigorous as they should be, or are slowed down from any cause.

Dr. Roger measured the amount of

carbon dioxide produced by a man when in the dark. Then he exposed the man's body to the light and again determined the amount of carbon dioxide produced. He found the increase to be more than one-third, the relative proportions being one hundred in the dark and one hundred and thirty six in the light. Here is striking evidence of the activating or energizing power of light.

But, strange as it seems, sunlight, that marvelous, wonder-working force, of all things essential to life, is one of the things most neglected. The farmer knows the value of sunlight on his crops. He knows that the number of days and hours during which the golden beams fall upon his cornfields determine the number of bushels of corn that he gathers into his granaries. But it seldom occurs to the farmer that the sunshine is as vital a necessity for the welfare of his wife and daughter. The average civilized human being has a pale or sallow complexion, and a skin so lifeless that it is a ready prey to every parasitic germ. So low is the resistance of civilized skin that it is only by eternal vigilance, and an infinite amount of painstaking care, that horrible parasites of various sorts are kept in subjection.

Sunshine is just as necessary for animal and human life as for plant life. Instead of shutting ourselves up in darkened rooms, we should let in every ray of sunshine possible. Some day we shall build our houses almost wholly of glass, perhaps, and of a sort that will transmit all of the rays of light, instead of excluding the ultra-violet rays as we do with the ordinary windowpanes of today. In thus ex-

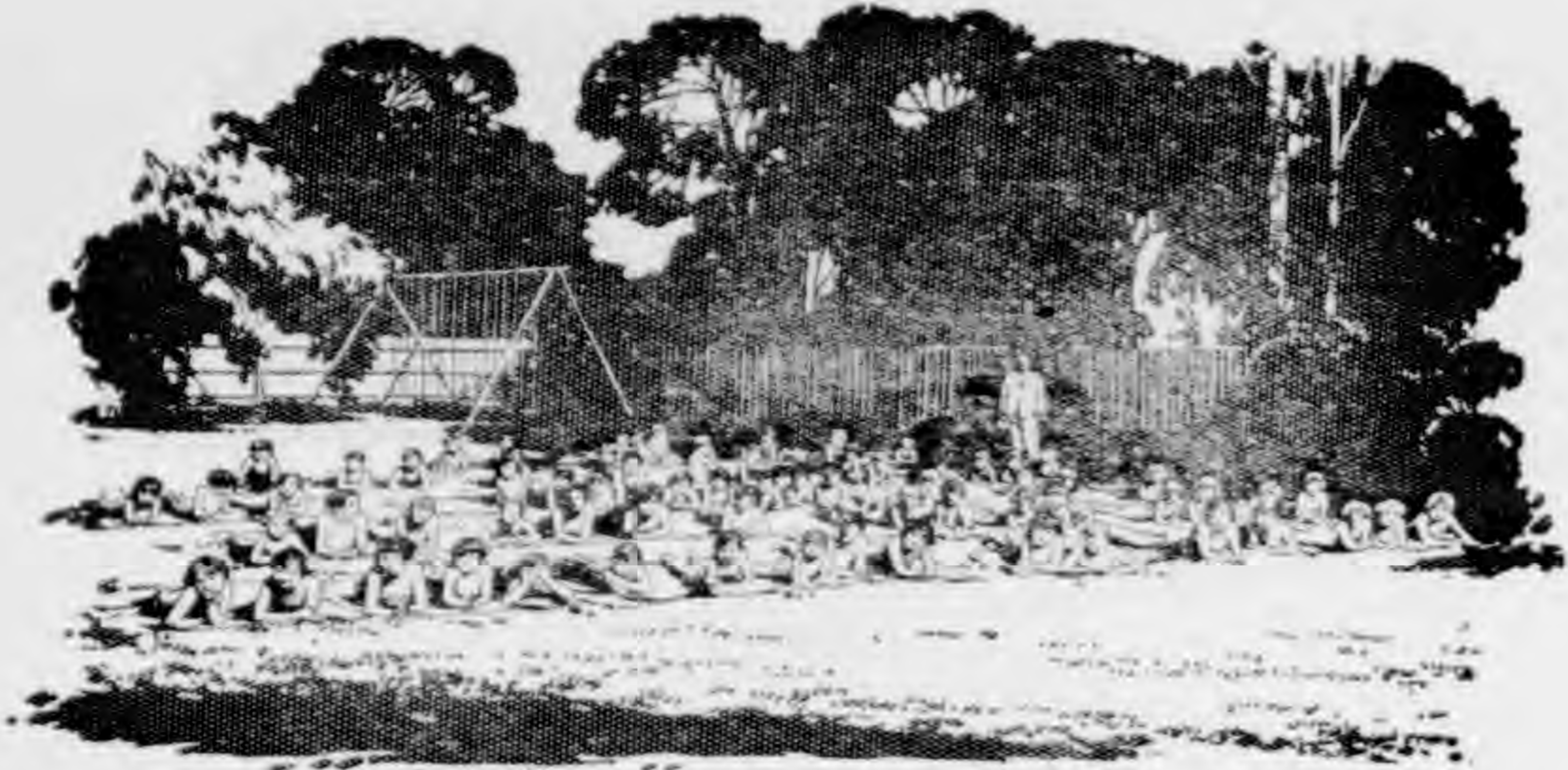
cluding ourselves from the light, we are depriving ourselves of the benefit of the most powerful of all known vital stimulants, and thus sustaining an irreparable loss, which shows its effects in the widespread prevalence of tuberculosis of the lungs, bones and other tissues, and in the anemia and other forms of malnutrition that are almost universal in highly civilized communities.

