JOHN HARVEY KELLOGG (1852-1943)

WORKS BY OTHERS (MANUSCRIPTS),
CA. 1885-1940

Pedagogics

By LAWRENCE F. ABBOTT

Contributing Editor of The Outlook

IT is a little singular that one of the most important scientific terms in the history of civilization is extremely unpopular. I refer to the word "pedagogy" or "pedagogics." It comes from a Greek word meaning the training of children, and I suppose there can be no science, certainly no social science, more important than that. Yet the average man would probably be less offended if called a bootlegger than if he were accused of being a pedagogue. Lexicographers, men of letters, and teachers unite in defining a pedagogue as a conceited, narrow-minded person. This unpopularity of the term cannot be because it is derived from the Greek. I suspect that the unpopularity of the pedagogue comes, not from his purposes, or philological ancestry, but from his methods. This suspicion is confirmed by what has happened in the case of two other representatives of modern social science whose designations have a classic origin. We regard the electrician with respect, although his name is Greek. But the Latin name of the plumber does not protect him from gibes and jokes. The plumber is really a scientist. He must know something about hydrostatics and the effects of ferric hydroxid. A modern household can get on much better with broken-down electric wires than it can with burst water pipes. Nevertheless we go on jeering at the plumber and touching our hats to the electrician. Just as I began to write this article I ran across a joke in the local paper of the country town where I am spending the present month:

She—I think these slow motion pictures are tiresome.

He—This isn't a slow motion picture. This is a view of a plumber working at top speed.

Here is the key of the pedagogical problem. It is their methods that have brought so many pedagogues into disrepute. One of the greatest teachers of all time, Socrates, had no method, but was content with merely being himself. In the mistaken belief that method is the essence of teaching, we try to ascribe it to the great Greek teacher and speak of the Socratic Method. But this is unfair to him. He had logic, wisdom, and a knowledge of the human mind and heart, but he was the least methodical of all the great teachers of whom we have any record.

Two books[1] have recently come into my hands, one by gift, one by chance, which bear out the contention that personality and not method makes the great teacher. Both are by pedagogues, using that term in its best sense. The first is by Dr. Charles F. Thwing, President Emeritus of Western Reserve University, and is entitled "The College President." The book is concerned with the office, functions, and personality of that important educational executive, and it treats of his relations with the student body, with the public, and with his official and professional colleagues. Without being didactic it is extremely suggestive. In it I find a quotation from an address by Senator Elihu Root on his own Alma Mater, Hamilton College. Mr. Root names half a dozen professors of Hamilton in his youth, among them his father and brother, and then says:

> Their students doubtless soon forgot the most of what they learned from book and lecture; but their students never could escape the deep and lasting impressions upon their characters, their tastes, and their intellectual methods. These professors were poor as the world goes, but they had a wealth that money cannot create. They loved their subjects and were happy in their work. They rejoiced in the exercise of their powers. They were content with simple pleasures. They filled the atmosphere about them with an enthusiasm for learning and literature. They sought for truth as one who strives in a game. They never talked or thought about money or investments or profits. They took little heed of all those things for which men are striving and wearing out their lives in the market-places of a materialistic civilization.
>
> For a boy to live with such men, to be close to them during four of the most impressionable years of youth, to observe and become accustomed to their simple and sincere lives, without money, made happy by the pleasures of the intellect and taste, to get their standards and become impressed by their estimates of the values of life, and to learn enough out of books in the meantime to understand it all—that is an education beyond price.

This is a beautiful interpretation of true pedagogics and deserves to be put alongside of Huxley's definition of education, which, although I have quoted it before, is certainly good enough to repeat more than once:

> That man, I think, has had a liberal education who has been so trained in his youth that his body is the ready servant of his will, and does with ease and pleasure all the work that as a mechanism it is capable of; whose intellect is a clear cold logic engine, with all its parts of equal strength and in smooth working order; ready, like a steam-engine, to be turned to any kind of work, and spin the gossamers as well as forge the anchors of the mind; whose mind is stored with a knowledge of the great and fundamental truths of nature and of the laws of her operations; one who, no stunted ascetic, is full of life and fire, but whose passions are trained to come to heel by a vigorous will, the servant of a tender conscience; who has learned to love all beauty, whether of nature or of art, to hate all vileness, and to respect others as himself.

The other of the two books which I mentioned above is also pedagogical—that is to say, it is a text-book prepared for high school students by Mr. John M. Avent, Principal of the Curtis High School, on Staten Island. It is entitled "A Book of Modern Essays." The first essay of the little handy volume—its leading position indicating the value which Principal Avent places upon it—is by William James. William James is the philosopher who "wrote like a novelist" and stands high among the great teachers that America has produced. Being a philosopher and a teacher, William James, in discussing, as he does in this essay, "The Social Value of the College Bred," might have been expected to say something about the methods of pedagogics as a technical science. But no. He dwells, as Mr. Root does, upon the paramount importance of personality. He advocates, to be sure, the teaching of the "humanities," including Greek and Latin, but they are to be taught in order to make us familiar with not merely the best that has been thought and said in the world—to use Matthew Arnold's fa-

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[1] The College President. By Charles F. Thwing, LL.D. The Macmillan Company, New York.

A Book of Modern Essays. Edited by John M. Avent. Allyn & Bacon, Boston.

mous dictum—but to make us familiar with the best men that have lived in the world. Here are his words:

> You can give humanistic value to almost anything by teaching it historically. Geology, economics, mechanics, are humanities when taught with reference to the successive achievements of the geniuses to which these scientists owe their being. Not taught thus literature remains grammar, art a catalogue, history a list of dates, and natural science a sheet of formulas and weights and measures.
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> The sifting of human creations!—nothing less than this is what we ought to mean by the humanities. Essentially this means biography; what our colleges should teach is, therefore, biographical history, that not of politics merely, but of anything and everything so far as human efforts and conquest are factors that have played their part. Studying in this way, we learn what types of activity have stood the test of time; we acquire standards of the excellent and durable. . . .
>
> The sense for human superiority ought, then, to be considered our line, as boring subways is the engineer's line and the surgeon's is appendicitis. Our colleges ought to have lit up in us a lasting relish for the better kind of man, a loss of appetite for mediocrities, and a disgust for cheapjacks. . . . The best claim we can make for the higher education, the best single phrase in which we can tell what it ought to do for us, is, then, exactly what I said: it should enable us to *know a good man when we see him.*

With William James's simple but conclusive definition of the goal of higher education I leave the subject of pedagogics—and it could not be left in better hands.

The Natural Diet of Man.

A remarkable volume has been recently issued at Paris, entitled "Human Longevity, & the Quantity of Life on the Globe". The author is P. Flourens, Professor of Comparative Physiology to the Museum of Natural History at Paris, Member of the French Academy, Permanent Secretary to the Academy of the Sciences, Member of the Royal Society of London Edinburgh, & many other in the continent. The work is a neatly printed duodecimo volume of 247 pages, & though it made its first appearance only a few months since has already passed to a second edition.

M. Flourens endeavours to prove, from existing facts, that there is, at all times, the same quantity of life on the globe; that if there appears to be less in one place, there will be more in another; & that, of this life is as it were used up by the inferior animals, there will be the less of it for man & the nobler — and (vice versa), the more men, the fewer brutes. He also endeavours to show, incidentally, that the present tendency is to the increase of the more useful & noble animals & the diminution of the inferior & worthless — which to the philanthropist at least, is truly encouraging.

It is, however, no part of my intention to enter, upon a formal review of this novel & highly interesting work; but rather to extract from it, the author's views concerning the natural or primitive diet of man. And his testimony, on this point, is the more valuable, not only from the fact that it comes from a distinguished naturalist, but because it is incidental, instead of being designed to sustain or defend a favorite theory. It is the honest conviction, no doubt, of an honest inquirer after truth; & though his testimony does not materially differ from that of Cuvier, Lawrence, Bell, & others, it is by no means the less important, but perhaps the more so.

The work of M. Flourens is in two parts. The following extracts are from the closing paragraphs of Part I — on Human Longevity. They commence at page 132.

"Man has been known, naked & feeble, on the earth; & I must add, with a natural diet by no means the most favorable

"It is a question which has very much agitated the minds of physiologists — and a point not yet fully settled — what is the natural diet of man kind. According to some, the primitive diet was the herbivorous; according to others, man has always been as we see him, both herbivorous & carnivorous; or in other words omnivorous.

"Now we know very well, at the present day — thanks to comparative anatomy — what are the conditions indications of a herbivorous diet, & what those of the carnivorous; & nothing can be more obvious than that man, originally was neither carnivorous nor strictly herbivorous.

"The carnivorous animal has sharp molar teeth, a simple stomach & a short intestinal canal. The lion, for example, has all the molar teeth sharp with a small straight stomach — a merely slight enlargement of the alimentary canal — while this canal, of itself, is very short, scarcely three times the length of its body. Now man, on the contrary, has no sharp molar teeth; his stomach is simple but large; & his intestines are seven & eight times the length of his body. Man therefore, is not naturally carnivorous

"In all animals, the form of the molar teeth determines the general character of the diet. The lion who has none but sharp molar teeth, subsists exclusively, by preying on living animals. The dog, who has two protuberances a projection on the molar teeth, mixes vegetables with his food. The bear who has all his teeth fully furnished with protuberances, can live entirely on vegetables

"Man is not carnivorous, nor is he truly herbivorous. He has not like the ruminating animals — those which are herbivorous par excellence — the teeth with alternate hollows and projections; nor a stomach composed of four stomachs; nor intestines from twenty eight to forty eight times the length of his body.

"By his stomach, teeth & intestines, then, man is naturally and primitively frugivorous, like the monkey.

"The frugivorous diet is that which is of all others, at least favorable because it prevents the animals confined to it from readily adapting themselves to the conditions of other countries; for they belong to warm countries. The monkey race belong to warm climates

"Since however, man has discovered the art for this regard in cookery, the art of making both animal & vegetable substances soft and tender, he is able to sustain himself in living animals; thus uniting all the various diets.

"Man then, in short has two diets; a natural primitive instinctive diet, by which he is frugivorous; & an artificial diet depending entirely upon his Education, by which he is omnivorous."

Mr. Flourens also shows, incidentally, in the progress of his work, that the natural duration of human life is a hundred years or more; or five times the period required for the attainment of physical maturity. Buffon, however, held that animals ought to attain to seven times the number of years consumed in reaching maturity

In saying that man has no sharp molar teeth Mr. Flourens may appear to have generalized a little too much; for we have four teeth in nearly two thirds of the carnivorous character. However the sheep & camel have their teeth sharper than man; yet no one ever suspected that their last were in any degree carnivorous.

It is worthy of remark, in connection with our author's statement that the monkeys & man belong naturally to warm climates, that Dr Clark & other writers of eminence have shown us that the monkeys which are kept in menageries & elsewhere confined to cool

females are very apt to become Tuberculous. Is it not worth
while to inquire whether Tuberculous diseases, especially Pulmonary
consumption do not owe their frequency & fatality, in no small degree
to the fact of man's being, prematurely, an inhabitant of unnatural
climates

We may see, most clearly, from a perusal of M. Flourens'
work the careful investigation of the whole subject, in what sense man is
pronounced by naturalists & by others to be omnivorous. He is so, by
in the same sense in which & by which he is a coffee drinker.
that is, by education Yet there have not been wanting, of late,
efforts to prove that man, in artificial life, requires coffee.
Of course he can, by dint of education, become coffee & tea
beer drinker & rum, so that in his drinking habits he may be called
Omnivorous; while instinctively & constitutionally, he is beyond
the possibility of an intelligent doubt, a water drinker. Farinaceous
substances & fruits are, principally, his only food, & water
principally, his only drink

Wm A Alcott M.D

Lebanon Auburn Dale. Mass Oct, 1855

Copied from "Synopsis Medicine or a Summary View of the whole Practice of Physick"
By - John Allen, M.D.

Fungi

Art. 1062. Mushrooms are the lowest and basest kind of vegetables, of which if some are absolutely poisonous, and come not under the denomination of Eatables, yet other indeed are surprisingly delicious to nicer palates. All the Species of them are pernicious; and Seneca did ingeniously call them a voluptuous Poison. Athanasius Kircher, in his Book de Peste, writes to this effect: The Fungus of every fort is frought with noxious and virulent properties; and although they are not immediately offensive, yet in some compass of Time, by the Operation of the Viscera on them, the hithertow latent evil displays itself. Away then with these woful delicacies, these treacherous gratifications. What, is a pleasure so precarious to be so highly rated? Is life then so burdensome, that we should give it up for so trifling a morsel? And should we put even Death upon the spur, that is already on the gallop towards us? Thus, alas! We shorten a being, of which we first received a longer lease; and are so far from the appearance of frugality, that we are even prodigal in the consumption of it.

The Effects of the fungi

Art. 1603. The Fungi when eaten, particularly the poisonous sort, affect the patient with the fear and imminent danger of suffocation, blow up the stomach, excite hiccoughs, bring on the Cholera Morbus, sometimes epilepsy, swooning, cold sweats, profound sleep, etc. nay, even death itself, many instances of which we find in authors of the best credit. Upon my once unwarily eating some of these vegetables, a violent diarrhoea seized me, and a continued as well as painful inclination to go to stool, as well as desire of making water. Not being apprised of the occasion, nor sensible of any pain or sickness of stomach, I trusted to nature for relief, till on the third day, on the continuance and the aggravation of my disorder, the mushrooms came into my head. Upon this recollection I

chewed a dose of Rhubarb, but it answered not the intention. The fourth day finding myself worse, and my strength much impaired, a kind of giddiness also attending my weakness, not without a grievous excoriation of the anus, I took in the evening an infusion of Ipecacuana for an emetic, which gave me three or four motions; and going to bed a dose of the Confectio Fracastorii, and was according to my wife,happily freed from my disorder

Method of cure

Art. 1604. To answer this purpose, the fungi must be forthwith evacuated by a vomit, and other means used, as was observed before for the cure of poisons in general. Lixivial Salts are of a surprising efficacy, particularly that Lixivium which is prepared from the twigs and cuttings of the vine when reduced to ashes. Against the injury received from these fungi, there are no better remedies than the following; Theriaca Andromachi cum Oxymelite Simpl. vel Scillitic. Gallinarum fimum duntaxat candidum Decoctum coctum mulsi venena fungorum beletorumque astringit. Lister de Humoribus, p. 392.

Aunt Margie & Uncle Irving on the occasion of the author's 50th birthday

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Leonard Bacon

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Nicht im Handel

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Analytical Psychology and Poetry.

By

LEONARD BACON.

The connections between Analytical Psychology and Poetry are so many and so various, the two subjects have so much in common, that some remarks on their relation are not inappropriate and may have a certain use. Their materials are in a sense the same, though their methods and objects are different. And they are both liable to terrible abuses in the hands of the incompetent.

For the purposes of this little paper, Analytical Psychology means that department of thought which has for its subject matter the human psyche in its conscious and unconscious aspects. The object of the science is to discriminate and describe the elements of the psyche, and to discover the laws which govern the world best and least known to all of us. It is likewise concerned with the diagnosis and treatment of spiritual illness. In short, it investigates every aspect of the soul, whatever that may be.

For poetry, definition is even vaguer and more difficult, perhaps particularly so in the instance of a man who has devoted his life to the art. Hardly two people who think about the subject at all, use the word in the same sense. And misunderstandings, not to say quarrels, are only too frequent in this branch of aesthetics. According to temperament the critics have leaned toward form or substance in their definitions, categories which by no means exhaust the possibilities of limiting the subject. And so in the vast collection of extremely dull prose works about poetry, we find definitions as atmospheric as "Emotion recollected in tranquillity", or as precise and jejune as "The metrical expression of ideas". To most minds the word probably suggests the idea of measured rhythm, measured to distinguish it from prose, which is also rhythmical. But very few minds would be willing to let it go at that. And here, unfortunately, we come at a stride to one of those frontiers of thought, or opinion, where precision has hitherto been, and may always be, extremely difficult to attain. Are we talking of a way of thinking or feeling, of a type of expression of something in the form, of something in the substance, of all of these, or what? It is all very trying. And one turns from most of the authors who have written on the subject with a sense that "great dialectic capacity has been displayed, and that the results have been nugatory". They remind you of city-children discussing the question as to whether a humming-bird is a dragon-fly or a wasp.