### III

In taking a sun bath it is first of all to be remembered that the naked skin must be exposed to the direct rays of the sun. A bath taken behind window glass has little effect, for the reason that the window glass filters out certain of the rays that are of the highest importance. Ordinary window glass is as opaque to the ultra-violet rays, which are essential for animal life, as black glass is to light rays.

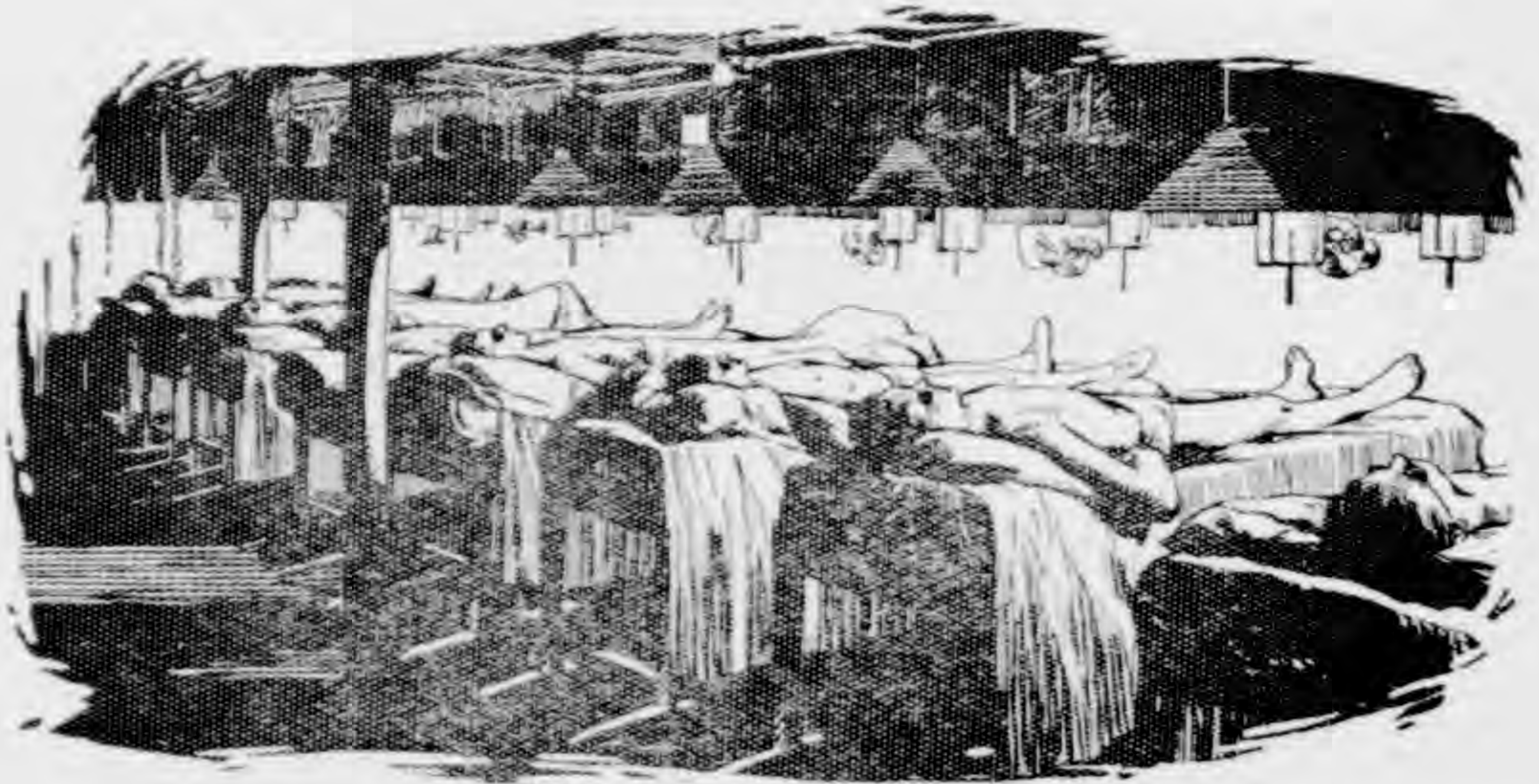
While it is necessary that the sun bath should be taken in the open air, it is also important that the body should be protected from the wind, even if the sun's rays are quite hot. If a cold wind is blowing, the body will be chilled, and under such conditions undesirable effects are produced. When the body is properly sheltered from the wind, sun baths may be taken without discomfort in quite cold weather, the direct rays of the sun being capable of producing strong heating effects.

The head, and especially the eyes, should be protected during the bath. A folded wet towel is good for this purpose. Ice water is not necessary. Simply wetting the hair and shading the head with a straw hat or an um-



### STORING SUNLIGHT

Children of Battle Creek, Michigan, drawing on the sun for their winter supply of good health and high resistance, in the Outdoor Gymnasium provided by Dr. John Harvey Kellogg on his private estate.



### NOURISHED BY THE SUN

Guests at the Battle Creek Sanitarium are following the example of the up-to-date athletes and drawing on the greatest health and life giver, the sun, whose rays have been captured and reproduced by powerful indoor lights.



brella, or keeping the head in the shade, will afford sufficient protection for the head. This protection is important as a precaution against sunstroke.

The duration of the sun bath naturally will depend upon the intensity of the sun. In Alpine regions, that is mountainous regions at a considerable altitude above the sea level, the ultra-violet rays of the sun are very intense. At lower levels, the rays are much less intense because they are filtered out by particles of water in the form of mist, cloud and fog, and are to some extent intercepted by dust. Also, the sunshine is more intense on the seashore. The sun's rays have the greatest intensity between the hours of ten in the morning and two in the afternoon. In such climates as Illinois, Michigan, Wisconsin, Iowa, in fact—in most of the Middle West—there is very little danger of serious injury from exposure to the sun except on the very rare hot days that are occasionally experienced in this region.