Some years ago, while attending the seminar of Doctor CARL GUSTAV JUNG, in whose honor this paper has been prepared, I heard suggested by him, in another connection, certain ideas which, it seems to me, have

a bearing on this subject. Upon these ideas, with appropriate diffidence, I propose to enlarge. In his study of the Unconscious, Doctor JUNG had in the first place divided the region into two parts, Personal and Collective. In the personal unconscious, only individual elements peculiar to the person were to be found. But in the collective unconscious, he became convinced of the existence of certain entities, knots of energy, group associations, which with some variation are common to race or sex, and, in certain instances, to all mankind. In dream and in daydream these entities appear. And in spite of the fury of the behaviourist, who (as Professor JOAD has acutely remarked) has taken up materialism just as the other scientists dropped it, I am quite as much persuaded of the reality of these entities as I am of the reality of any reflex that ever was conditioned. For these newly discriminated factors in the unconscious, Doctor JUNG proposed the name archetypal image, or archetype, — meaning a symbol with which the unconscious mind has been familiar for a very long time, perhaps from the beginning. To avert a misunderstanding at this point, it should be said that this statement does not involve anything like innate ideas. The archetypes are not conceived of as inherited. They are thought of as images toward which a predisposition is inherited, as a preference for animal food is inherited by a tiger. For instance, a ship may well carry the value of an archetype for a Scandinavian, and a horse for a Tatar. It is not improbable that a Swede in Minnesota, or a Yakut in the Aleutians, will dream each of the symbol toward which he has inherited a predisposition from many generations that made their way by the sea or the plain. And his symbol will come to each lit by "The awe-inspiring fire of the depths". It will have for him a force and a value not possessed by the casual phenomena which can be traced to his personal experience, his everyday associations.

The late F. W. H. MYERS, the inventor of the word "Subconscious", and a poet of force and distinction, was, I believe, the first person to see or to point out a connection between creative ability and the unconscious. It appears that the artist always has a low threshold. He has, so to say, the deep hidden images constantly in view, and they supply him with a variety of motives and reasons different from those known to the conscious mind. All people who have low thresholds are not artists, for other elements enter in. Technical capacity is, of course, necessary, if the artist is to evoke in others what he discovered in himself. And the method by which he does this no doubt remains as mysterious as any form of action at a distance, as gravity, as radiation. Curiously enough the artist has a strong tendency to conceal the real source of his power, and is more than likely to attribute the success of his picture, his poem, or his sonata, to his conscious reasoning powers. Which is, of course, as ridiculous as if the hawk were to attempt to put on the carapace of the tortoise. Thought naturally is as useful to him as to other men, but it comes after something of initial and essential importance, without which art cannot exist.

And it may be stated in passing, that critical preoccupation with thought in works of art is what rendered criticism, "that dead twig on the tree of literature", in general so leafless. Too often the critic has to all intents and

purposes directed attention to the mechanism of the piano, rather than to the burning symbols in the enigmatic deeps whence the sonata emerged. Greatly to dare also, it is that same critical preoccupation with conscious problems which has castrated such a quantity of modern poetry and modern painting, and reduced kinetic living things to cold geometry and fruitless abstraction. The arts have the right to be themselves, and they never are gainers when they are subordinated to a chilly intellectualism, whether philosophic, political, or religious.

But this is by the way. Whether the reader is in agreement with the views expressed in this paper or no, he will see that an acceptance of those views makes possible a definition of poetry that has some satisfactory aspects, though no sort of finality is claimed for it. To the writer, poetry appears to be that form of communication, whose important function is to touch and arouse the ancient and permanent elements in the spiritual structure by symbol and by measured rythmical sound. The measured rhythm, which is the body of poetry, as the symbol is the soul, has itself the quality of an archetype. And those moderns who, on logical grounds, have rejected metre, or even rhyme, are not to be congratulated on choosing such a handicap. They have elected to dispense with whole categories of unconscious sympathies between their readers and themselves, and in the pursuit of private originality have ignored deep-seated instincts common to genius and ordinary mankind. This does not mean, of course, that something new and strange is never to take place, any more than it means that a tree should never have new leaves and new branches, though it does imply that a tree ought not to put forth lobster-claws. But the new must have a tincture of the primordial, and the strange will derive its force from ancient and shadowy relations with the familiar. This last statement has the force of a law. And it perfectly explains why the extreme positions of what are called schools, vanish automatically because of their failure to connect themselves with the living, growing, immortal unconscious, that remains the same the more it changes.

The common term in poetry is hard to be found, and when found may appear misty and vague enough. A category that includes the celebration of the wrath of Achilleus, the blasting of the character of Shaftesbury, the lament for Lesbia's sparrow, and the Rhyme of the Ancient Mariner, is varied enough in all conscience. But it does not take much penetration to see how Homer and Dryden by image and sound have evoked from our depths as from their own the archetypal symbols of anger, though one chants in oceanic hexameters and one in the stately, confined, and pointed couplet of the English Augustans. Behind both if you go far enough is a war-dance. Behind every poem is an archetype.

It seems to the writer that a delightful, useful, and clarifying criticism may conceivably arise from the new ideas, if the Analytical psychologist learns how to pass the white light of poetry through his prism. This process will not destroy that light's beauty, any more than spectrum analysis destroys the beauty of actual light. Rather it will add to the interest because it will be real. Personal predilection disguised as universal law by dialectic devices will no longer govern aesthetic ideas. And, as in all

cases where truth begins to appear, we shall, to borrow the words of a great writer, find the mystery even more mysterious than we supposed, but our knowledge of the phenomena ought to increase, and with it our satisfaction. We shall have a living aesthetic that moves, and grows, and changes. And it is not improbable that rational connections between things that seem as hopelessly unrelated as the constant sun and the instantaneous thunderbolt, may become clear to us. The new aesthetics will bear the same relation to the old that physics does to what used to be called natural philosophy. As distinctions grow sharper the science will grow more factual, even if hypotheses have to become more complicated. And let us hope that there will be such fine sport as the physicists have had since relativity and the quantum theory disturbed the symmetrical system of 19th century science.

If, as the writer believes, the general tendency of these remarks is correct, then these remarks are significant for the poet. Though the interior universe will never, thank God, be completely explored any more than that other brave o'erhanging firmament, still the poet ought to find his account in these novel investigations. By increasing his understanding of the interior objects of contemplation, he ought to increase his power of self-criticism. By studying the idiosyncrasies of that strange process called fantasy he may learn to go farther and fare better. Of course, I do not mean that a poet, struggling with the aesthetic problem of a poem will say to himself "I'll have a good go at the anima this afternoon, and the sonnet will come out right tomorrow". In point of fact, he must not do that, for the conscious exploitation of the unconscious, as Doctor JUNG long ago pointed out, is a psychological crime and reduces the individual to the level of Hindu charlatans teaching Yoga to millionairesses for money. It is a different thing to have trained oneself to recognize and interpret the messages that come at the proper time to the conscious mind, from the far side of the threshold. One must not force the unconscious, but it is proper and even necessary to use it to the limit when it is disposed to assist.

There are many things to discover in that strange world which lies so close and is so hard to enter, where ugliness and beauty and good and evil are so intervolved as to be almost interchangeable. It is difficult not to pass conscious judgments on conflicts of energy. It is difficult to recognize that the resultant is more important than the fact that one of the forces might be adjudged good and the other evil. It is hard to realize that it is all the same energy, as a river is all one river, whatever whirlpools and backwaters there may be in it.

As for all men so for the poet, these things are necessary to be learned. But in one specific instance the Analytical psychologist may be able to help the poet in particular to more thorough understanding, if not to greater power. A better system of what someone has called "The pre-natal care of ideas" is not by any means impossible. And a better knowledge of the whole strange process of the gestation of a poem would in any case be fascinating whether it were useful or no. From that palpitating second when the symbol appears in the mind with the startling suddenness of a great fish breaking water, a suddenness that carries the implication that

the symbol had its own existence before it was consciously recognized, through the ancillary flashes, and the conscious struggle with the intellectual difficulties implicit in the image, whether it be a clear-cut picture, a consonance of cadences, or a shadowy and ill-defined mood, what subject is there in the world within or the world without more intrinsically interesting? Nor will the investigation of the elements of this process make it less so. Biologists do not love their children less because they know more about chromosomes than other people. On the contrary out of fuller knowledge should come keener and more varied appreciation, founded on fact, based on living experience of a living thing.

And if nothing else had come out of these new and, to many people, enigmatic ideas, for the poet a continent dimly guessed and only timidly visited in the past, has been unveiled, and lands long since wasted and deserted have taken on their original beauty and interest. The inner world is suddenly full of huge cloudy symbols of a high romance. Dead allegory has become live value. In a world enslaved by the fiction of objective reality, mythology is reborn. The god is in the grove and the nymph at the fountain. "It is good. They belong there." The dreamside of things is restored to its dignity. And the whole spectacle of mental life has grown larger, as it should, for we have drawn nearer to it. Furthermore every item in that spectacle is invested with vivider charm.

It is interesting, though perhaps profitless, to speculate on the results which the new points of view are likely to produce. For one thing an intense artistic renaissance is to be expected. A deeper poetry than the last half century has known is practically certain to emerge. Old tales will have to be retold in the light of a new knowledge. And new ones will have to be told for the first time. Though the explorers have only touched the strange coasts, or at most heard rumours of fantastic rivers, it is clear that man's discovery of himself must have on him a liberating effect not dissimilar to the effect of his first steps in the study of the frame of external things.

To the men who have played large parts in this discovery we ought to be intensely grateful. Among them CARL GUSTAV JUNG is not least. His gigantic contribution to every department of the field stands in no need of my praise and still less of my exegesis. Nevertheless it gives me pleasure to bring this little tribute to the thinker, the doer, the delightful man, who has thrown light on a thousand problems, and has helped countless troubled men and women to a sight of that four-petalled flower which can only be discovered in the inner gulfs.

(From a paper by Ralph Barnhart) (The Life of a Serf in the Middle Ages)

Langlands Piers Plowman gives this description of a peasant :

"I have no penny pullets for to buy nor either geese or pigs, but two green cheeses, a few curds and cream and an oaten cake and two loaves of beans and bran baked for my children. I have no salt bacon nor no cooked meat callops for to make, but I have parsley and leeks and many cabbage plants and a cow and a calf and a cart mare to draw a-field the dung while the drouth lasteth, and by this livelihood we must all live till Lammartide (August)."

The Irish potato, tomato and Indian maize were unknown in Medieval times.

Meat was a staple of diet during the middle ages, but it was probably eaten a great deal more among the higher classes than among the peasants. A writer of the eleventh century describing the peasants of Ireland, remarks about their excellent health, and ascribes it to the fact that they lived a pastoral life and subsisted upon milk rather than meat.

Salt was scarce and little used. As a consequence meat was poorly preserved and much sickness resulted. Scurvy and other skin diseases were common, and were often confused with leprosy.

Sugar was almost unknown, and honey was used for sweetening. Bees were kept by all classes.

Milk, butter and cheese were also articles of diet. Cheese was often made of ewes' milk as well as from that of cow's.

The peasant took little pains to raise fresh vegetables, but raised a variety of medicinal herbs. This was particularly true up to the twelfth century.

(Serfs)

During the thirteenth century, nut trees, beans, peas, cabbage, water cress, and hops were raised; later, pumpkins, turnips and carrots.

The cereals raised were wheat, rye, barley and oats. The wheat and rye were sometimes ground and made into a sort of bread, described as tough and black and just a little better than shoe leather.

Fruits, especially apples and grapes were known and wine was made, especially in France. Wild fruits were eaten when available. Wild game was also eaten, but the nobles for the most part prohibited or tried to prohibit hunting by the serf.

(Interesting notes about clothing follow).

From J. Ell[illegible] Barker, Albion Lodge, Fortis Green, East Finchley,
London, N.2., England.

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HEALTH-BUILDING AMONG THE ANCIENT GREEKS.

I

The ancient Greeks have never been surpassed or even approached by any of the succeeding nations. Success among nations falls naturally to the large nations. Where the inhabitants are extremely numerous there ought to be the highest development of science and art, because normally genius and talent should be found in approximately the same proportion among men. Large nations also should furnish the ablest athletes, the most perfect types of mankind, etc., because there are larger numbers to select from. The Greek nation was a nation small in numbers, or rather it was a race, for the Greeks were divided in numerous states which were jealous of each other and which made frequent war upon each other. Some of the petty Greek city states were backward in most respects. Others were highly advanced, and among the latter the city state of Athens stood first. If we speak of Greek civilization we really mean Athenian civilization.

Athens contained only a few thousand Athenian families. The rest of the inhabitants were partly foreigners, both Greeks and non-Greeks, for Athens was a great international and cosmopolitan centre and trading town, a kind of ancient New York on an extremely small scale. Besides, the majority of the people of Athens were slaves engaged in bodily labour. The Athenians proper, the ruling class of the people, counted only a few thousand. The whole Athenian nation could therefore easily be assembled in a moderate-sized open space and be addressed by their statesmen and orators and form their decisions. Practically the whole Athenian "nation" could be given accommodation in a large open-air theatre.

One would imagine that a nation of a few thousand could not achieve anything very notable because of the small number of the people. However, the Athenians and the other tiny Greek tribes did more for

all the sciences and arts in a few decades than all the other nations of the world combined in a great many centuries.

To most of us the Greeks are people who produced the grandest works of art in architecture, sculpture, pottery, etc. Modern artists stand in awe of the ancient Greeks, who did not possess the countless scientific tools and instruments which are at the disposal of the modern artist. However, the ancient Greeks were equally great in all the sciences. They were foremost in engineering, geography, history, exploration, astronomy, natural history, shipbuilding, trade, and the arts of war. Last, but not least, they had cultivated to the highest degree the science and art of health building, a matter which is vastly more important than medicine and surgery. A healthy body does not give much employment to the doctor. It doctors itself.

The Greeks were originally composed of ordinary average human stock. There is not the slightest reason to believe that natural conditions in Greece created a race of super-men. The Greeks were paramount in the world, not only in brain power - that may be seen by the wonderful masterpieces they have left us - they were foremost as well in physique. I do not want to speak of their athletes, for picked athletes are not true representatives of the nation. I speak of the racial type, of the masses of the people in general.

The Greeks were realists in sculpture. Their statues were mostly faithful portraits of living men and women. Physically the Greeks were obviously a race of demi-gods and, unless we believe that Providence created a unique race in a country which has now disappeared, we must assume that the ancient Greeks converted an ordinary, average type of mankind into the most perfect type ever known. If climatical conditions had been responsible for the creation of the wonderful Greek physique of antiquity, modern Greece ought to produce a similar race.

The Greeks of antiquity were not only men and women of wonderful proportion, rhythm, poise, and beauty, but they were possessed of extraordinary physical strength and endurance. That

may be seen from the military and naval achievements of their citizen armies and of their citizen crews. The Athenians donned their armour and defeated the hosts of their enemies, however large their numbers, in battles which were fought breast against breast, where the best men prevailed. They left their employment, went on board their warships and excelled their enemies likewise in naval battles where success depended largely on strength of limb in wielding the oars, handling the sails, leaping aboard the enemy's vessels, etc.

How did the ancient Greeks convert an ordinary, average race into a race of veritable demi-gods possessed of health, strength, talent and genius, such as has never been known before or after? They did so by deliberate health-building, realising that, as the ancient Romans said, a healthy mind dwells in a healthy body.

At the time when Greece was at the height of her power arose Hippocrates, the Father of Medicine. He was undoubtedly the wisest and the greatest physician, surgeon, and hygienist of all time. He did not know microbes. He possessed no microscopes and test tubes. He had no clinical thermometer, no stethoscope, no X-rays to assist him, but he possessed observation, insight, vision, and medical genius to the highest extent. Modern medicine and surgery can still learn much from Hippocrates. After all, brain power is far more potent than the mechanical power of dead tools. A genius can achieve miracles in carving with a blunt bread knife or in painting with a pointed stick, or in sculpture with a few flints, while men without brain power will produce nothing but failure with the most perfect and the most costly tools.

Hippocrates has left us bulky writings which are worth reading and re-reading. Learned commentators have vainly endeavoured to sift the Hippocratic writings and to separate the genuine from the spurious since the time of Galen. For those who wish to discover the reasons for the extraordinary development of body and mind in ancient Greece it does not matter very much whether on philological and other grounds certain writings may be attributed to the Master himself, or to others. After all, the

whole of the Hippocratic writings were composed in the best time of ancient Greece, and they give us therefore a wonderful insight into Greek conditions of life, Greek methods of health-building, of curing disease, etc. They are therefore of inestimable value, and I shall endeavour to summarise as briefly and at the same time as completely as possible the teachings contained in the bulky writings attributed to Hippocrates, of which there is unfortunately as yet no adequate and complete translation in the English language. Hence those who do not know Greek can study the whole of the Hippocratic writings only in French and German, for the complete works of Hippocrates have been translated into these two languages.