The first exposures should be shorter than later ones. Ordinarily the body may be exposed for fifteen minutes, even on very sunny days, without risk of greater injury than slight sunburn, gradually the bath may be prolonged to one hour, care being taken to change the position from time to time so that the whole surface of the body will be equally exposed.

Soon after Mr. Edison perfected the electric light, the writer recognized its possibilities as a therapeutic agent, and devised the electric light cabinet bath, and other appliances, for the application of light therapeutically. The

electric light bath has now come into very general use throughout the civilized world, and has almost wholly replaced the old Turkish and Russian, or steam, baths. The superiority of the sun bath, over other forms of hot bath, is due to the fact that the rays of radiant energy do not stop at the surface, but penetrate the tissues to a considerable depth, thus producing effects that cannot be produced by ordinary sources of heat.

At the Battle Creek sanitarium, our indoor sun baths are found to be one of our most effective agencies for combating degenerative disease, as well as for toning up the apparently well and for bringing the athlete up to his very fittest degree. Greek athletes were much in the sun, and it is to that fact probably that much of their extraordinary efficiency was due.

Just as the light that shines from our electric lights is sunlight that shone upon the world thousands of years ago, that was captured by plants, converted into trees, ferns and mosses, which later, when buried in the earth, were changed into the coal that becomes resuscitated sunlight in the glowing filament of the electric bulb, so the heat of our bodies is nothing more nor less than transfigured sunlight, caught in a chlorophyll trap, converted first into food, then eaten, digested, absorbed and burned in our bodies to keep us warm.

Of all the forces of nature, there is no force so wonderful as the mystic energy concealed in the sunlight. Just what it is, and how it works, the most astute scientist is not able to explain. But its miracle-working activity is one of the most impressive things in all the world.

## LIGHT

"Let your bodies be filled with Light."

Light is the Life-Giver. Light falls upon the brown earth and a carpet of green springs forth. Every springtime is a Resurrection Morn.

Light perfumes the violet and tints the orchid; it falls upon the bud and lo, it bursts in a glory of bloom.

The light of the rising sun sets the birds singing and the woods trembling with ecstasies of joy.

Light is energy. It turns the wheels of the world—wind, water, steam.

Light impels the body machine, aids every vital function and quickens every cell in the merry dance of life. Light digests.

The sallow, sour, dyspeptic slave of business gets out in the sunlight for a week, and can digest a farmer's dinner.

Light shines upon the pallid face and paints a rose.

Light caresses a darkened face, and presently an illumination blazes forth and melancholy flees like a phantom.

Build your house on the sunny side of the street.

Keep the shutters open.

Roast in the sun every time you get a chance.

"Walk in the light."

—John Harvey Kellogg

## THE INCANDESCENT ELECTRIC LIGHT

— OR —

# RADIANT HEAT BATH.

BY J. H. KELLOGG, M. D.,

Battle Creek, Mich.

[*A paper read before the American Electro-Therapeutic Association at its Fourth Annual Meeting, held in New York City, Sept. 25-27, 1897.*]

ALMOST since the discovery of the electric light, it has been made the subject of interesting experimentation for the purpose of discovering whether this excellent artificial substitute for sunlight, possessed the property of stimulating the vital processes of plant life in a manner analogous to the action of unlight. An interesting paper by Wm. Siemens, published in March, 1880, contained a detailed account of experiments made for the purpose of determining the influence of the electric light upon vegetation, from which the following conclusions were drawn by the author:—

1. That the electric light is efficacious in producing chlorophyl in the leaves of plants, and in promoting growth.
2. That an electric center of light, equal to 1400 candles placed at a distance of two meters from growing plants, appeared to be equal in effect to average daylight at this season of the year (March), but that more economical effects can be attained by more powerful light centers.
3. That the carbonic acid and nitrogenous compounds generated in diminutive quantities in the electric arc, produce no sensible deleterious effects upon plants inclosed in the same space.

4. That plants do not appear to require a period of rest during the twenty-four hours of the day, but make increased and vigorous progress if subjected during the daytime to sunlight and during the night to electric light.

5. That the radiation of heat from powerful electric arcs can be made available to counteract the effect of night frosts, and is likely to promote the setting and ripening of fruit in the open air.

6. That while under the influence of electric light, plants can sustain increased stove heat without collapsing, a circumstance favorable to forcing by electric light.

Similar experiments have been made by others. The first to make experiments was Hervé Mangon (*Compt. Rend.* 53, 243). These experiments showed that the electric light was capable of causing the development of chlorophyll and inducing heliotropism, or the phenomenon of turning or bending toward the light.

Prillieux (*Compt. Rend.* 69, 410) showed in 1869, that the electric light is capable of promoting assimilation in plants, or decomposition of carbon dioxide and water.

Siemens found that the plants exposed to ordinary daylight and six hours of electric light in addition "far surpassed the others in darkness of green and vigorous appearance generally." Strawberries and other fruits were fully equal to those raised under ordinary conditions, and grapes were of stronger flavor than usual. Melons were remarkably large and aromatic, and bananas were pronounced by excellent judges to be "unsurpassed in flavor."

Many of these experiments have been repeated in this country and with similar results. The most important experiments were those conducted at the Cornell University Agricultural Station in 1889-90. These results showed clearly—

1. That the electric light may be used under such conditions as to make it fairly comparable to sunlight in its power to promote protoplasmic activity.

2. That the electric light acts as a tonic to plants so that they are able to endure adverse conditions which otherwise would cause them to collapse.

3. That the electric light is a true vital stimulus, since the

effect of its use at night, upon plants, is essentially the same as that of the longer day of the Arctic upon plants growing in that region.

Another fact of importance which had sometimes been observed, was the deleterious influence of powerful arc lights upon workmen engaged in close proximity to them, effects analogous to those of sunstroke.

Although not fully acquainted with the facts above referred to when I first began the use of the electric light bath, I had seen brief notices of these experiments, and thereby became interested in the subject from a therapeutic standpoint. For more than twenty years I have made use of the sun-bath as a therapeutic means, and twelve or thirteen years ago experimented with large convex lenses for the purpose of concentrating the sunlight, and thus intensifying its effects in the treatment of neuralgia, and spinal and other hyperesthesias. I found good results from its use employed in this way, but did not complete my observations, on account of the great amount of time required and the uncertainty of having sunlight at the time desired.

Something more than four years ago I began experiments with single lights provided with reflectors, and soon after had constructed two cabinets, or small rooms, large enough to contain one person, with fifty to sixty incandescent lamps arranged in regular rows on the inside. Since that time I have made constant use of the electric light emitted by the incandescent lamp, as a therapeutic means. Together with my colleagues I have employed the bath by this means nearly ten thousand times, and in a great variety of ailments, at the Battle Creek Sanitarium, and have largely used it as a substitute for the Turkish, Russian, vapor, and hot-air baths, all of which I had previously employed for many years. Finding it free from any of the objections to which the baths named are open, for numerous reasons, some of which I will point out subsequently in this paper, and also finding its effects extremely agreeable to patients, and remarkably efficacious in many stubborn cases which did not readily yield to other therapeutic agents, I have employed it much more frequently than I had previously made use of analogous means, and in a much wider range of cases.

My earliest experiments in the use of the electric light bath showed me that it was capable of producing very characteristic effects. This led me to undertake a series of physiologic experiments for the purpose of placing its therapeutic use upon a rational basis, and for the purpose of comparing the effects of the electric light, Turkish, and Russian baths. Some of these experiments were made three years ago; others have been made more recently. The objects of the experiments were to deter-



FIG. 1. Electric Light Bath and Log Bath, and Spring Bath.

mine the effects of the electric light bath as compared with those of the Turkish and the Russian baths upon —

1.  $CO_2$  elimination.
2. Urinary secretion.
3. Perspiration.
4. Surface and internal temperature.
5. The number of blood corpuscles and the amount of hemoglobin. The results of these experiments and the methods employed may be summarized as follows:—

1. *CO<sub>2</sub> Elimination.*—Three healthy young men were subjected to the influence of the incandescent electric light or radiant heat bath for five, ten, twenty, and thirty minutes respect-

ively, the time being the same for each, and all other conditions being made as nearly alike as possible. The same young men were likewise subjected to the influence of the Turkish and the Russian baths for the same lengths of time, but on different days, care being taken to maintain a uniform dietary during the entire series of experiments, at the same hours of the day. The influence of the bath upon  $\text{CO}_2$  elimination was determined by carefully measuring with a delicate air meter which I had constructed for the purpose, all the air expired during the ten minutes before the experiment, collecting an average sample of the air for analysis. During the bath the air was collected for the same length of time. In a case in which the bath lasted only five minutes, the figures were doubled so as to make them comparable with the rest. In case the bath lasted twenty minutes or more, the air was measured and collected during the last ten minutes; the results obtained were corrected for barometric pressure and vapor tension so that the figures given in the table for the different experiments are, in every respect, properly comparable. The results were as follows:—

The average per cent of  $\text{CO}_2$  obtained before the experiment, was 3.60.

For the electric light bath the average per cents obtained were as follows:—

5 minutes.....	4.10		20 minutes.....	4.20
10 ".....	4.10		30 ".....	5.10 and 5.13

In a repetition of the thirty-minute bath, the higher percentage of 5.13 was obtained.

For the Turkish bath the average per cents obtained were:—

5 minutes.....	4.03		10 minutes.....	4.07
			30 minutes.....	4.01

For the Russian bath the per cent was 3.96 for a bath of thirty minutes.

The highest amount of  $\text{CO}_2$  elimination was 4.29 liters, which was in the incandescent electric light bath for thirty minutes.

The temperature of the air in the baths was as follows:—

Electric light bath, 28 to 36 degrees C. (85 to 97 degrees F.), or constantly below the temperature of the body; Russian

bath, 38 degrees C. (100 degrees F.); Turkish bath, 55 degrees C. (131-155 degrees F.)

2. *Urinary Secretion.*—The following table shows the average figures obtained for the three young men who were the subjects of experiment. The facts determined in relation to the urine were: the amount, the specific gravity, the acidity, the amount of urea, the amount of uric acid, the total chlorides expressed in terms of HCl, the phosphoric acid, and the total solids. The figures given were determined by accurate quantitative analysis of the whole amount secreted in twenty-four hours. The figures obtained in relation to the most important of these quantities were as follows:—

Electric light bath: urea.....	26.32	grms.
Total chlorides.....	5.25	"
Total solids.....	49.50	"
Turkish bath: urea.....	27.30	"
Total chlorides.....	6.91	"
Total solids.....	52.70	"
Russian bath: urea.....	29.56	"
Total chlorides.....	7.60	"
Total solids.....	55.14	"

The figures obtained for the urine were the exact reverse of those obtained for the CO<sub>2</sub> elimination.