Hippocrates is the first among the physicians and writers of health who attached the greatest importance to air, climate, water, exercise, diet, baths, massage, and all the other natural remedies of disease which were neglected and forgotten for many centuries until recently, when the Greek methods of natural cure and of health building were revived. With regard to air, Hippocrates taught that those cities which are open to the health-giving winds are healthy, and those which are in a sheltered position where the wind does not blow away the noxious vapours are necessarily unhealthy. He taught us that the air has an extraordinary influence on the human body in health and disease, illustrating the importance of air by the fact that men can live without food for a long time, while deprivation of air for a few minutes destroys life. He illustrated the importance of fresh air further by the prevalence of certain diseases, the spreading of which is favoured by the closeness of the air. In his writings Hippocrates discussed the qualities of the air, whether it be hot or cold, moist or dry, and its various other qualities, and he told us:

"The physician who wishes to obtain useful knowledge in the art of healing must observe the seasons of the year for they differ very greatly from one another, and great are the changes which occur with their variation, and he should particularly observe the effect of the different winds."

Hippocrates pointed out that different winds affect the constitution in different ways, and that certain winds give to persons of delicate constitution various complaints by affecting the throat,

chest, bladder, bowels, etc.

In accordance with the high importance which he attached to matters climatic, Hippocrates urged that diet should be arranged in ~~accordance~~ harmony with the seasons and the weather. He advocated that in the hot and dry season the food should be cooling and the drink diluting, but that towards the change of temperature in autumn our food should again become of a warming nature and that we should use thicker clothing. He furthermore wrote interestingly and acutely on the effect of the seasons and of the weather on the bodily juices and the composition of the blood, and he pointed out that unseasonable weather, such as heat in winter or cold in summer, put a considerable strain upon us. Moreover, he showed that the physique and health of men is largely determined by the climate, that different climates and different countries favour the rise of certain physical types, that Asiatics therefore differ greatly from Europeans in body and mind, and that these differences account to a large extent for the different forms of government prevailing. He was of opinion that a bracing climate not only made for strength of body and mind, but also for a love of freedom and independence, for republicanism, while soft and relaxing air made men soft and cowardly, and favoured absolutism and tyranny from above, accompanied by cringing meekness below.

Although Hippocrates knew many drugs and medicinal plants, hundreds of which are mentioned in his writings, he attached by far the greatest value to food and diet for maintaining people in health and for curing them when suffering from disease. He tells us that the physician who would thoroughly understand the science of dietetics should not only know the natural qualities possessed by every kind of food, but should also be acquainted with the changes brought about in the various foodstuffs by the different ways of preparation, cooking, etc. Bread was then, as it is now, the staff of life, and he pointed out that white bread and wholemeal bread vastly differed in their effect upon the human body, informing us that wheaten flour mixed with the bran belonging to it opens the bowels, but it is less nourishing than pure white flour, which is

very nutritious but constipating, and that the fact whether bread was made of white flour or flour mixed with bran, whether the grain was finely ground or coarsely ground, whether the dough was thoroughly mixed or lightly mixed, whether the bread was well baked or lightly done, etc., was of the highest importance to the individual.

According to Hippocrates every physician should be a good cook, or at least he should thoroughly understand everything connected with food and cooking, and the doctor should understand not only the qualities of different foods, but also the nature and constitution of different persons with respect to what they eat and drink. A medical man should not only be acquainted with all the complaints which are due to faulty nutrition, but he should also learn why certain foodstuffs harm some people but do not harm others, that for instance cheese is hurtful to some but digestible to others, so that he can order a diet which is not only good in the abstract, but will not upset the individual patient who has to be treated dietetically.

According to Hippocrates, health consisted in right food, exercise, and a due proportion between the intake and the excreta. He taught:

"It is very injurious to health to take more food than the constitution will bear especially if one takes no exercise, for by exercise one can carry off this excess. On the other hand it is equally pernicious to take in less nourishment than the body needs. Abstinence is a powerful factor and health may be procured by it. The diseases of repletion can be cured by depletion, and diseases of depletion by repletion. On the other hand, under-nutrition if carried to excess may cause weakening of the body and death. As both over-feeding and under-feeding are harmful, diligent observation is needed to strike the mean, and no absolute rule can be laid down as to the quantity of food which men require. Only individuals themselves have this knowledge, and it is difficult for a medical man to regulate this matter. A variety of foods of unharmonious character should not be taken at the same meal, for incompatible foodstuffs disturb digestion and create flatulence in the bowel. On the whole, slight over-indulgence in food is less dangerous than prolonged under-feeding, and those who are habitually abstemious suffer little from occasional excess. On the other hand, no rigid rules can safely be laid down to regulate men's food. Doctors must be guided not by abstract theory but by careful observation. Strength is derived from the foods which we digest, but those which the body cannot deal with do not strengthen the body, but weaken it. Some are able to eat three meals a day owing to the strength of their constitution, and owing to established custom. However, two meals or one per day are the rule, and established custom dictates whether the one or the other should be followed. Those who are used to taking two meals a day will grow weak and faint, disinclined to work, and com-

plain of pain if reduced to one meal, and they will feel discomfort in their abdomen, feel heavy-eyed, and suffer from cold hands and feet."

Although Hippocrates knew and used hundreds of herbs and drugs, some of which were imported from India and other countries far away, and although he undertook many important and extraordinarily modern operations,-for instance he trepanned the skull for eye disease, amaurosis, which is due to a diseased condition of the brain, not of the eye itself, an operation which was rediscovered only a few decades ago,-he attached by far the greatest importance to natural means, such as right food, exercise, fresh air, etc. for keeping the body in health and for bringing about the cure in case of disease. In the writings of Hippocrates and of his pupils we find often the maxim that the body is a single entity, that local diseases are as a rule caused by faulty general bodily conditions, that there are no purely local diseases of the liver, kidneys and so forth, that most of them are due to faulty nutrition or other faulty methods which can be corrected. These views of Hippocrates spread not only among the medical men of antiquity, but also among the non-medical. For instance, his great contemporary, Plato, wrote in the Laws:

"Every physician and every skilled artist does all things for the sake of the whole, directing his effort towards the common good, attending to one part for the sake of the whole and to the whole for the sake of the part."

In his "Charmides" Plato writes:

"I dare say you have heard eminent physicians say to a patient who consults them because he suffers with his eyes that they cannot cure the eyes by themselves, that if his eyes are to be put right the head must be treated, and then again they say that it would be the height of folly to think of curing the sick head alone without paying any attention to the rest of the body."

In his "Timaeus" Plato says, expressing the contemporary dislike of treatment by drugs instead of by diet, exercise, etc:

"Diseases, unless they are very dangerous, should not be irritated by medicines, since every form of disease is in a way akin to a living being, for every disease has been given a character and constitution of its own, and an appointed term of life. What holds good for human beings holds good for the constitution of diseases. If anyone, regardless of their natural course, tries to subdue them by doing them violence with medicines, he only aggravates and multiplies them. It follows that we ought always to try to deal with diseases by regimen as far as this is possible, and not provoke a disagreeable enemy by irritating medicines." In his "Georgia" Plato

In his "Georgia" Plato stated:

"There is an art, the art of gymnastics and of bodily exercises for medicinal purposes, which is the true minister of the body and which ought to be mistress of all the rest. All the arts which deal with the body are low and illiberal except gymnastics and health exercises, which have a place by themselves."

It is worth mentioning that the ancient Greeks not merely cultivated gymnastics as a thing by itself, but organised their amusements with a view to their physical benefit. For instance, the Greek dances, very differently from our own, were not merely undertaken for amusement and relaxation and for bringing together men and women. They were undertaken for the purpose of making the whole body supple and strong, healthy and graceful, and there were innumerable forms of dances, religious, warlike, etc., so that every occasion could be celebrated by universal health building gymnastics.

In the foregoing the teachings of Hippocrates have been summarised by taking somewhat indiscriminately extracts from all his writings. It will no doubt interest readers to be acquainted with the style of the Father of Medicine, and I would now quote a somewhat lengthy extract from his most authentic work, "Ancient Medicine", in which he deals with the all-important subject of diet as follows:

"Those who have cultivated and invented medicine diminished the quantity of the articles of food which they used, and this alone would be sufficient for certain of the sick, and be manifestly beneficial to them, although not to all, for there would be some so affected as not to be able to manage even small quantities of their usual food, and as such persons would seem to require something weaker, they invented soups, by mixing a few strong things with much water, and thus abstracting that which was strong in them by dilution and boiling. But such as could not manage even soups, laid them aside, and had recourse to drinks, and so regulated them as to mixture and quantity, that they were administered neither stronger nor weaker than what was required.

This I know, moreover, that to the human body it makes a great difference whether the bread be fine or coarse; of wheat with or without the hull, whether mixed with much or little water, strongly wrought or scarcely at all, baked or raw - and a multitude of similar differences; and so, in like manner, with the cake (maza); the powers of each, too, are great, and the one nowise like the other. Whoever pays no attention to these things, or, paying attention, does not comprehend them, how can he understand the diseaseswhich befall a man? For, by every one of these things, a man is affected and changed this way or that, and the whole of his life is subjected to them, whether in health, convalescence, or disease. Nothing else, then, can be more important or more necessary to know than these things ...

Strength, growth and nourishment result from them and this for no other reason than because they are well mixed, have nothing in them of an immoderate character, nor anything strong, but the whole forms one simple and not strong substance ...

It appears to me necessary to every physician to be skilled

in nature, and strive to know, if he would wish to perform his duties, what man is in relation to the articles of food and drink, and to his other occupations, and what are the effects of each of them to everyone ...

During convalescence from diseases, and also in protracted diseases, many disorders occur, some spontaneously, and some from certain things accidentally administered. I know that the common herd of physicians, like the vulgar, if there happen to have been any innovation made about that day, such as the bath being used, a walk taken, or any unusual food eaten, all which were better done than otherwise, attribute notwithstanding the cause of these disorders, to some of these things, being ignorant of the true cause, but prescribing what may have been very proper."

It will be noticed that the great Hippocrates was not entirely absorbed in the ultra-scientific and technical side of medicine and surgery but that, notwithstanding his vast knowledge of drugs, medicinal treatments of every kind, and surgical operations, he studied with the greatest attention the all-important food factor, which is unfortunately only too often disdained nowadays by laboratory-trained doctors who have become estranged from living life. It will be noticed that twenty-three centuries ago the Father of Medicine pointed out the great value of wholemeal bread, and that he insisted that every medical man ought to be acquainted with practical dietetics which are very different from theoretical laboratory dietetics, ~~which~~ for the latter have ruined the digestion and excretion of mankind. // It would be well if modern doctors, who suffer in their own bodies very severely through their lack of dietetic knowledge, should take to heart the admonition of the Father of Medicine that it is "necessary to every physician to know the effects of the various articles of food and drink in health, disease and convalescence." Medical men in general pay lip-worship to Hippocrates, but do not read him, pitying him because he had no microscope, stetoscope, test tubes, etc., and knew nothing about germ diseases. However, Hippocrates had, what is far more precious than the most scientific tools, a high intelligence, vast experience, imagination and a great power of observation, by means of which men of ability can achieve more than third-rate men can with the most magnificent laboratory tools.

Hippocrates taught the virtue of moderation. He was wise in doing this. Among the rich and the well-to-do there is an enormous mortality from the diseases of repletion, such as diabetes, arterio-

sclerosis, apoplexy, diseases of the stomach, liver, kidneys, etc., while among hard-working and sparingly living rural labourers the mortality from these diseases is very small. Hippocrates advised, as we have seen before, that people should have one or two meals a day, not from four to six as we have nowadays, and that they should eat sparingly, writing:

"Those who have been accustomed to only one meal a day will, if they take two meals a day, soon grow dull and heavy, and owing to this change disease may develop. Those who have over-eaten, and who feel heavy and disturbed in the stomach, will do wisest to bring up the food by vomiting. That sort of food is justly considered most digestible which, if taken in moderation, or slightly in excess, causes neither fulness nor griping nor flatulence, but is quickly digested and quickly excreted. On the other hand, that kind of food is most indigestible which, even if taken in small quantities, leads to physical discomfort and disturbance. Excess in drinking is not quite as harmful as excess in eating."

The Greeks were drinkers of wine, but they drank it in great moderation, diluted with an abundance of water. In Homer the heroes mixed one part of wine with ten or twenty parts of water. To drink pure wine in ancient Greece was a sign of vulgarity and coarseness. Intoxication provoked general disgust. Occasionally slaves were made deliberately intoxicated, and were shown to the children as warning examples. It follows that Hippocrates by no means favoured excess in wine drinking. On the other hand he did not recommend total abstinence from wine. On the contrary, he used it medicinally with the fullest knowledge of the character of the numerous red and white wines which were available. People were not given any kind of wine as a stimulant, as is done nowadays, but the special character of each wine was carefully studied so that the strongest medical action could be obtained by its use. However, the favoured drinks given to sick people and convalescents were non-alcoholic. Among them were the celebrated barley water, thin barley soup and barley gruel, plain honey water and fermented honey water frequently recommended by Hippocrates, etc. Naturally, the health drinks of the great temple hospitals were largely adopted by private people who wished to lead a healthy life.

Hippocrates taught that growing people required more food than full-grown ones, middle-aged more than the aged, that concentrated

foods and heating foods, such as flesh, fish and wine, if taken to excess, lead to disease and death much sooner than the weaker and less nourishing things. His "Aphorisms" are full of the wisest dietetic counsels. We read, for instance:

> "When a person who is recovering from an illness eats his meals with a good appetite and yet receives no strength from them, it shows that he eats more than he can digest, but if he eats very moderately, and yet remains weak, it appears that there is unwholesome matter in the body which requires evacuation. A body which is impure or loaded with disease material does not benefit by good food. The more you nourish it the more you injure it."

Nowadays people overfeed habitually on highly-concentrated food, eating meat and fish three times a day, etc., and they suffer in consequence very seriously from protein poisoning and all the diseases springing from it, especially if they are troubled with chronic constipation, as are most of us. People in that condition become unwell or fall ill. They suffer from repletion. Hippocrates taught in his Maxims: "Diseases of repletion must be treated with depletion, and diseases of depletion must be treated with repletion." If we heeded his counsel we should reduce our diet very greatly, or fast, or live for a time on juicy fruit and water in order to get well. Instead, sufferers from repletion are urged by their friends and relatives, and only too often by shortsighted doctors, to eat abundantly of the most digestible food "to keep up their strength." The foods which are described to us as the most digestible invalid foods are, as a rule, chicken, fish, custards made of eggs, sugar and milk, etc., all of which add to the existing repletion instead of relieving it.

Modern biological chemists, studying vitamins, have told us that the quality of the milk yielded by the cows and of the meat of animals eaten for food depends on the character of their feed. In the time of Hippocrates there was no chemical science, and there were no chemical instruments. However, careful observation without instruments is more potent than scientific dulness sitting in the most lavishly appointed laboratory. In his writings on food Hippocrates pointed out that the quality of flesh depends on the nutrition of the animals. In the case of cattle he discriminated

between the wild and the tame, between the stall-fed and the pasture-fed. In the case of fish he discriminated between the fish living in water with a muddy bottom and in water with a rocky floor, and he declared that the latter were more digestible. He taught that fish living in stagnant water was as a rule fat and hard to digest. The truth of that observation is seen in the case of eels. Hippocrates was wise enough not to divide foodstuffs into good and bad ones, as is unfortunately done nowadays, but he wisely recognised that good food may be bad in certain cases while bad food may be good. For instance he wrote, when discussing milk, that it was hurtful to those suffering from fever, from headaches, from flatulency, from biliousness, but good for the underfed, the emaciated, the consumptives. Hippocrates and his disciples considered melancholia and various other forms of insanity to be chiefly due to the combined effects of constipation and protein poisoning. Melancholia was cured by drastic purgatives, such as hellebore, the strongest purgative of the ancients, enemas and a lacto-vegetarian diet which combined effected a cure in innumerable instances. The wisdom of the ancients was forgotten, and only towards the eighteenth century the wretched insane who were kept in chains, like wild beasts, were no longer considered to be possessed by the devil but were treated for brain disease largely by the methods practised by the ancient Greeks and Romans two thousand years and more ago.

From J. Ellis Barker, Albion Lodge, Fortis Green, East Finchley,
London, N.2., England.

HEALTH-BUILDING AMONG THE ANCIENT GREEKS.