The diminished amount of urea, total chlorides, and total solids present in the urine during the twenty-four hours in which the subject was subjected to the electric light bath, was evidently the result of increased elimination by the skin, showing that the electric light bath is much more powerful than either the Turkish or the Russian bath as a means of stimulating vicarious eliminative work upon the part of the skin.

The amount of perspiration induced by the incandescent electric light bath was fully double that induced by the Turkish bath in the same length of time.

The amount of perspiration induced by the Russian bath was less than that induced by the electric light and the Turkish bath.

3. *Perspiration.*—Two points were determined in reference to perspiration:—

- (1.) The time required to induce perspiration.
- (2.) The temperature at which perspiration began.



The averages were as follows:—

*Incandescent electric light bath:* time required to induce perspiration, three minutes, thirty-two seconds. The average temperature at which perspiration appeared was 27.2 degrees C. (81 degrees F.).

*Turkish bath:* the time required to induce perspiration, five minutes, thirty-five seconds. Temperature of the bath, 53.6 degrees C. (128.5 degrees F.).

*Russian bath:* the time required for perspiration, six minutes, forty-five seconds. Temperature, 101.8 degrees F.

The above figures show very clearly the superior value of the electric light bath as a means of stimulating cutaneous activity.

4. *Surface and Internal Temperature.*—The influence of the bath upon surface and internal temperature is a matter of importance, since Bouchard has shown that the heat-regulating apparatus of the body is called into operation by a rise in the temperature of the blood equal to .40 degrees C. (.72 degrees F.).

In experiments made in December, 1891, for the purpose of determining the effect of the bath upon surface and internal temperature, I obtained the following results in a comparative study of the effects of the electric bath and the Turkish bath upon surface and internal temperature:—

*Electric light bath:* temperature of bath, 34.5 degrees C. (94 degrees F.). Internal temperature of subject before the bath, 36.6 degrees C. (98 degrees F.). Surface temperature, 35 degrees C. (95.14 degrees F.). Patient began to perspire after one minute. At the end of five and a half minutes he was removed from the bath. The temperature was taken at once and the internal temperature was found to be 37.5 degrees C. (99.6 degrees F.); the surface temperature, 37.9 degrees C. (100.2 degrees F.). Ten minutes after the bath the mouth temperature was 37 degrees C. (98.5 degrees F.); and the axillary temperature was 36.6 degrees C. (98 degrees F.).

*Turkish bath:* temperature of bath, 70.5 degrees C. (159 degrees F.). Temperature of the subject before the bath, 36.4 degrees C. (97.4 degrees F.); axillary temperature, 96 degrees F. Perspiration began in five and a half minutes. Immedi-

ately after the bath, the mouth temperature was found to be 37 degrees C. (98.7 degrees F.); axillary temperature, 37.2 degrees C. (99 degrees F.). Ten minutes later the mouth temperature was 37 degrees C. (98.8 degrees F.); axillary temperature, 36.6 degrees C. (98 degrees F.).

From these statements it appears that the incandescent electric light bath is far more effective than the Turkish bath in raising both surface and internal temperature, which clearly indicates the penetrative power of the intense heat rays of the electric light.



FIG. 2.—Electric Light Trunk Bath.

5. *The Blood.*—The effects of the incandescent electric light bath upon the blood were determined by a careful count of the corpuscles by Gower's instruments and a determination of the hemoglobin by the hematoscope of Henocque. The figures obtained showed no very marked increase in either blood corpuscles or hemoglobin, although in one case the number of corpuscles was increased nearly 200,000 per cubic millimeter.

The physiological effects of the electric light bath are chiefly those of heat, and do not differ very essentially from the effects obtained from other sources of heat, except that the electric

light bath is a much more efficient and convenient method of administering heat than any other which has been devised, with the exception of water, which doubtless has a wider range of use.

The purposes for which heat is applied are usually two:—

(1.) The induction of perspiration.

(2.) The stimulation of protoplasmic activity, and thus increase of tissue metamorphosis. As before remarked, Bouchard has shown that a rise of temperature of 40 degrees C. (72 degrees F.) is sufficient to induce perspiration. This rise of temperature may be produced either by artificial heat, by the retention of bodily heat, through diminished heat elimination, or by increased production of heat through exercise or other means.

In the Turkish bath a high temperature of the surrounding atmosphere and a considerable amount of time is required for the induction of perspiration, for the reason that the heat of the air is slowly communicated to the body and the heating of the skin, and through it, the transmission of heat to the blood is directly antagonized by the rapid evaporation produced by exposure to a dry atmosphere whereby the skin is rapidly cooled. This cooling may take place so rapidly, indeed, that a temperature of several hundred degrees may be tolerated for a short period without injury, as was illustrated by the Fire King who used to enter an oven with a piece of raw beef and remain until it was roasted.

In the incandescent electric light bath the heat enters the body directly as a radiant force, instead of by the slow method of convection and conduction, thus more rapidly raising the temperature of the blood, and hence quickly inducing perspiration. That heat stimulates vital activity is a fact which every one who has ever studied the amoeba, or white blood corpuscle, upon the warming stage is well acquainted. The effect of poultices and fomentations in producing pigmentation of the skin, as well as the effects of intense heat, either from the sun or other incandescent sources upon the complexion, afford further evidences of the important physiological effects of heat. Entering the body directly, instead of slowly working its way through the poor conductors which are found in the successive

layers of tissue which compose the covering of the body, the radiant heat of the incandescent electric light stimulates and vitalizes the tissues to a high degree.