II

Those who visit museums containing originals or reproductions of Greek art, or who read books on ancient Greece, cannot easily picture to themselves the daily life of that wonderful race which has never been equalled physically, intellectually, or artistically. In the museums we see wonderful statues of naked and draped figures, sculptures taken from public buildings, models of temples, urns, vases, clay figures, drinking cups and so forth, which tell us next to nothing about the daily life of the people. We can realise how the Greeks lived from incidental passages in the writings of the philosophers, of the historians, of medical scientists, of the dramatists, ~~of~~ from pictures and drawings on vases, etc., and it is eminently worth while to reconstruct from all these isolated scraps of information the Greek household and the Greek house.

The Greeks led a life of cultured and elegant simplicity. The most striking fact about Greek civilisation is its simplicity, and we can understand the ancient Greeks only if we constantly bear in mind how plainly, simply and frugally they lived. They lived so simply and plainly that one might almost say that they lived like primitive natives who possessed the most wonderful objects of art.

We moderns have coupled beauty with luxury. Only the very wealthy can afford to purchase original works of art, and the very wealthy certainly do not lead lives which are characterised by the utmost simplicity and frugality. They over-eat as a rule, over-indulge their body with hot baths, over-clothing and under-exercise. They never take simple natural foods. The ancient Greeks lived very differently.

Modern industry and art do not go together. Modern industry produces goods in prodigious masses by labour-saving machinery. Now-a-days one man can do, without exertion, the work which was done by a hundred hard-working Greeks. The result is that we have a hundred times as many goods as the ancient Greeks, that nowadays the poorest beggar can afford to wear and to eat things which Pericles could not have afforded. In ancient Greece houses were laboriously constructed by hand, waterworks and canals were the work of unaided human labour, food was chiefly produced locally because methods of transport were lacking, although Athens and various other towns obtained bread corn and other foodstuffs from long distances. Yarn was laboriously twisted ~~by hand~~ between forefinger and thumb, and was very scarce, and from that yarn cloth was woven on ridiculous little hand looms.

The ancient Greeks had a super-abundance of artistic masterpieces, but there was an ever-present scarcity of house room, for there was little wood available and there were no brick-making machines, cement works, etc. Greek furniture was very beautiful, but only the very wealthy had a few pieces of furniture. The poor had practically none. The luxurious modern bed was possessed only by a few wealthy people. The majority wrapped themselves up into a cloak or some other simple piece of cloth and slept on a skin, on leaves, or on straw on the floor.

In view of the primitive conditions of the narrow houses, which were uncomfortable, unheated, uncarpeted, and possessed often not a single chair, people spent the minimum of time under their roof. Houses existed mainly for shelter during the night and the inclement weather. Lack of accommodation made the Greeks an open air ~~people~~ race. The Greeks spent their time in the market place, at sports, at the theatres, at their baths, etc., because their homes were no homes in the modern sense. It was far more comfortable to sit in the open on a stone bench than be inside the house. As windows were of the most primitive type the interior of the houses was indeed very unattractive. No-one stayed at home who

could be in the open.

The climate of Greece was rather chilly. Life in the open was bearable only if one kept on moving. If a Greek felt cold he could not put on thick woollen underclothing, stout overcoat, etc., because clothing was scarce and dear. The Greeks were an under-clothed race. Sport was carried on by nude men and women, partly to get the benefit of the air, partly to save the precious hand-made clothes which were exceedingly scarce. Besides, the garments worn by men and women were rather flimsy and unsuitable for active exercise. A glance at the Greek statuary shows us that men and women wore flowing garments, wrapping themselves up in a piece of material about as large as a bed sheet, or larger. It is characteristic of Greek statuary that the bodily form is visible in all its details through the clothing. From this we may conclude that the Greeks used only the lightest and the flimsiest of materials, which were rather an ornament or conventional covering than clothing designed to keep out the cold and preserve the body warmth. If there was any purpose in the Greek dress, the purpose must have been to allow fresh air access to the body. The feet were shod in sandals, but as sandals were expensive the great majority walked probably bare-footed except on ceremonial occasions when they fetched out their precious sandals which had to last a lifetime. The head was usually left uncovered.

The Greeks were fond of vigorous exercise. They disliked dust and dirt, and loved cleanliness. As they possessed no coal, and as wood was very scarce and dear - wood was largely imported from abroad - hot water was a very great luxury. Hot baths were practically unknown. Those who wanted to cleanse themselves used cold water all the year round, and swimming was universally practised. It is difficult to have a water supply in one's house at a time when lead, iron, brass and other metals used by the plumber are exceedingly scarce and dear. Those who wanted a bath had to go to rivers, lakes and the sea.

The ancient Greeks, having little furniture, rarely sat

down. Comfortable chairs of modern type were quite unknown. People walked, stood, squatted, or laid down on the ground. Our comfortable chairs are responsible to a large extent for the prolapse of the intestines and consequent constipation and auto-intoxication. The Greeks were apparently very free from that evil, which is also favoured by relaxing hot baths, relaxing hot clothing and over-refined, over-concentrated, artificial food, such as that on which we subsist almost exclusively.

The ancients lived in cultured poverty. Their food was of the simplest kind. They subsisted on crushed or roasted grain, in bread made from coarse wholemeal flour, plain vegetables largely eaten raw or plainly boiled, fruit, oil, milk and a little wine mixed with an abundance of water, fish and moderate quantities of meat. As fuel was expensive and scarce, and as the Greeks did not possess the wonderful cooking appliances which we have now-a-days, the mere fact that people lived on cooked food was always taken as a sign of prosperity. Homer describes in loving detail how the plain food eaten at the banquets was cooked. Cooking was obviously a luxury. The Greeks lived in the fresh air, drank an abundance of cold water, took cold baths and spent their lives largely in vigorous physical exercise. They could not over-indulge themselves at the table because there was only a very limited choice of plain foods grown in the immediate neighbourhood. Chemically preserved, chemically dyed, chemically adulterated foods and similar horrors of civilisation were unknown to them. A handful of beans, some raw greenstuff, an onion, a piece of fish, and a drink of water flavoured with a little wine, was the wholesome daily meal of the average Athenian. Nor did the Greeks over-eat in quantity. Instead of having from four to seven meals as we have now-a-days they had as a rule either one meal or two meals a day, as we learn from Hippocrates and other writers.

In the Greek States, and particularly in Athens, the ordinary work in the towns was done almost exclusively by slaves. The Greeks themselves, the glorious figures portrayed by the sculptors of the past, were occupied wholesomely in agriculture, tending of flocks, sailing ships and boats, and training themselves for war.

Circumstances enabled them to cultivate body and mind, and their health was not ruined by strong alcoholic drink, tea, coffee, tobacco, and the innumerable drugs which we foolishly employ as stimulants, sedatives, laxatives, etc. Self-drugging was practically unknown, ~~but~~ and there was little illness about because people lived in accordance with natural law.

Twenty-three centuries ago the science of chemistry did not exist. There was no chemically-refined sugar, there were no chemically-adulterated foodstuffs, and people selected their food not in accordance with the views of a professor of chemistry who sat in a laboratory and made tests with glass tubes. The selection of the food of the ancients was based not on more or less unreliable scientific findings, but on practical experience of untold ages and on practical experiments made on animals and on human beings. In the course of ages men had learned which foods are wholesome and which are unwholesome. The greatest food wisdom is possessed not by the most eminent chemists, but by the savages. We find perfect teeth and bones among all the primitive races, whether they are vegetarians, exclusive eaters of meat and fish, like the Eskimos, or mixed feeders. Only the scientifically-fed civilised nations, whose dietary is shaped by the scientist, suffer universally from ~~xxxxxxxxxxxxx~~ weak bones, diseased teeth, diseased gums, diseased tonsils, adenoids, a ruined digestion, a crippled colon, flat feet, etc., troubles which are principally due to faulty nutrition and which are not known to the uncivilised.

The ancient Greeks took food and drink in accordance with age-old experience and tradition. As they had no chemical instruments of modern type they could learn the effect of various foodstuffs not by scientific analysis, which is very delusive, but by the methods which are employed now-a-days by the biological chemist who makes experiments on animals and men. Hippocrates mentions quite casually facts such as that the quality of meat depends on the feed of the animals, and that the quality of the feed is determined by soil, weather and so forth. The ancients obviously

knew the great influence of soil conditions upon food, and although they had no instruments for scientifically examining water, they knew the difference between good water and bad water, and the medicinal virtues of different kinds of water. Hippocrates tells us, for instance:

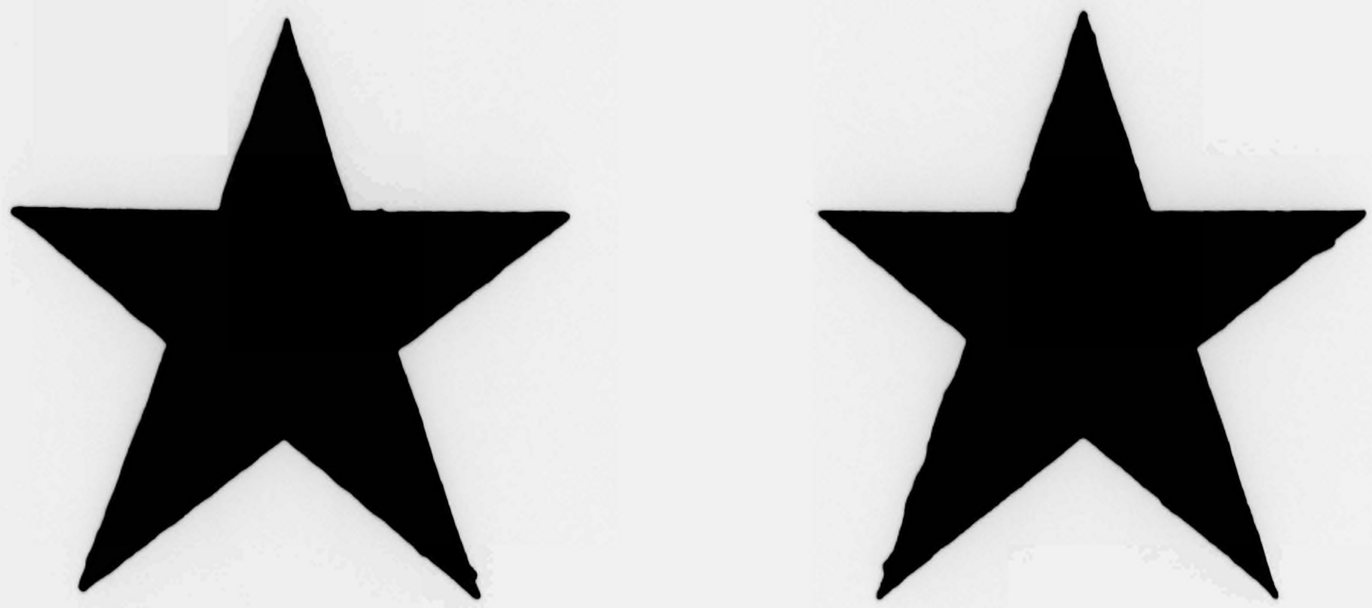
"Those waters are best which come from springs which break forth in high places or on rising ground, and the best of these are to be found towards the east, and these have a good flavour and are usually limpid and light. Rain water, if collected in clean vessels, is light, sweet and limpid, having been distilled by the sun, but it is apt to grow putrid if unclean. In the latter case it ought to be boiled and strained before using it. Water which comes from melted ice or snow is usually bad, and I cannot approve of its use, particularly if it is not clear, and then it is unwholesome and it causes various diseases, particularly in summer. The healthy and strong may drink almost any water without injury, but the delicate and the sick must be careful and they should choose only the lightest, purest and softest water, especially if they are inclined towards constipation, while hard water will be of use to those who are inclined towards diarrhoea. People of a hot temperament receive much benefit from drinking water, and water-drinkers have usually keen appetites."

The ancient Greeks obviously knew not only how to train the body by scientific exercise, but had a very excellent practical knowledge of nutrition. Hippocrates, though not having any scientific instruments, gave most excellent advice as to the virtues of plain water. Besides, the ancient Greeks knew the medicinal value of mineral springs, which they used very largely. Hippocrates mentions incidentally some of these mineral springs, and deals with their characteristics. The Greeks were fully acquainted with the curative effect of the different waters. Hence they established health temples, which were at the same time hospitals, sanatoria, and religious institutions, near the various mineral springs. People who were ailing or ill were as a rule treated not with drugs, although Greek knowledge of drugs was very considerable, but with natural agencies of healing, such as diet, fasting, exercise, baths, water cure, open air treatment, massage and so forth.

Although the Greeks rejoiced in bathing, they fully realised the danger of rashness and the various effects of hot, cold and tepid baths, of fresh water baths and salt water baths, etc. Addressing the doctors, Hippocrates wrote:

"Every physician ought to know how patients may be damaged by unseasonable bathing. A bath of fresh water moistens and cools

CORRECTION



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the body, while salt water warms and dries it. A hot bath wastes and chills a person who uses it fasting, while a cold bath has the contrary effect, warming those who take it on an empty stomach. Tepid bathing is beneficial in many diseases. A tepid bath gives ease to those who suffer from pains in the side, breast and back, it soothes those who suffer from difficulty of breathing, it promotes spitting and therefore relieves the chest, it stimulates the flow of urine, relieves headache, and removes lassitude. However, great care is required in using the bath properly. Experience alone can give the necessary knowledge, but, generally speaking, bathing is not advisable for those who readily bleed from the nose, who have a very weak or very sick stomach, who suffer from diarrhoea, and those who are constipated should be purged before being given a bath."

The doctors of ancient Greece ~~preferably~~ employed nature cure wherever possible. Hippocrates and his successors wrote copiously about the medicinal use of fresh air and sunshine, diet and fasting, baths and massage, exercise and singing, rest and sleep, and so forth. Broadly speaking, the Greek physicians studied the requirements of nature, and advised their patients to lead natural biological lives, thus strengthening their body and enabling them to overcome disease. Dealing with rest and sleep, Hippocrates shows that wonderful commonsense which is characteristic of the Father of Medicine. He tells us:

"Both activity and sleep are injurious to health if carried beyond their proper bounds. Excessive activity interferes with the digestion and absorption of food, and creates unwholesome juices in the body, while too much sleep relaxes the body, oppresses the head, and causes people to look as if their face had been boiled. Nature means us to be awake during the day and asleep during the night, and those who act in a contrary manner will suffer for it. If people dream about their daily activities, occupations and interests, such dreams may be considered a sign of normal health and no medical intervention is called for. But those who have abnormal dreams, dreams which are strange and wild, suffer from some distemper which should be attended to. For instance, if people dream of evacuations, it may be that their bodies are plethoric and that they want emptying and cleansing by vomiting, abstinence or exercise. On the other hand, a man who dreams of meals is frequently underfed and requires additional nourishment. Terrifying dreams are a sign of disease which ought to be treated by proper means. Those who attend to their sleep and dreams in the proper manner should always enjoy good health.

If the body is given more rest than it needs it will not become stronger, but weaker, and the same applies to every part of the body. On the other hand, if people who are unused to exercise take up exercise over-vigorously, they will only hurt themselves. The feet of those who have never taken much exercise are unfit for energetic walking, and all members lose to a large extent their use by disuse. Custom is a potent factor. A soft bed is irksome to those accustomed to hard beds, and a hard bed is uncomfortable to those who are used to a soft one. If people for some reason or other are compelled to lead very inactive lives, they must live very abstemiously. Otherwise their body will soon be tortured by pain, which arises owing to the action of unwholesome fluids in their body. Friction and massage make the body warm, firm and fleshy. Reading

aloud and singing warm and dry the body, and of all exercises walking seems the most natural for those who are in good health. Generally speaking, moderate exercise strengthens the body and invigorates the mind, and exercise is most wholesome and most advisable before meals."

The Greeks were a nation of athletes. Those who won great contests at the various sport meetings where athletes from all the Greek states met in friendly rivalry received the highest honours. They became national heroes. They were rewarded with a simple wreath or other token without value, but they were given a magnificent reception throughout the country, songs were sung in their honour, portrait statues were placed in a prominent position, etc. They were not given large money prizes. There were no professional sportsmen in Greece. Although every Greek was keenly interested in sport, and although record-breaking achievements evoked the greatest enthusiasm, there was little over-training and over-straining among the people in general. People did not train to break the record in running, wrestling, weight-throwing, etc., but they trained with the view to improving their strength, health and gracefulness all round. There was a wonderful poise and balance in Greek art, and we notice similar wisdom in bodily training. We have no Greek statues showing men with hugely over-developed biceps, muscles. The Greek athlete was an all-round man, who possessed a harmoniously-developed body.

Free excretion is a most important matter for health preservation. The Greeks gave the greatest attention to the development of the abdomen. All the Greek statues show a perfectly developed abdominal muscle system. The abdomen is retracted. We can see every muscle, and we never meet in Greek statues the protruding, flabby, egg-shaped and more or less pendulous belly which is almost universal among the civilised. Only in Greek caricatures we find the kind of abdomen with which we meet currently now-a-days. The great principle of Greek life was simplicity and moderation, poise and balance. Hippocrates taught his contemporaries and his successors:

"Excess of every kind is unnatural. In exercise and rest, in meat and drink, in sleep and in sexual intercourse, wise

moderation should be observed. Sudden changes are inadvisable, and extremes should be avoided. If those who have been accustomed to drink wine suddenly replace it with water they will suffer from indigestion and flatulency, while an equally sudden change from water to wine will cause thirst, palpitation of the heart, headache and other troubles. The great preservatives of health are temperance and exercise. There should be a proper balance between the food consumed and the exercise taken. The exercise should be sufficient to cause the proper elaboration and elimination of the food, and only if food and exercise are properly balanced there will be good health. Food fills and exercise ~~xxxx~~ empties the body, and perfect health can be maintained only if one balances the other. Those who eat more than they need often suffer from colds and congestion of the nose, inflamed eyelids, or they lose their appetite and grow pale. Others who overfeed sleep too long and yet are drowsy during the day. In course of time they become restless in their sleep and they have stirring or frightening dreams. Then the danger arises that disease will follow unless food consumption is checked and exercise increased. Those, who in consequence of over-indulgence at the table, suffer from repletion and lassitude, often try to find comfort by laziness and self-indulgence. Unless they treat their complaint with abstinence and exercise they will fall a prey to disease. Others again suffer in consequence of over-nutrition from indigestion and flatulence, which will lead to various troubles unless food is diminished and exercise increased.

Those who take too much exercise in proportion to their diet often complain after a time about a sense of heat, and of feelings of pain, which may be followed by the loathing of food and affections of stomach and bowel which are difficult to treat. Others who over-indulge in exercise become extremely constipated, and they complain that their mouth is dry, that they have a bitter taste, and these symptoms may be followed by suppression of urine. At last their stomach will no longer tolerate any food. People in this condition should be treated with warm bathing, quiet sleep, a cooling, moistening and nourishing diet which is gradually increased, and their accustomed exercise should be greatly diminished."

Hippocrates was the earliest and the greatest medical writer of Greece. He was no doubt a great, original genius in medicine, surgery, hygiene, etc. However, he echoed ~~not only~~ the accumulated wisdom of the past but his teachings powerfully influenced his contemporaries and succeeding generations. We can understand that the Greeks were physically, intellectually and artistically beyond compare when we realise that they strove to live in accordance with the will of nature. They did not outrage nature, and their bodies day after day as we do now-a-days.

The great characteristic of the ancient Greeks was this, that they led a life of cultured and elegant simplicity and frugality improving thereby body and mind. Unfortunately they defeated the Persians, the most luxurious nation of the East, and they learned from the conquered to appreciate and to love all the vices of luxury. The simplicity of the forefathers was abandoned. The

plain, unattractive houses, which compelled an open air life, were replaced by commodious ones which made the Greeks an indoor race. Comfortable furniture, hot baths, over-clothing with Persian elegance, high class cooking, medication to counteract the consequences of over-indulgence in food and drink, etc completed the decline of the great Greek race. The race of demi-gods became a race of ordinary mortals. The Greeks began to suffer from all the diseases of self-indulgence which had been practically unknown to their ancestors. The wonderful physique of the race declined and decayed. They were defeated in battle time after time. The race became sterile, the number of the inhabitants dwindled, and the Greek genius disappeared. The modern Greeks are a different race of men, a strange mixture of races and tribes. The great Greek race of classical antiquity is no more. It has been destroyed by self-indulgence. Success in war and in industry and commerce led to a short-lived exaltation of the Greek race and to its permanent decline and decay.

SOYA FLOUR IN BREAD MAKING

By
JAMES BELL
Royal Technical College, Glasgow

IN VIEW of the general interest in the use of soya flour in baking and confectionery, we give below two recipes worked out by James Bell, of the Royal Technical College, Glasgow.

Most people are now familiar with the nutritive qualities of soya flour; the following tables will, however, serve as a reminder:

*Percentage Composition**

	Soya Flour.	*Finest Wheat Flour.*	*Rye Flour.*	*Oat Flour.*	*Maize Flour.*	*Bean Flour.*	*Pea Flour.*
Water	9	13	13	9	13	11	11
Protein	42	12	10	14	10	23	26
Fat	20	1½	1½	6	3	2	2
Carbohydrates	25	73	74	67	72	59	57
Ash	4	½	1	2	1	3	3
Calories	470	360	356	389	363	357	356

In bread anything from 3 lb. per sack to 25 per cent. in replacement of flour may be used, and as an illustration to what extent nutritive values are increased, the following figures are interesting:

*Readers should note that this is only one of many analyses and that the constitution of soya flours varies considerably according to the methods of preparation involved.

	White Bread	10 *Per Cent.* *Soya Bread*	22 *Per Cent.* *Soya Bread*
Proteins	13.13	15.75	20.83
Fat	1.65	3.26	6.05
Starch	80.60	72.23	64.20
Soluble carbohydrates	3.75	6.36	6.50
Fibre	0.39	0.60	0.61
Ash	0.48	1.80	2.20

In using soya flour as a bread improver, two points must be carefully watched. Firstly, owing to the remarkable water absorbing capacity (thus giving a greater yield) additional liquid must be added at the doughing stage, (about 2 lb. of extra liquid to every 1 lb. of soya flour is quite a good guide). Secondly, as soya is an excellent yeast food, the rate of fermentation will be accelerated, and this can be overcome by reducing the amount of yeast used. On the other hand, the yeast may remain the same and the time of fermentation be cut down. By using 2½ to 3 lb. per sack (280 lb.) the general appearance of the loaf is improved, and the brightness of the crust is most pleasing to the eye. The texture is also improved and is more even, while the crumb is soft and silky, due to the high protein value. Keeping qualities are naturally enhanced, while the flavour is all that can be desired. Another important point is that when bread contains soya flour it does not tend to go stale as quickly as bread without it.

It must be remembered that to obtain best results the dough must be free, as a tight dough will never give satisfaction, even under the best conditions.

If after trying out the following recipes the baker decides to adopt them, the quantities may be increased as desired, remembering, however, to decrease the ratio of yeast as the quantity of bread increases.

SQUARE BREAD

Sponge

6 lb. strong flour.
3 qt. water at 110° F.
3 gills water at 84° F.
2½ oz. yeast.
2 oz. salt.
6½ oz. soya flour.
Turns in 35 to 40 min.

Dough

5 qt. water at 95° F.
12 oz. salt.
26 lb. strong flour.
6 lb. soft flour.
Time in dough, 1¼ hr.

In setting away the sponge, dissolve the salt in the water in a large sponge-tub, then break up the yeast with the 3 gills water at 84° F. Sift the soya flour along with the strong flour and add to the tub. Beat up well and add the yeast water, and continue beating until smooth. Next cover the tub and place in a warm corner till it turns, the time usually taken being from 35 to 40 min. While the sponge is standing, weigh the ingredients for the dough. Just as the sponge is turning, dissolve the 12 oz. of salt in the water at 95° F. and transfer along with the sponge and the flour to a small doughing machine. Dough till smooth, then cover up in a trough and allow it to stand for 1¼ hr. during which time it should be cut back twice. When this period has expired weigh off at 2 lb. 3 oz. per loaf and proceed to mould, prove, and when ready, fire. This recipe gives 2 doz. loaves, which can be fired in the centre of an ordinary batch, or can be increased to suit the size most suitable to the individual baker, remembering, of course, to cut off some of the yeast.

PAN BREAD

Straight Dough

8 lb. strong flour.
2½ lb. soft flour.
4½ imp. pt. water.
¾ imp. pt. water at 84° F.
4 oz. yeast.
1 oz. lard.
1 oz. sugar.
3 oz. salt.
2½ oz. soya flour.
Time in dough, 1 hr.

Sift both flours together with the soya flour and make a print on the table, into which place the sugar, salt, and lard. Break up the yeast in the ¾ pt. water at 84° F.; then measure off the 4½ pt. water. The temperature of this water is obtained as follows:

Double dough temperature 82° F. x 2	=	164° F.
Subtract flour temperature 65° F.	=	65° F.
Water temperature	=	99° F.

This calculation is based on the dough temperature being 82° F. when finished, and can be used the same way to suit any dough temperature. Next cream up the sugar, salt, and lard; then pour the 4½ pt. water into the print. When about half of the flour is incorporated, add the yeast water and proceed with the doughing till a smooth silky dough results. Put away in a warm place for 1 hr. and cut back twice during this period. When ready, weigh at 2 lb. and mould. Place in pans and put away in steam-press for about 20 min. The time in the press varies, however, with the rate of fermentation and with the temperature. Allow to prove about three-quarters way up the pan; then place in oven about 450° F. At this temperature the bread should take 40 min. to fire.

613.08

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THE ATWATER CALORIMETER.

A Lecture at the Sanitarium Parlor, Battle Creek, Mich., Monday, December 31, 1906, At 8:00 P. M. by,

Dr. Francis G. Benedict

Of the Wesleyan University, Middletown, Connecticutt.

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Dr. J. H. Kellogg: Ladies and gentlemen: We shall have the rare felicity this evening of listening to a man who knows things. We people who live on the outskirts of the scientific horizon, we have to live on borrowed thunder very largely; especially practical doctors like myself do not have time to make original investigations very much, and we depend for our facts upon men who spend their lives in their laboratories, and who are hidden out of sight, like the alchemists of old, are hunting for the real gold, something that turns gross metals into gold. Dr. Benedict has been for many years connected with the Middletown experimental work which is sustained by the United States government, and where there is the most complete equipment for the study of foods to be found anywhere in the world. I think we have here the most complete ~~xqmix~~ establishment for the fletcherizing of foods, but Middletown is the place where we find out what is in foods, what is the value, the worth, the assay of foods, just as the chemist assays ore. I have been there and seen something of it. It certainly is the most wonderful place in the world. You can pick up a French work or any other work on the subject of foods, and you will find the Middletown work referred to--the work done by Dr. Benedict and Dr. Atwater.

One of the instruments of their work is the great iron box. I was

down east a year or two ago, and I had a great anxiety to see that iron box, so I made a pilgrimage to Middletown. I had an appointment with Dr. Benedict, and he promised to let me see the inside of it; so I was on the way there, and passing through the town in the morning as I was going up to the laboratory, another gentleman got into the hack with me, wanted to ride a little ways, and he looked me over and thought I was something of a suspicious character; he looked at me ver sharp and asked me where I was going. I told him I was going up to the College. "Ah", he said, "are you one of the professors up there?" "Oh, no." I told him I did not enjoy that distinction. "Well, you are a lecturer, perhaps?" "No, I am not going there to lecture." I saw he was very anxious to know what I was going there for, so I said, "I am going up there to be shut up in an iron box." "Oh," he said, "is that so?" "Yes, " I said, "haven't you ever heard of it--Dr. Benedict's iron box, they have up there, where they shut people up sometimes and keep them there for days and weeks?" "Is that so? Is that so?" he said. "Yes," I said, "They have got such a box there, and I have got to go and be shut up in it." "Well," he said, "I am very sorry for you. I hope you will get out safely. What did you do?" I told him I was perfectly innocent. He said, "You have my sympathies."

Well, I spent ten hours in the iron box, and I think it was the most interesting ten hours I ever spent in my life. Dr. Benedict is going to tell you about it tonight. It is a regular Pandora's box, I think; certainly wonderful things come out of it.

Dr. Benedict. Dr. Kellogg, ladies and gentlemen: Dr. Kellogg told you how I got him in the box; I think I ought to tell you how he gets me in a box tonight. I came here an unsuspecting state, and I had a box of slides in my grip, and I asked the porter if he would be especially careful not to drop

it, and Dr. Kellogg's ears went right up when he heard of slides, and the result is I am landed upon you in this way. As a matter of fact, I am bound for the University of Wisconsin, and the Doctor thought I ought to ~~appear here~~ practice my lecture here first.

What I wish to tell you about tonight is the apparatus that we have at Middletown for studying the effect of food on the body in a wholly physiologic way. Whether we treat, or whether we study normal subjects, so far as things can be normal, and have done nothing at all whatever with pathological cases; so you will please bear in mind that all that I have to say,--and I will say very little as regards actual results but more about the apparatus,--bears wholly upon what we call normal cases.

When Professor Atwater came back from Europe about thirty years ago, he was very much interested in the great advances Germany was making in agricultural science. He had been to various experiment stations there and had seen how they began to use chemical fertilizers, and how they began to use the more concentrated feeds for animals,--how the science of feeding animals for milk, and for fattening stock was increasing; and when he came to this country, he started in a little, small, freshwater college a study of scientific agriculture,--a thing entirely foreign to our curriculum--a quite small fresh water college. He fought that thing through alone and almost unaided except through the generaus assistance of Orange Judd, of Orange Judd farm fame; and it was only a few years before he began to study the feeding of the human animal. He then received support from the United States Department of Agriculture, and in recent years he has been receiving support from the Carnegie Institution of Washington.

The mother, in studying the nutrition of her infant, lays great stress upon the generous appearance of her child, the gain in weight, the growth; certain

attention is paid to the excreta, especially to the feces; but in later years, when we come to study, even in the common way, the ordinary, physiologic way, we find the analyses of excretory products are of very great value to us in our interpretation of the transformations taking place in the body; but there are two excretory products that we know nothing about, because we do not have the ordinary method for studying them, analyzing them.

We are continually giving off something--carbonic acid gas from the lungs and the skin,--and we are taking in the life-giving oxygen. Furthermore, we are continually giving off heat. Every individual here is giving off about as much heat as a twenty-four candlepower electric lamp. I think these heating pads the Doctor has been showing me would drive us out of the room if we had so many in this room. One of the greatest functions of food is to furnish energy to run the body. Unfortunately, there are only two few methods for studying this important factor--the heat of the body. It is not so important, perhaps, except in pathology, unless it is in the case of fevers; but certainly, in the harder muscular work, it becomes important to know as to the total heat output of the body. We have an apparatus for measuring this total heat output, and we can also measure the carbonic acid gas output, and the water output, and the oxygen intake. So, in addition to the ordinary studies of the solid and liquid excreta, we are enabled to study the carbonic acid gas output, the water output, and the heat output. We put air into this calorimeter and make all these studies of all these products, and we have a very good series of experiments to estimate the excreta of the body.

This picture, which I always delight in showing, is a picture of Professor Atwater sitting at his desk among his books, because in the opinion of the family, it is the best picture he has ever had taken. Professor Atwater was the starter of all this work, as I said before. In addition to

the interest of this slide, the interest from showing Prof. Atwater in his office, immediately under this room is the calorimeter room. This calorimeter is located in range with his laboratory of science. The calorimeter laboratory itself is in this corner. Here is Dr. Atwater's office here. Now, let us go downstairs and look at the general plan of the room.

Here are these windows I pointed out a moment ago, at the top; here is a door which comes in from the basement; and here is the respiration chamber itself. All around the room in different parts are the different accessory instruments, the balances, the purifying system for the air, and the electric motors, the sink, desks, etc. Looking from one window, we see the interior of the laboratory room. Here is the respiration chamber proper. Here are all the various accessory apparatus and balance for weighing the absorbing system; here is the absorbing system, the purifying system; here is the table at which the observer sits to record the measurements pertaining especially to heat. Here is the opening in the rear through which food can be passed and the excreta removed.

Now let us go inside and look at the chamber itself, but before we do that, I must call your attention to this diagram here, which represents in a very general way the scheme. The apparatus is correctly termed a respiration calorimeter. The calorimeter has to do with the measurement of heat. I am going to take up first the discussion of the respiration part, the part containing the measurement of respiratory products.