*Therapeutic Uses.*— I have found the electric light bath of far greater value in the treatment of a great variety of maladies than any other means of applying heat, except water, and find that it may be much more generally employed than the ordinary Turkish, Russian, vapor, or hot-air baths. One reason of this is the convenience and rapidity with which the degree of heat employed may be graduated by turning on or off one or more groups of lamps, by which means the amount of heat is rendered absolutely and instantly controllable. The source of heat relied upon is the incandescent filaments of the lamps rather than a heated atmosphere, and hence is easily and instantly controllable.

The instant the lamp is turned off, the heat which it has previously emitted is withdrawn from operation. If additional heat is required, the desired number of lamps may be turned on and become instantly operative.

Another reason for the more universal application of the incandescent electric light bath is the fact that when properly applied, its effects are highly tonic in character. A short application of the bath at full force for a time just sufficient to induce powerful stimulation of the skin without provoking perspiration, is one of the most effective means of periperal stimulation with which I am acquainted. The tonic effects of such an application may be still further intensified by instantly following the bath with a cold spray or other cold application, thus producing a revulsive effect of the most agreeable and effective character. The excessive heating of the skin prepares the way for the cold application, without at the same time so overheating and relaxing the blood-vessels as to render recovery of the tone of the cutaneous tissues so tardy as to involve the risk of exhausting the patient too greatly or exposing him to the liability of taking cold.

The advantages of the incandescent electric light over the arc light for therapeutic applications are :—

1. Its superior convenience in application and distribution in the bath.

2. Freedom from the deleterious effects which several observers have noted as due to the arc light when in too close proximity to plants, or when nearer than two meters. These effects were found to be due, not to the gases given off by the lamp, but to some effect from the light itself. It cannot be doubted that similar deleterious effects might follow the use of



FIG. 3.—Electric Light Trunk Bath, in Use.

the arc light when applied for therapeutic purposes if placed nearer to the patient than six feet, a fact which must render its use inconvenient, if not dangerous, to say nothing of the impossibility of securing a uniform distribution in its application.

Still another special advantage of the incandescent electric light bath over other sources of heat is the facility with which it can be localized. In this respect it is far superior to fomen-

tations or any other local application of heat. By means of suitable appliances, the heat can be focused upon a small point if desired, and affects not only the surface, but the deeper tissues. I am sure that the radiant energy of the electric light penetrates the tissues to a depth of several inches. This I proved by actual observation, as before intimated. For deep-seated pain, as well as for the relief of hyperæsthesias of the skin, I know of no remedy more valuable. Many applications of this sort have been made by myself and my colleagues, several thousand in all, and I have constant reason to be grateful for the acquisition of this therapeutic measure, as it has afforded relief to many cases which have stubbornly resisted all other therapeutic means which I have been able to employ.

*Rationale of the Effects of the Incandescent Electric Light Bath.* — The peculiar value of the electric light bath I consider due to its efficiency as a source of radiant energy. In the Turkish bath, heat is communicated to the body chiefly by the convection of heat and air. Air, being a very poor conductor, communicates heat to the body very slowly. Absorption of heat is further hindered by the skin, an excellent non-conductor, and by the rapid evaporation of moisture upon the skin, whereby it is cooled so rapidly that it is possible for a man to enter and remain for a considerable time in an atmosphere far above the boiling point. I have several times been in a Turkish bath at 300 degrees and suffered no inconvenience. The heat is derived from the electric light, however, by radiation, and not by convection. The skin, as well as the air, is to a large extent transparent to radiant heat, and the same is true of all the living tissues. This is evidenced by the phenomenon of transillumination. By a speculum placed in the vagina or rectum and a suitably arranged electric light of 16 or 32 candle placed over the abdomen, I have seen the whole interior of the trunk illuminated and made to glow with a bright red light, the red color being due to the reflection from the red corpuscles of the blood. Even the bones are transparent to light when in a living state. This is clearly shown by placing the hand between an electric light and the eye, with the fingers in close contact; the hand being placed near enough to the light, the whole fingers will be

seen to be illuminated by the light, and not simply the soft parts.

It may thus be said that heat from the electric light penetrates the body just as it would penetrate any other transparent or semi-transparent medium, while the heat of the Turkish, vapor, or Russian bath is communicated to the body by convection and slowly works its way into the body by heating the successive layers of living tissue which, although, like glass, transparent to radiant energy, also possess to a greater or less degree the non-conducting powers of glass and allied substances. It is true that non-luminous as well as luminous heat waves are thrown off by heated bodies, the whole gamut of radiant energy in the form of heat being stated to consist of fully four octaves, more than two of which are below the red, while a whole octave is above the violet, the luminous range occupying a space only a trifle greater than what would correspond to the chord of the sixth in music. But the lower octaves of these heat waves seem to be far less active than those included within the luminous area and above it. I do not consider that there is any specific effect obtainable from the electric light which would not be derived from any equally efficient source of radiant heat, and on this account I have preferred the term, the *radiant heat bath* rather than *electric light bath*, as the former term leaves room for the employment of any luminous source of heat which may possess properties identical with those of the electric light.

One of the great advantages of the radiant heat or incandescent electric light bath over the Turkish, Russian, vapor, or similar forms of bath, is the fact that the body can be subjected to the most intense heat desired without confining the patient, and without overheating the atmosphere surrounding him. This is due to the well-known fact that rays of heat pass through such transparent media as the air without heating them. This accounts for the intense cold experienced by balloonists, and by those who ascend high mountains, even in the tropics. The wood-chopper in the logging camp roasts his back before a big log fire on a cold winter's day, while Jack Frost is taking sharp nips at his nose on the other side. So the man in the incandescent light bath, while perspiring freely, may be surrounded

by an atmosphere considerably below the temperature of the body, as shown in my experiments and in the daily application of the bath.