Here is a large chamber, perfectly air tight, with a current of air coming out here. Air contains oxygen and nitrogen. When the body takes in air, it gives off carbonic acid gas, CO_2, and water, H_2O. As the water leaves this respiration chamber, therefore, it is watery vapor, carbon dioxid, nitrogen and oxygen, but it has used up some of the oxygen that was originally present, so the oxygen is deficient. This air is then carried around here to a rotary

blower--simply an inclosed electric fan, so to speak, which pushes the air along, and at this point the water is taken out of the air current by passing it through strong sulphuric acid, oil of vitriol, which removes the watery vapor. Then the air leaves this chamber free from watery vapor, still containing carbonic acid gas, and is deficient in oxygen. The next step is to remove carbonic acid. That is done by simply passing the air through caustic soda and quick sulphur. Now, we have the air containing nitrogen and deficient in oxygen. At this point we put in oxygen. The young man back here is using oxygen in this calcium light. We use that same oxygen, put it into this apparatus here, and the air goes backinto the respiration chamber in the same condition in which it started. If we provide for weighing the water absorbed from that air, and for weighing the carbonic acid absorbed from that air, and weighing the oxygen introduced, you see we have immediately a measure of the carbonic acid givenout, the amount of water vapor given out, and the amount of oxygen consumed. That is the simple principle of the apparatus.

Let us now go inside of the apparatus, and look in the window. This slide I always consider a triumph of photography, because when you come to consider that this wall here is a dull copper wall that is very non-actinic, the photographer has got a very bad place. This reporesents the chair, and the folding bed on the wall, beaause my man has to set up light housekeeping for several days at a time. Now this chair is an interesting apparatus. There is an electrical thermometer for measuring the body and the temperature. We can record the temperature of a man to the one hundredth of a degree Centigrade, and do all that without his knowing anything about it. Up here is something which looks like a pipe. This pipe is something like an automobile air cooler. It is for absorbing the heat that is given out by the man's body.

If we put our camera at the back of the room and look this way, we will

get this view. Here is the window; here is the bed again; here comes in at one point and goes out at another the telephone system, and again here is the absorbing system which is shown a little clearer here, perhaps. A man goes in there and stays several days. As a matter of fact, we have had a man in there for nearly two weeks. Our air current I told you is kept moving around all the time and is maintained simply by a little blower. We spent $1500 on a pump, and threw it in the scrap heap, paid sixteen dollars for a blower and are using it now.

The first step was to take out the water vapor from the air. That is done by passing through strong sulphuric acid. Sulphuric acid has great affinity for everything foreign, especially for men's clothes; and my assistants are always provided with two or three pair of overalls that they wear in the room. It is very difficult to get it in such form as to take all the water vapor out of the air. It was done by means of this crockery jar. The air goes through here and bubbles out through these holes. The air spurts through there at a very rapid rate, comes out of this opening here. These are simply the rubber elbows, the connections that are commonly used for making connections. Before and after every hour, as the fourth hour, the eighth hour, the tenth hour period, we can tell how much water has been absorbed, and how much a man has given off. The next thing is to remove the carbonic acid. That is done by passing it through a sulphur plate and a glass can containing a mixture of quick lime and caustic soda. The air combines with the quick lime and forms a white substance like carbonate of lime. As the carbonic acid becomes absorbed, it comes out in white cakes. In order to prevent the air from rushing along one side, we had to put in some wire disks. This cover is fastened onto this can by means of a clamp. This simply shows putting the clamp on the can. By weighing these cans before and after a period, we can tell how much carbonic acid

acid is absorbed.

The next point is the question of oxygen. This oxygen used in this calcium light is in a large cylinder under a pressure of about 225 lbs. We buy our oxygen in a similar cylinder under 1800 lbs. pressure. The oxygen contains a little of carbonic acid, a little bit of water purifier. By weighing this cylinder before and at the end of a period, we will have no difficulty in telling how much oxygen a man has consumed. This shows a little more in detail the purifying system. Here is coming in this direction new air. Here is one of these sulphyric acid bodies. The air leaves this dry, but still containing carbonic acid. It must pass through here to take out all the carbonic acid, but this quick lime and caustic soda must contain a little moisture in order to be very effective, because constantly we must absorb the moisture in this can. We weigh this can, and the increase in weight is the amount of water. We weigh all these separately, and some increase in weights is the weight of the carbonic acid. It may happen sometimes that this can will be so exhausted that it will give up some of the water. But any water lost through that can will be caught through here; so the algebraic sum of these weights is the amount of carbonic acid.

Then at this point the oxygen is put in. The air goes back into the chamber through this pipe ready to be used over again. One very important feature of this method is our ability to run it in a short period. We can of courseput a man in there and let him stay there twenty-four hours; but it is ver y desirable to know whether he gives off a different amount of heat or carbonic acid, or oxygen absorbed, when he is asleep and when he is awake. We must have some method of deflecting the air current from one side to the other side. Here comes the air from a little blower, and at the present time it is coming along

this way, coming out here. One side is shut off, and at the end of a period, it can be connected up and shifted from one side to the other. We spent hundreds of dollars trying to get something, and finally used some old pipe fittings and got just what we wanted.

One very important factor in our work was to get a balance. Those big crocks, sulphuric acid jars, weigh thirty-five pounds. Now it is very desirable to know accurately how much water vapor a man gives off for two hours, say. Consequently those ought to be weighed very accurately. Here is a balance we found in Germany. This does weigh accurately indeed. It is suspended on a steel wire, and a little levator to the platform which can be raised and lowered. The actual increase in weight is noted on these brass indicators here. We can take thirty-five pounds, and if we should drop a pin on it, we would know it instantly. If a man were on the balance and should drop his lead pencil, we should know it instantly. These balances are very sensitive to accurate weight.

This view shows one corner of the laboratory with balances, dessicators, and electric motors. Now, having shown you how we can measure the amount of oxygen, the carbonic acid, and the water vapor, let me take up the most interesting feature of the apparatus, namely, the direct measurement of heat. This shows a cross section of the respiration chamber looking down from the top. There are four walls come up. The inner one is of copper; the next one is of zinc, an air space of three inches between them; then an air space, then a wooden wall, then an air space, and then an outer wooden wall. Here is a door, a window, a table, a chair, and the bed folded up. Here is the food aperture I spoke of. The air passes here--where the air can come in and go out. This shows very well indeed the construction. That is, you see, a good deal on the refrigerator plan, viz., the insulated walls. Heat can not get out very well, there is so much dead air space. And, as a matter of fact, we

don't want it to get out.

One of the most difficult things in measuring heat in any calorimeter is the so-called calculating factor. We had a professor of physics who is now assistant of the bureau of standards who hit upon this very ingenious scheme. Suppose you have two walls kept both at the same temperature. Suppose this wall becomes warm; then no heat can get through one way or the other. If you immediately warm the zinc wall after the copper wall is warmed, you can prevent any heat from coming out. Conversely, suppose this becomes cool; then if you cool off this outer zinc wall, you won't have any loss of heat the other way. In other words, we keep the walls idiopathic. That necessitates two things. In the first place to know when the wall is cold or hot; in the second place, how are you going to heat the cool wall? The inner wall is the temperature of the whole internal chamber; but this outer wall we can handle. We can heat or cool it as we want to. So the first thing we must know is which is the cooler. Must this space be cooled, or heated? In order to determine that, Professor Richet(?) made use of a very simple thermo-junction. Take a piece of iron wire and German silver wire, and solder them together, and there is a very feeble current of electricity generated, which blows through this wire. That current is so feeble you could not test it probably. But put it on a very delicate galvanometer and it will show deflection one way or another. Multiply these and then you can get it very quickly and clearly on the galvanometer. These are all wrapped on a spool for the sake of convenience, and placed in this position so that I suppose all these ends are placed in thermo-contact with this inner wall. These outer ends are all placed in thermo-contact with the zinc wall. Lead these wires to the galvanometer, and you can tell instantly whether the zinc is warmer or cooler than the copper.

Here is a view showing the cross section of the box looking vertical-ly

ly. You see it is on casters. We can take out these back panels, and roll the whole thing out. We have taken out these two back panels. You see these pipes. I told you we could heat or cool the space back of the zinc wall. We heat it by a simple device of passing an electric current through the German silver wire. We cool it by passing cool water through iron pipe. These thermo-junctions I showed you are scattered all over the box. As a matter of fact, there are something like three hundred different junctions from this box. Therefore it is possible for us, by making connections with any of these junctions, to tell whether the top of the box, the bottom of the box, or an upper zone, or a lower zone, or the bottom wants to be heated or cooled. These black wires are connected from the interior. They all lead together around from the front, and they are connected with the galvanometer.

Now, we will look from the front end and see the box itself. Here are the iron pipes, insulators; here is one of the heating wires. These black wires are wires conducting another set of thermo-junctions which cause the temperature of the outer air space and the inner air space to equalize. The air next the zinc is, as a matter of fact, between this wood and the zinc when the box is rolled in. Here is the cooling pipe and the heating wire. Here are some flaps which are turned down into sub-divided spaces. So it is possible for us to determine very accurately if each section what part should be heated and what part should be cooled. These wires hanging down here like a beard are the wires connected with the galvanometer. We can tell whether any section should be heated or cooled. And the air comes in here and goes out here. You see the chair inside, the food aperture again, and the heating system. Now let us look at this drawing of the interior. Of course, this is a diagramatic, but shows better than anything else the way of bringing away the heat. I call attention expecially to this heating system up here. In winter-time we frequently heat

our houses by passing hot water through pipes. If a man should go inside this chamber and sit still for a while, he would get so hot he would be uncomfortable; after several hours he would really be in distress, because the heat of his body would be so great it could not get out through the wall. So we cool this little house by passing cold water through pipes, and the pipes are up here. As the water passes through these pipes it absorbs the heat. It therefore becomes warm, and all we have to do ~~now~~ is to know how much water passes through those pipes to know how much heat is given off. The amount of water passing through multiplied by the rise in temperature is the amount of heat. We must arrange to bring away the heat from that apparatus just as fast as it is generated and no faster. That means we must keep the whole chamber at a constant temperature. It is a pretty big thing to get the temperature of a room like this and get it accurately, but we have an electrical chronometer for doing that. Here is a coil of wire on a spool, and here is another one, and here another one. All of these are so adjusted that the slightest change in temperature will affect their electrical resistance. And we can tell whether the chamber inside is becoming warmer or cooler. If it is becoming warmer constantly, the man lowers these shields and exposes a larger surface for the heat to be absorbed. If it is getting too cold inside, he raises these shields which form a sort of protection. I think the most perfectly heated house in this world is the house of parliament in London. They have steam pipes areound the walls, and have big ~~electric~~ asbestos blankets. If half a dozen members go out, an attendant goes over and takes off an asbestos blanket. If half a dozen come in, these blankets are put on again. But this house is heated almost as accurately, if not a little more accurately, than the house of parliament, because it is heated by the man; so instead of heating this house, our attention is given to cooling it, and I suppose there is no house in this world that is cooled so accurately as this

house. We keep it to within a few hundredths of a degree Centigrade day after day and week after week I was going to say; certainly, day after day. The air goes in at this point and comes down like this. The air comes out at this point, and comes out here. Here are a lot of little things that look like a sheaf of wheat. Those are a lot more of those thermo-junctions. It is important that the air coming in should be of the same temperature as the air going out. We warm or cool the air going in so that it is always of the same temperature as the air coming out.

Now, let us look outside here and see the connections for putting in the air and taking it out. Here is this air pipe coming in, and here is the air pipe coming out. If this air is cold, we must heat it by means of this thirty-two candle power lamp. If it is hot, we cool it by means of a coil wrapped around this lead pipe here. In order to measure the amount of water passing through and the temperature, we must use thermometers to give us very accurate records. Cooling water comes in at this pipe and runs along this block of wood--a very good insulator,--and comes up here. The temperature is taken in this upright thermometer. It comes out through this pipe. The water then travels off through an opening on the side through a meter which is a very accurate measure. Here is a lever for raising or lowering those shields or drops.

Now, let us look at a photograph of what we call our observer's table; and one of the busiest men in Middletown is the man that sits at this table. He has a chair and sits right here. Here is his lever that he raises and lowers; here are these two thermometers; here are the heating systems. Now we come to this very interesting table which is used solely for measurement of heat. The man sitting here must knowin the first place whether the top of the box is too warm or too cold. He does it by pressing a key on a very delicate switch, and here is the galvanometer on a very delicate scale. If he finds it neces-

sary to cool a section, he opens one of these valves, cools off a section; so he has complete control of the apparatus at this point.

Now the question of measuring the amount of water. It is necessary not only to know the temperature the water is carried to, but how much passes through. This is our water meter--two large copper cans. The water is now running through this pipe here, through here. , When it gets filled up to this point, it will come down, sink down on this liver arm, it will be automatically deflected from this part to this part. It measures the water with the greatest accuracy. We can measure ten kilograms of water to within one or two grams. Here are the electrical connections. I am sure there must be a physicist somewhere around here, and I would not feel I hd done justice if I had not shown one or two of these slides on the machine. In using a switch in a connection of this kind, the ordinary metallic switch won't last. Two men sit there, and two men relieve each other, twelve hour shifts, sometimes for fourteen days, pressing keys perhaps every ten seconds. Any ordinary switch you ever found will wear out. Here is a little mercury cap, and here is another. He drops a link into that cap, and it makes the connection. This is our typewriter switch. Each one of these keys represents a certain connection. The wiring system on the bottom is very complicated indeed. Here is the switch open. Here are the mercury caps, and here are all these links. Here is the switch turned upside down, so you can see that the connections are very, very complex.

Once again I am going to show you our diagram of connections which, I am free to confess, I do not understand. Now, let us pass to another phase of the apparatus, and that is this. You may very properly say this is a very remarkable apparatus, but how do you know it will measure heat so accurately, and all that? The only thing we can do is to test it. And here is our scheme for testing it. For instance, if you take a certain kind of electric current,

and you know the amount of the current, and the tension of the current, and the voltage, you can compute very accurately the amount of heat.

So this represents roughly the respiration chamber. Here is a coil hung up in the chamber through which the current of electricity is passed. Her is the ameter, the voltmeter, and the storage battery. We can compute very accutately the amount of heat we put in there. How does that compare with the amount we measure with the water current? It is extremely accurate. This apparatus is for use in determining not only the amount of heat, but the carbonic acid given off, the water vapor given off, and more specifically the oxygen separated.

We have found one excellent use for alcohol, and that is for testing the respiration calorimeter. We have found it a very good servant indeed for the purpose of testing calorimeters. Here is our apparatus for this test. Here is an alcohol lamp which is so adjusted that we can fill it to a certain mark by looking through this glass and letting the alcohol run out of this bottle. The lamp is burning continuously. We will say let it burn several hours, and we will start our experiment. At the end of two hours, e will see how much we had put in. So we can tell exactly the amount of alcohol burned. From this and from the combustion of the alcohol which is necessarily very gradual, we can compute first the amount of carbonic acid produced, second the water vapor, third the amount of oxygen produced, and fourth the amount of heat given off. So we have the four factors right there. Now, the apparatus as a whole gives results that are all within one per cent extremely accurate. I am never quite sure as to whether this current is coming in or coming out, because people want to know whether that expression is of the amount going out or coming in.

The man goes in, the window is then closed, sealed up with specially

prepared wax and made absolutely air tight. I told you one of our measurements was the man's body temperature. The doctor takes your temperature with a clinical thermometer, and if you have fever, it is very noticeable that you have a temperature of one hundred degrees or over. Our men do not have fevers, but nevertheless there are remarkable fluctuations in the ordinary, everyday temperature. Here is a series of curves taken with our electrical thermometer which takes the temperature to a fractionm of a degree. Here are three different men, yxx and you see how remarkably the curves run. This is rectal temperature. At eleven o'clock he goes to bed. In one hour it is lower than it was at first. The lowest point is at five o'clock in the morning, and then there is a steady rise which jumps up after seven o'clock, slowly creeps up during the middle of the day and is highest at five o'clock in the afternoon. Here is the morning rise, here the highest point, here the lowest point in the morning, and the evening fall here; and these are very characteristic. Those are temperature measurements of a person simply sitting up or lying in bed and with no fever. We find another point very interesting. When a man works, his temperature goes up like everything. Here is a case where a man began riding a bicyclemeter. His temperature went up just one degree in one hour. He stayed fairly constant, and at quarter past twelve stopped work. It fell down, and at two o'clock he began to work again, and in three quarters of an hour, it went up a degree and stayed there. So we have not only the heat output, but also the measurement of temperature and other things. This shows the apparatus of the bicyclometer. We can tell exactly how much work a man does. We do not have to put on a brake. This disc here rotating in this magnetic field generates peculiar currents and gives off a great deal of heat. We put the apparatus right inside the respiration chamber and measure the heat given off. We can now tell that every revolution of the wheel means .00232 calories, for every revolution.

Here is an interesting picture. We want to know how our man changes in weight. This is the chamber, this the copper wall, the zinc wall, and two wooden walls. Here is the floor above; here is the floor of the office. Here is the platform scale and the yoke over it, and it is suspended here, and this man sits in this chair. This balance is by no means so accurate as the balance I spoke of a few minutes ago, but this will weigh a full grown man to within two grams or one fourteenth of an ounce. One very important factor is the pulse rate and the respiration rate. I found after I got this thing all rigged up, that Dr. Kellogg had anticipated the thing some twenty-five or thirty years before. Here is a rubber tube which goes around this man's chest with a spiral spring inside which can expand and contract as the chest wall rises or falls, there will be produced compression or expansion of air. This little pointer goes up and down at each respiration. The minute the man goes inside this rubber tube, is connected to this thing here, the tube is carried away around to the other end, and the fellow at the table can count the number of respirations this man has without his knowing anything about it. Furthermore, we found if we adjusted this tube over the apex of the heart that when the pointer rose and fell it went like this (illustrating)--the larger movements, the respirations, the smaller movements with the pulse rate. So we are able to count the respiration rate and the pulse rate at any time during the experiment, utterly unknown to the man.

I have one or two pictures showing the man actually at work. Here is a young man at the observer's table, the young man computing, and here is the water meter. These are all flashlights I have had taken at the laboratory. A couple of years ago Prof. Sherrington of England was passing through the laboratory, and he said, "What are all those cylinders on the floor?" I said, "That represents the oxygen our subjects have lived on during the last two weeks."

He says, "Could I have a photograph of it?" So we had it. Each cylinder contained 283 liters. This represents the actual amount of oxygen a man breathed in two weeks. This shows the method of putting in food or drink, and taking out small articles; and the gas analyses, which are very important factors of the method, are made by a young lady here. She makes an analysis of the air which is got once a day. We might very properly ask what is this all about? and I h have here two slides, only two slides which show some of our results expressed in a popular way. Here the average normal hourly output of carbon dioxid and heat from the body; conditions of muscular activity, when a man is at rest, sleeping; and an average man gives out twenty-five grams of carbonic acid every hour, and 65 calories of heat. When he is at rest, sitting up in a chair, and doing no muscular work, he gives out thirty-five calories of heat, and in muscular exercise, 100 calories per hour. What do we mean by light muscular exercise, very active, etc? The important point is this: As the muscular activity increases, the carbonic acid output increases, and the heat output increases. So, as a matter of fact, the heat output, and the carbonic acid output are practically wholly determined by our muscular activity.

This last set of figures is very remarkable. A man at very severe muscular exercise gave off 210 grams of carbonic acid in one hour, and 600 calories of heat. I don't believe there has ever been another case of heat output measured as high as that. This man was one of America's best bicyclers, and he wrote that bicyclometer inside that respirtion chamber for four hours. He gave off 600 calories of heat in one hour. He said he was all in when he came out. From this data almost any one can compute their heat output. As a matter of fact, women give off less than men, because there is more subcutaneous fat. But the average man can ompute quite readily what he does. I have figured out a very simple instance of such a man, an ordinary working man. He

has a solid eight hours, 65 calories per hour--520 calories. He is at rest, awake, sitting up around the house, perhaps moving about the house, going to his office, say six hours at 100 calories per hour. He has light muscular exercise, say at 170 calories per hour. Then, of course, comes the question how much the activity is. A man with an activity amounting to that much per hour would give out 2820 calories per day. Some men would give off more than that, and some less. He would approximate more for the whole day, 100 calories per hour, rather than this. Probably, for the sedentary man, 100 calories per hour, sitting still in the chair, reading most of the time, or at a desk, would be not a fair estimate.

Just before I began this lecture, Dr. Kellogg took me around your building, and I felt as though I had been in the midst of a cyclone. I am very much obliged for your kindness in listening to me so long.

Dr. Kellogg: I am sure we all feel under great obligations to Professor Benedict for giving us this lucid explanation of this wonderful apparatus which has done something which was never done before, which has given us facts, accurate facts. When you go to breakfast tomorrow morning, you will find your bill of fare with some figures in little columns. Those figures all came out of that box. That is where they got those figures. If it had not been for the work done by Professor Atwater and Professor Benedict, who has really been the active man in the work, we would not be able to feed you on calories, but we should have to feed you with ordinary foodstuffs. Thank you very much.

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PROFESSOR FRANCIS G. BENEDICT

At a Luncheon in his honor at the Sanitarium Dining Room, January 2, 1908, 3 P.M.

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Dr. Benedict: Ladies and Gentlemen: I don't suppose it is fair for me to use the time, but I told the Doctor what my experience has been with visitors at our laboratory, and I have been loading the Doctor up with adverse criticism, it is needless to say.

I have an opportunity, perhaps, a little better than most people do in your institution, because I have had some very interested friends here--Mr. Fletcher, and Professor Fisher, and Professor Bowditch have all been here, to saying nothing of Professor Chittenden who I think stayed only a short time, or rather, Professor Mendel; so I have come to think I know something of your work.

Now, I really can not say what I feel regarding how much I think of the work. I am convinced of one thing, that you have here a gigantic matrimonial bureau, and consequently I really can not say I am sorry I did not come here sooner, because Mrs. Benedict would not like me to make that remark; but nevertheless, I feel a good many have missed a great deal in not coming here.

Dr. Kellogg: I am scared to death for fear they will come.

Dr. Benedict: I am glad to see the opportunities are appreciated. Some of you, one of you at least, to say nothing of the Doctor, has been in our laboratory. Just at the present time we are in the throes of breaking up. We

are going to break up; we are not going to be at Wesleyan University any longer. On the one hand, I am very, very sorry indeed; on the other hand, I can not help but be glad. The university is located in a very small town with no hospital facilities of any kind; and we feel that it must begin to take up some pathological work, and it is necessary for us to go into some other city, and we probably will be located in either New York or Boston; which I can not tell at present. But let me assure you--on our laboratory door when we are busy, we have a sign that says "no visitors atmmitted", and if you will turn the sign over, you will find the sign, "Visitors Welcome." If you ever get there and find that sign out, I hope you will turn the thing over and walk in. (Applause). I shall deem it a privilege at any time when I have got established to have you come and visit us and stay as long as you wish to. We have no opportunities, such as you have here, for experimenting on a heroic scale. You certainly have a wonderful opportunity here, and the Doctor has been good enough to offer to co-operate in some experiments; and we are going to see if we can not coalesce the physiological ~~experimenting~~ experimenting and the pathological experimenting.

I can not think at this moment of any place where this system of menu is enforced with anything like the scientific accuracy you have here. When I was told that you weighed out your portions, I accepted that in the ordinary sense. I supposed, for example, if you hd potatoes or squash you had something on the order of an icecream dipper to turn out a certain amount; and I was verily astounded to go to your kitchen and find these things weighed with great accuracy. When you come to consider that potatoes are perhaps eighty per cent water, those measurements are very important in makinga menu of this kind. I know of nowhere else where there is anything like the scientific accuracy in scientific methods that you have here. Of course, the establishment of such a method has

been due to a very close appreciation of the importance of scientific accuracy. The opportunities for large experiment are nowhere as great as here, and I shall certainly welcome, and I am sure all physiologists and those interested in nutrition are very proud of the work you have done here. One of the first things I am going to do is to get thoroughly familiar with the work you have done. And the Doctor has been very kind indeed in showering literature upon me.

I want to thank you all for your unfailing courtesy at different times. I have met so many of you I can not call any of you by name, or very few of you, but I think I recognize practically every face, and it is a very great pleasure to meet you, and I am very glad indeed to have met with you. (Loud applause).

Dr. Kellogg: The Doctor said he did not expect any experiments would be made upon us, but personally I recognize the fact that we are all subjects of experiment, that this institution and this work that we are trying to carry on here is an experiment; and we certainly are subjects of experiment. I have so regarded myself, and it is a matter of interest to me to know what I am going to die of. I recognize, as you know, sometime I shall want to find out with very great interest. Some of you probably will be able to know the particulars more accurately than I will myself. You are all younger than I am, so you have the advantage of me in that regard; but the Doctor's kind words here have certainly encouraged me, and I trust have encouraged you to continue in the experiment, at least until we have good reason for believing that we are on the wrong track; and we shall be very glad to have the Doctor use us as subjects of experiments along this line as freely as he likes. We certainly feel very thankful for the information we have received and the help we have got, and the inspiration of the wonderful work that has been done by Dr. Benedict and his colleagues at middletown, and it will be the greatest honor that could be conferred upon uf if we may have the privilege of co-operating in any way with this great work which is simply carried forward on a larger scale.

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7-18-27.

LIGHT TREATMENT IN SURGERY

By

DR. O. BERNHARD

A B S T R A C T

"Huldchinsky claims, however, that light-baths reduce the death rate. Thus in an epidemic of whooping cough none of the rickety irradiated children under his care died of broncho-pneumonia while thirty non-irradiated cases died."

The Assyrians had arrangements for sun baths on the roofs of their houses.

Herodotus says, "'I saw a great marvel there. It was the skeletons of those on both sides who had fallen in the battle, piled up separately from one another; among the skeletons of the Persians the skulls were so weak that by throwing a pebble you could make a hole in them; on the other hand, the skulls of the Egyptians were so strong that you could scarcely break them in by striking them with a heavy stone. The inhabitants gave as the cause, and easily convinced me of its truth, that the Egyptians from their earliest childhood have their heads shaved, and so by the action of the sun the skull becomes thick and hard. This is also the cause why they do not become bald: for among the Egyptians one sees the fewest bald heads of all mankind. This then is the reason why they have such strong skulls. Among the Persians, on the other hand, the reason they have weak skulls is that from the commencement they lead an indoor life and wear turbans on their heads. That this is so in truth I myself have seen.'"

According to Herodotus, the children of the Persians did not see their fathers until they were five years of age.

The ancient Egyptians had sun baths.

See picture of Acknaton (Amenophis IV, about 1370 B. C.) sitting on a porch with his family taking a sun bath.

The sun was worshipped as a source of life and health.

The temple of Aesculapius had a gallery opening off a sick ward which was used for sun baths where the priests placed their patients.

Hippocrates recommended sun baths and heat for wounds, compound fractures and tetanus, extolling the soothing and healing effects of heat.

Oreibasius, a Greek physician of the time of Hadrian, said,

"'Sunning is most necessary for those needing the restoration or building up of the muscles; but a cloudy sky must be avoided by them, also one which becomes darkened over during a calm. The sun must also be avoided in winter, spring and autumn, as it is unseasonable. In summer weakly persons must beware of too great heat, and above all the back must be turned to the sun as to a fire, for the nerves of the will are chiefly found here (nervi enim, qui voluntatis sunt). When these are hot the whole of the body becomes stronger. The head must be protected by a covering.'"

"Thus it is related that the wife of the Emperor Gallienus (A. D. 218-268) was sent by the physicians to Nicaea, the present Nice, for a sun-cure."

Antyllus, a Greek physician (A. D. 300) said,

"'Many sit out in the sun, some anointed, others not, some lying or sitting, others standing, walking or running. As for those patients who recline, whether it be on a cushion or on a skin, in sand or even in the sun, the sun's heat moderately used with inunction increases the inner transpiration and causes sweating, hinders increase of body weight, strengthens the flesh, makes fat disappear and reduces the size of indolent ulcers, especially those occurring inthe dropsical.

The breathing becomes quicker and more vigorous, which stimulates the narrow-chested and those who breathe with a stiff neck; those also who suffer from chronic weariness of the head will find the sun-cure useful, strengthening them and hardening them against disease. But it is necessary first to empty the belly, for the heat of the sun on the head is injurious unless preceded by the emptying of the bowels.'"

Said Pliny, "'After a meal certainly in the summer, if you have leisure, lie in the sun. After sunning take a cold bath, and then take a light meal and sleep a short time.'"

"There is also an Italian proverb 'Dove va il sole non va il Medico' ('Where the sun enters the doctor doesn't'").

"When his uncle perished on the destruction of Pompeii, 79 B. C., he wrote to his friend Tacitus: 'You asked me for a description of my uncle's death so as to leave a true record of it for posterity. Many thanks, for I know that by this means his death will always be famous . . . my uncle was in Misenum where he commanded the fleet in person. On August 24, about 1 p. m., my mother said to him, 'I can see a cloud of unusual shape and size.' He had sunned himself and had taken a cold bath, and was lying down eating and studying. He asked for his shoes, and went up to a height from which he could get a good view of the wonderful phenomenon.'"

"From this letter we see the ancient Romans combined the sun- and water baths. Pliny arranged his baths in his Tuscan property, that they could be warmed by the sun's rays at certain hours."

Said Galen, "Those who expose themselves to the sun's rays are protected from illness."

Ulcers were cured by exposure to the sun's rays by Faure (1774).

Doebereiner (1816) said, "'To every living creature including man it is given to enjoy the light of the sun; every spot which receives the direct rays of the sun furnishes for man a light bath in

which he can dip naked or loosely clothed in white. When one wishes the light effect only, white clothing is to be preferred to every other, even coloured, or to the naked body, because the white divides the rays into those of pure light and heat, driving off the latter, while coloured surfaces and also the skin suck in the warmth which accompanies the light and so change a sun-bath into a 'fire-bath.'"

Doebereiner used burning glasses for intense local applications of light.

He understood the effects of clothing of different colors.

"'Sunlight is almost wholly changed into heat by coloured, especially black, fabrics, so that if one wants to give a heat-bath in the sun it is best to clothe the body in black garments.'"

Rosenbaum (1835) used sun baths for rickets and tuberculous children.

Bonnet (1845) used sun baths for chronic arthritis.

Turck (1852) published a work on old age and the means of combating it and recommended air baths and sun baths.

ABSTRACT OF BISHOP ON BLOOD- PRESSURE.

The subject deals in general with slowlydeveloping or long established conditions.

Of importance in acute disease, but chiefly important in chronic disease.

Changes in blood-pressure chief disorder of the general circulation.

The mechanism of the circulation is an arrangement for maintaining high pressure or low pressure in given parts as required.

The chief point in circulation is not to maintain a certain degree of pressure, but a proper relat ion between the pressure in the arteries where the blood is stored, and the tissues or parts where it is needed.

Blood-pressure relates almost exclusively to the arteries.

It is only in the last stages of circulatory disease that venous pressure is important.

The point of ~~xxxxxxxxx~~ paramount importance is the state of the arterioles as regards freedom with which the blood can move from the arteries into the veins.

PHYSIOLOGIC CONDITIONS.

The arteries a reservoir in which the heart maintains a certain pressure.

The veins, canals which carry blood back to the heart with practically no pressure,--barely enough to keep the ~~xxxxx~~ blood moving.

The arterioles and capillaries, passages which vary in size under control of the vasomotor system, directing the arterial

reservoir and the venous drainage canals.

The portal system an extensible and expansible storage tank capable of holding all the blood in the body.

The general venous system has long been recognized as a storage reservoir, but this view of the arteries is more recent.

Exercise, mental and physical, especially the latter, raises blood-pressure at first by reflex increased heart action which increases the amount of blood in the arteries.

After a little, blood-pressure falls to normal or below normal, even when exercising, from dilatation of the arterioles.

The extra supply of blood first stored up in the arteries is derived from the portal circulation. (When sitting or lying, the abdominal muscles are relaxed, the portal circulation is filled. While exercising, increased action of the diaphragm and contraction of the abdominal muscles diminishes the blood in the portal circulation. In a very feeble person the very reverse of this might be true, due to weakness of the abdominal muscles.)

Illustrations: Coldness of hands and feet, and general chilliness after eating due to portal congestion.

Indigestion or lack of digestion, due to violent exercise, the result of withdrawal of blood from the muscles.

Indigestion from violent mental emotion due to withdrawal of blood to the brain.

Drowziness, mental inactivity after excessive eating, due to portal congestion. (In neurasthenics a small amount of food may produce this effect. In peritonitis,

patient's mental condition generally good due to spasm of the abdominal muscles with accumulation of blood in the abdomen. In fainting, shock, or collapse, low blood-pressure due to accumulation of blood in portal circulation, either from reflex inhibition of the vasomotor centers, or exhaustion of the vasomotor centers, or paralysis from anesthetic.)

(It should be remembered that the portal veins, as well as the mesenteric arteries, are supplied with muscles which are under the control of the splanchnic nerves.)

(Note relation of different parts: arterial system carries arterioles and capillaries, 500 times that of the aorta Portal circulation may hold all the blood in the body. Skin may hold two thirds of all the blood of the body; the muscles, one-half of all the blood in the body. Three reservoirs which may be utilized therapeutically for regulating the blood-pressure)

The chief purpose of the heart is to maintain pressure in the arterial reservoir. The movement of the blood is an incidental and necessary consequence.