The question of priority in the use of the electric light bath



FIG. 4.—Upright Cabinet Electric Light Bath.

is one in which I am not especially interested, but so far as I know, an empiric in Cincinnati was the first to make use of the arc light for therapeutic purposes. His use of the bath, however, was in connection with the "blue glass" fanaticism which spread so extensively over the country a few years ago, the



electric light being substituted for sunlight, a very uncertain quantity at some seasons of the year. His use of the bath was, however, not founded on a scientific basis, and I have always regarded it as unworthy of thought or attention. About four

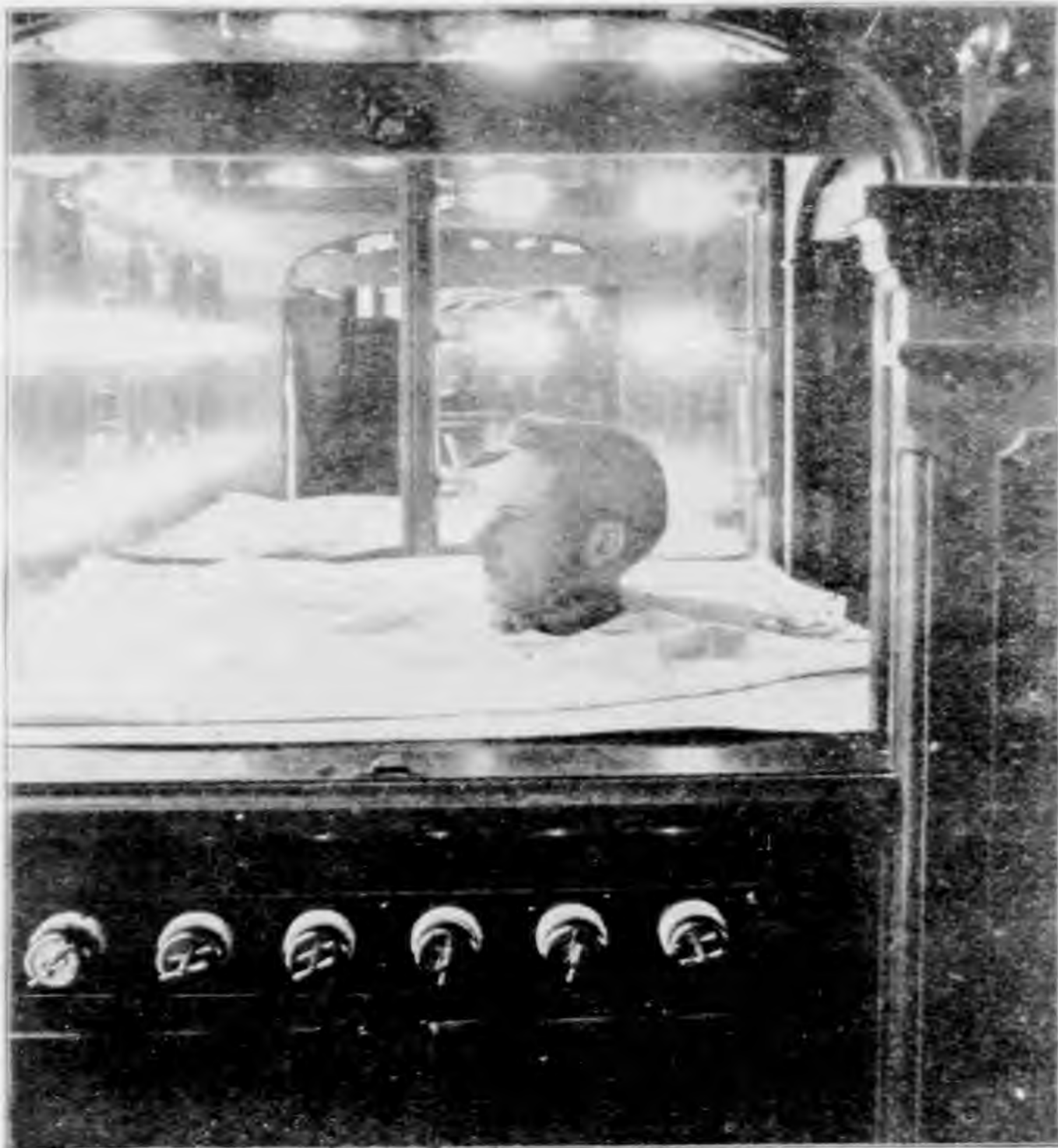


FIG. 3.—Gallinger Electric Light Bath, in Use, Head Excluded.

years ago one of my colleagues, Dr. Kate Lindsay, called my attention to the personal benefit derived from the use of the heat of the electric light obtained by the application of a lamp in contact with the body and covered in such a way as to collect and retain the heat derived from it. I learned from

several other persons, of similar effects obtained in the same way, and at once had constructed a variety of devices for applying heat to the different parts of the body, and also for general application.

The first bath for general application consisted of a bank of lights, between thirty and forty in number, arranged upon a frame which was hinged upon the wall in such a way that it could be raised and folded back against the wall while the patient was placed upon a suitable couch beneath it. The patient being in readiness, the frame was lowered to a position about six inches above the body of the patient, and the space about the patient inclosed by means of curtains which dropped from the edge of the frame carrying the lights.

The second form of bath which I had constructed soon after, consisted of a cabinet about eight feet in height (Figs. 4 and 5), upon the inside of which were placed between fifty and sixty incandescent lights arranged in rows, the spaces between the rows of lights being filled with silvered glass so as to multiply the number of lights to an infinite number by reflection. The cabinet is so arranged that the whole body of the patient, including the head, can be exposed to the influence of the light, or the head can be excluded, as in the ordinary vapor bath. The cabinet is freely ventilated, and by means of switches and a proper grouping of the lamps in wiring, the number of lights in use can be instantly and perfectly controlled. This bath, which I have had in use for more than three years, is somewhat imperfectly shown in a photograph that I herewith present. A description of this bath was published in a German medical journal by Dr. Gebhardt, who visited the Sanitarium and personally tested the bath something more than two years ago.

The third form of bath for general application of the incandescent light, which I have had constructed more recently, consists of a cabinet lined with mirrors (Fig. 6) and containing some sixty incandescent lights, so arranged that the patient lies in a horizontal position, the lights being placed on three sides. The patient lies upon a suitable couch with rollers, which is pushed entirely within the cabinet, or only so far as to expose such portions of the body as it is desired to bring

under the influence of radiant light and heat. By this plan the influence of the light can be confined to the feet and legs, or any other portion of the body up to the neck. It is only necessary to protect, by a sheet and a piece of mackintosh, any portion of the body which it is desired to exclude from the action of the bath.

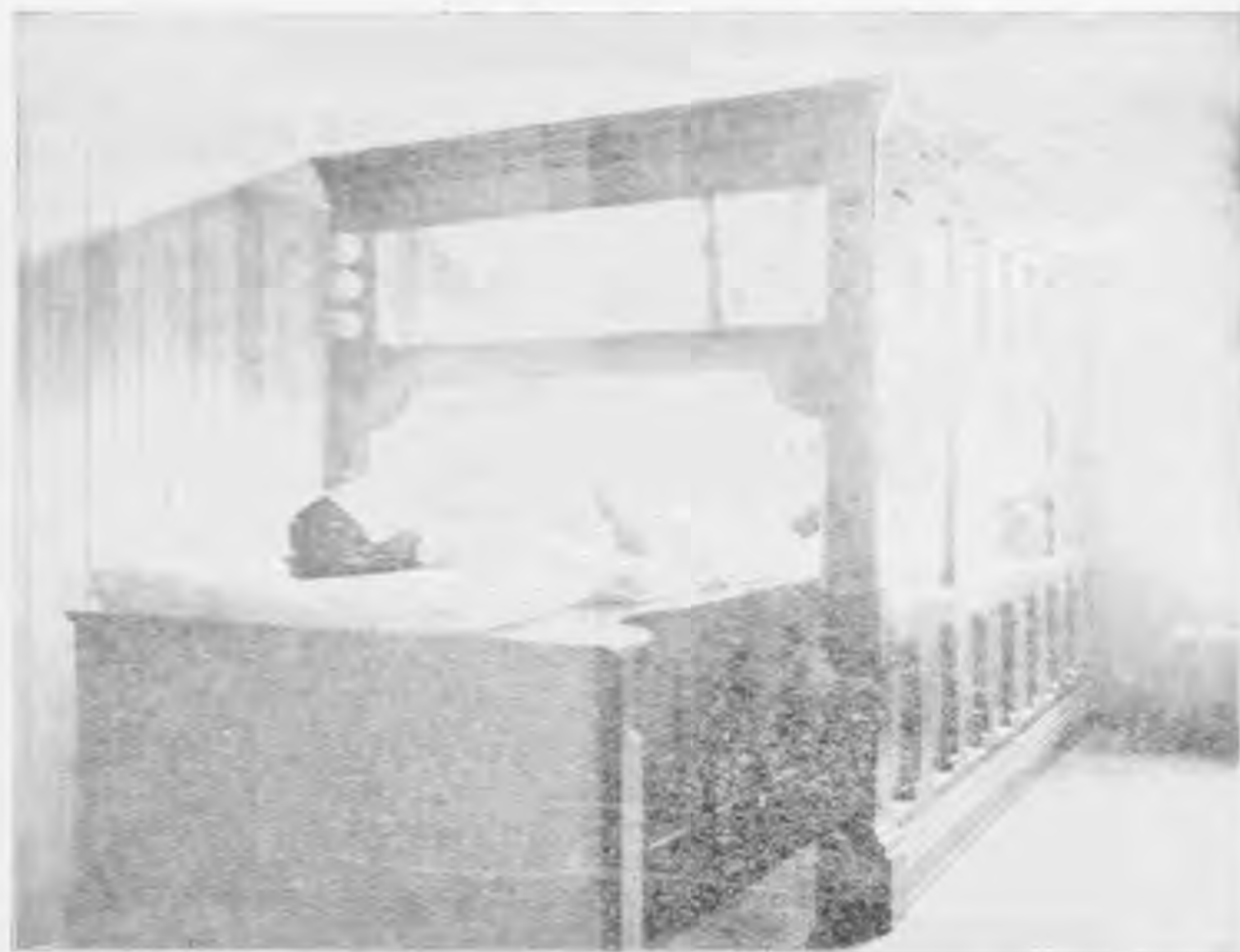


FIG. 1.—Hemlock Cases—Electric Light Bath.

I have also had constructed and have in use special appliances by means of which applications may be conveniently made to the spine, the trunk, the feet, and other parts of the body.

After nearly four years' use of the electric light bath in a great variety of ailments, I esteem it as of greater utility than any other means of applying heat to the body, with the exception of water, the universal applicability of which gives it

paramount value over all other therapeutic agents which can be employed for this purpose.

In conclusion, I wish to acknowledge my indebtedness to Professor Gomberg, of the University of Michigan, who kindly consented to devote a part of his summer vacation to the tedious chemical work required by this investigation, and to my assistants, Drs. Rand and Paulson, who assisted in the chemical work, and carried out the details of many experiments with great painstaking, and to Dr. Burleigh for careful studies of the blood in connection with the experiments.