The amount of work done by the heart is regulated by opening and closing of the arterioles in various parts of the body, or in the body as a whole, thus determining the amount of blood in it.

This is the reason the heart works harder during exercise--because the arterioles and the muscles are opened.

Arterial pressure practically uniform through the arterial system. (Hence the value of measurements made by tonometer and the sphygmomanometer.)

This proves that the movement of the blood is controlled

less by pressure from behind than by the outlets in front.

When blood is needed in any part of the body, remain intact, and the arteries of the abdomen supply it.

The heart gathers the blood from the organs where it is made, from the kidneys, liver, and lungs where it is purified, and pumps it into the reservoir.

The heart and arteries supply blood to the tissues as it is needed, such as a gland--salivary glands, and the liver, by secretion in quantity as needed.

The study of blood-pressure leads to the classification of cases into two general groups and two sub-groups.

1. High pressure.
2. Low pressure. a. Primary.
   b. Secondary.
   Often preceded by high pressure.

High tension cases all due to disordered arterioles.

a. If temporary, result of contraction from an irritant of some kind.

b. If permanent, from contraction of arteries as a result of degeneration of coats under the influence of toxins. This contraction of outlet leads to raising of pressure, so that the proper amount of blood may be supplied to the tissues, and of course implies increased work of the heart.

Low tension cases are those in which the heart has become disabled from inflammation or degeneration of its muscle, inflammations of its envelopes, or disease of its valves,--

anything which interferes with its efficiency as a blood pump.

Primary low pressure cases.

Disorders of circulation are generally regognized by symptoms indicating either congestion or anemia.

The symptoms of anemia and congestion are often similar.

Delirium may accompany either congestion or anemia.

(In delirium accompanying anemia, is not the condition due to a toxin which contracts the vessels of the brain, while at the same time irritating the brain-cells rather than to the defisiency of blood? Query J. H. K.) (What about delirium of collapse)

Dyspnoea generally due to anemia.

May accompany congestion of the lungs.

Acute congestion of kidneys causes suppression of urine.

Anemia or deficient blood supply causes scanty secretion.

The function of an organ is influenced not so much by the quality of the blood as by the amount of fresh blood. (Pure blood heals).(Hence the benefit derived from blood-letting, or counter-irritation which serves to start the circulation when stagnant.

(H. & C. applications, local, general, or remote; applications of the sinusoidal are of great service.)

Always necessary to give attention to the general circulation when the cause of low pressure is general as in petty congestion due to cardiac disease, etc.

Low pressure not marked in acute stages of valvular disease.

Generally not a question of great practical importance which valve is involved.

Worthy of note, however, that in aortic disease, the chief effect is deficient supply of blood in the arteries, while in mitral disease, there is an increased pressure in the veins. I

In both cases, the result is diminished difference in pressure between the arteries and the veins, hence interference with proper movement of the blood from the arterial reservoir through the tissues to the veins.

Mistake to suppose that cardiac disease is chiefly confined to the left side.

The most serious and fatal cardiac disorders involve the right side.

This belief was founded on the old doctrine which considered valvular deformities as the chief cardiac affections.

Inflammation and deformities of valves chiefly confined to the left side.

Both sides equally as regards incompetency of valves, resulting from strain or weakness of the heart muscle.

Patient may have marked disease of left side and get along all right until dilatation of the right side takes place, causing bi-cuspid regurgitation and venous engorgement.

Low arterial pressure is only pathologic when it approaches so nearly venous pressure that there is a deficient flow toward the tissues.

True low pressure cases are solely due to failure of the heart pumping mechanism.

Low pressure due to dilatation of arterioles when the heart is able and ready to do additional work if required is not pathologic because the tissues are amply supplied with blood.

It may be low pressure due to general exhaustion, or conditions in which the nerve-centers are at fault; is not the diseased condition of the heart or blood-vessels.

TREATMENT OF PRIMARY LOW PRESSURE CASES.

Low pressure without defect in the valves or obstruction in the arterioles is due to weakness of the heart.

The remedy is improved hygiene, increasing number of meals, outdoor life, improved nutrition. (Ice-bag over heart, mild tonic baths, mitten frictions, towel rubs, abdominal massage, centripetal friction.)

Low pressure due to valve disease requires special care of the heart under three conditions:

a. Before complete compensation is established.

b. During the existence of compensation.

c. After compensation is broken.

BEFORE ESTABLISHMENT OF COMPENSATION.

In case of recent valvular affection, long rest in bed, the gradual return to active life.

Resumption of exercise must be gradual to avoid excessive ~~painstaking~~ conservatory hypertorphy.

Patient must remain very ~~much~~ quiet until the subjective and objective symptoms of low pressure have disappeared.

Drugs generally inadvisable.

Digitalis suggested as useful in cases where compensation is long delayed. (The evil effects of rest in bed should be counteracted by general massage, by abdominal massage, and tonic cold frictions, sun baths, arc light baths, for toning the skin, avoiding violent measures of all sorts as general hot or cold baths. Sinusoidal current; S. R. to abdomen; S.S. to muscles, best in form of G. S. S. Respiratory exercises lying. General series of exercises for enteroptosis confined to those which can be taken in the lying position, gradually introducing breathing and other exercises in sitting position as the patient's compensation improves. Dry friction of the skin with rough towel, mitt, or flesh brush. Oil rubbings. Hot and cold rubbings to dropsical limbs; heating compresses to legs. Heating compress over liver and abdomen when liver is enlarged. Hot foot-baths; hot and cold to spine; neutral sinusoidal bath."

These cases must always be considered as low tension cases because of the tendency to relapse. Hence a case of Bright's disease must always be considered as a high pressure case although the symptoms of Bright's disease may have passed away.

TREATMENT DURING THE STAGE OF COMPENSATION.

The stage may last a long time. The patient must give special attention to good hygiene, avoiding over-exertion while under motion, and dissipation.

Patient must avoid violent exercise which leads to excessive hypertrophy and subsequent degeneration. Bishop recommends the occasional use of iodide of soda to prevent

degeneracy. (A better plan would be low proteid diet.)

Rest in bed.

Great care in diet.

Bishop recommends the use of digitalis when there is congestion of the kidneys and edema of the extremities.

Bishop recommends fresh air, the cold air treatment for cardiac disease as being just as important as in tuberculosis.

Care must be taken when inflammation or congestion of the kidneys is present.

Patient should be trained to sleep with open windows.

Danger of taking cold in warm baths over-estimated.

LOW PRESSURE due to degeneration of the heart muscle not preceded by hypertrophy.

Rare except in acute or chronic general disease.

In these cases, treatment of general disorder.

Little can be done by direct treatment of the circulation.

The same is true when the heart is overloaded with fat.

Weak muscle requires special precautions, but treatment is chiefly hygienic.

TREATMENT OF HIGH PRESSURE CASES.

These are cases characterized by excessive resistance in the vessels. May be or may not be high pressure in the blood-vessels.

Characteristic feature is the tendency toward the necessity for abnormal high pressure in order to properly circulate the blood.

These high pressure cases include all cases in which disease of the blood-vessels or kidneys, or toxemia which causes disordered action of blood-vessels of the kidneys, resulting in high tension.

Precedes or accompanies cardiac disease.

Low pressure cases may become high pressure cases if valvular disease causes secondary Bright's disease.

High pressure cases do not become low pressure cases.

In cases of low tension following high tension, the arterial resistance is constant, so that the real situation is not changed.

The treatment of high pressure cases more common than of low pressure.

This condition comprises a large share of the diseases resulting from over-work and luxurious habits.

Important to recognize the first tendency to high tension.

Is then amenable to treatment.

Duration of life depends primarily upon the integrity of the heart and blood-vessels.

In these cases, the heart, blood-vessels, and kidneys are associated.

Serious disease of one is not found without the others being involved.

These cases frequently referred to as chronic Bright's disease.

Chronic Bright's disease is not essentially disease of the kidneys, but the kidneys are the last involved.

Bright's disease is primarily disease of the circulation, though the brain and kidneys may give the first symptoms.

Case may die of Bright's disease with fairly good kidneys, death being due to coma and paralysis, result of advanced disease of the blood-vessels of the brain, good hygiene having kept the kidneys in fairly good condition, and thus prevented death from uremia, dropsy, and exhaustion.

Kidneys insensitive, so disease may reach grave stage before patient is conscious of it.

Brain circulation may give symptoms of Bright's disease before the kidneys.

Even in Chronic Bright's following acute nephritis, the chronic condition is characterised by vascular change.

In acute nephritis care should be taken to watch for changes in the vessels which lessen the prospect of recovery.

The change from acute nephritis to chronic nephritis is indicated by the changes which take place in the arteries.

This same change occurring in valvular disease in the heartindicates the development of chronic nephritis, the result of prolonged congestion of the kidney.

Cardiac hypertrophy often first symptom of chronic Bright's.

Cardiac hypertrophy may be present without high pressure at the moment, since the change in the vessels is not yet great, and the pressure may be lowered by treatments.

Increased flow of urine in early Bright's disease due to increased blood-pressure. This increased amount of urine leads to frequent urination.

Nose-bleed and other early symptoms of Bright's disease

due to increased tension.

Headache due to increased arterial tension and cerebral congestion.

Indigestion due to disturbance of the circulation of the stomach in high pressure.

Early symptoms of high pressure often atypical; may be symply unhealthy look, less strength, disturbance of digestion, albumin in urine at rare intervals.

First symptoms are disorder of function, especially disturbance of pressure regulating function.

Irregular tension is thus an early symptom of Bright's.

These symptoms may be present for a long time--a condition known as Bright's disease.

Smaller arteries first attacked, giving rise to irregularities of the circulation of inferior parts of the brain and other parts.

Result may be temporary indigestion, slightparalysis, or simply clumsiness of a limb.

In Typical high pressure cases following ~~severe~~ the symptoms are found:

Heart htpertrophied.

Arterial tension high.

Urine increased.

Subjective nervousness.

Headache. Nose bleed

Insomnia.

Dizziness.

Threatened aphasia and hemiplegia.

The cardiac hypertrophy in these cases is compensatory, due to the narrowing of the arter o

due to the narrowing of the arterioles necessitating an increase of pressure.

While arterial ~~xx~~ tension is maintained, patient is safe from failure of the circulation, but ~~in~~ danger of injury to the nervous system, rupture of vessels in the brain, also extensive failure of the kidneys.

Heart is ~~especia~~ finally worn out by the excessive work.

High pressure is merely a symptom.

Should never be treated as primary symptom by prolonged use extension of the vasodilators which of course is useless.

TREATMENT OF HIGH PRESSURE CASES.

Causes are--

1. Everything which tends to lends increased activity to the circulation.

2. Incompletely oxidized wastes.

3. Accumulation of toxic matters in the blood from deficient renal activity.

Conditions 2 and 3 are generally known as acute Bright's disease.

The special toxins produced in acute disorders may cause high pressure by damaging the kidneys.

FIRST PRINCIPLE OF TREATMENT: Removal of causes.

Forbid alcohol.

Lessen work and responsibility in the over-worked.

Restrict diet in those who over-eat.

If kidneys are crippled, regulate diet accordingly.

In the use of hydrotherapy, special care must be taken to distinguish between high pressure and low pressure cases.

Cold bathing is contra-indicated in high pressure cases.

Warm bathing is generally beneficial.

Cold bathing especially ~~contra~~-indicated in low pressure cases.

Warm baths, short hot baths, with special precautions, are sometimes beneficial in low pressure cases; but general cold baths never in high pressure cases.

Nauheim baths adapted to high pressure, and even cases of secondary low pressure.

Brand baths adapted to the low pressure of acute disease.

~~General cold~~ baths very damaging in such cases.

Cold baths injurious to old persons, pressure being always high

Nauheim baths especially useful in cases of beginning and secondary low tension.

For a person with effective kidneys, a warm bath with bicarbonate of soda in it is preferable to the Nauheim bath.

The Nauheim bath is really a tepid bath of varied temperature, from 95° to 88°. sometimes lower as 77°

Arteriosclerosis is most likely to attack successful men because of the high pressure at which they work, and lack of proper rest.

High pressure may be easily reduced by nitrites, but unpleasant effects are produced.

Secondary low pressure is the greatest danger to be feared in high pressure cases. The most important thing is to save the heart from over-work so as to postpone the time when its failure results in secondary low pressure.

The peripheral vessels must be dilated, but at the same time

time the cause of the high pressure must be removed, hence drugs which dilate the vessels are not alone effective.

Bishop recommends giving two or three times a day two to fifteen drops of a solution consisting of equal parts of iodide of soda and water. Patients can usually take two or three drop doses for a long time. Some people can take five.

CHAPTER VI.

SIGNIFICANT SYMPTOMS OF CIRCULATORY DISORDER.

Head Noises in elderly people. Puffing blowing sounds. Often referred to ear but are not relieved by ear treatment. An indication of commencing secondary low arterial low tension. Noise due to movement of blood through imperfectly filled vessels. Most troublesome at night.

Slight Attacks of Pseudo-Paralysis. Slight transient loss of power, right and left side. Described as clumsiness of leg or arm. When attacking right side there may be also slight loss of speech,--loss of certain words. Symptoms indicate beginning thrombosis. Generally relieved by attention to general circulation.

Pain, particularly sciatic, often accompanies secondary low tension. Neuritis accompanying edema of lower extremities.

Nose-bleed often precedes low tension period, especially in cases of broken compensation.

Congested Liver. Large and tender, with indigestion. Accompanies general circulatory failure.

Congestion of Lungs. Serum in lung cavity. Found in cardiac cases with disease of right side. These cases also complicated by bronchitis.

Acute Mania and Chronic Mania. Changes of disposition. Disorders of memory, Impaired judgment. All due to circulatory disorders in old people.

Conditions resembling epilepsy much relieved by treatment of the circulation.

Circulatory Disturbances May Be Caused Of: numbness, tingling, formication, coldness, cramps, "limbs going to sleep."

Pain in the extremities often due to embolism.

CHAPTER VII.

TREATMENT OF SECONDARY LOW PRESSURE.

Muc h harm done by medicating the heart when unnecessary. Slight edema may be removed by improving the general health.

General progressive edema very dangerous, particular generally fatal, unless stopped.

Secondary low tension most difficult of all cases to handle.

Best methods not immediate in effect. Methods adapted to ordinary low tension not suited to secondary. In secondary low tension the heart is exhausted. Resistance in arteries must be diminished. Nothing gained by vasodilator drugs, blood-pressure being already low. Nothing gained by digitalis as the heart muscle is too weak to respond.

Digitalis and other drugs produce no permanent result. Great harm from excessive drugging.

Attention to digestion of primary importance. Milk often disagrees. Improve nutrition. Raise general vital resistance. Give nutritious diet.

Saline baths; exercise in the open air as much as possible without dyspnea.

Avoid prolonged rest in bed, restricted diet or drug therapy. Combat cachexia by all methods which improve blood and tissues.

CHAPTER VIII.

GENERAL CONSIDERATIONS.

Degeneration of the arteries better term than arteritis, arteriosclerosis or endarteritis.

Advanced arteriosclerosis often accompanied by few marked symptoms. We may find marked symptoms with little apparent change in the arteries.

The important thing is perfect performance of the functions of life. Circulatory failure may be due to functional failure as much as structural change.

Earliest sign of disturbed circulation irregularity of arterial tension, gradually changing to high arterial tension with compensatory hypertrophy of the heart.

Most cases of arterial disease are seen by the physician after the beginning of secondary low tension.

Heart stimulants as unphilosophical as whipping a horse struggling under a heavy load or opening the throttle of an engine when already going too fast.

The best heart stimulants, as ammonia, ether and amyl nitrite, are poor regulators, and the best regulators, such as digitalis, strophanthus, and iodid of soda are poor stimulants when quick action is needed.

Fever excites the heart.

In acute disorders the chief thing is to control the overstimulation of the heart.

Injudicious drugging may greatly damage the heart.

Heart failure most frequently shown by increased rapidity, from failure of inhibition. Control of overstimulation of the circulation often needed. So-called heart stimulants are not stimulants but regulators.

Slow pulse in a very sick person a very good indication.

Primary low tension without rapid pulse not dangerous. Drugging might aggravate the trouble.

Rapid pulse with feeble heart due to failure of inhibition. Such failure can only be combated by improved nutrition and general increase of vitality. Removal of causes.

Restore inhibitory force by general measures which restore whole body . Consider less the mechanics of the circulation than the patient himself. The heart is as good as the man.

Heart sounds often deceptive. Often get good sounds with poor pulse. Often the reverse,--good pulse with heart murmurs.

Diseases of blood-vessels often mistaken for heart diseases.

Benefits of Nauheim treatment due to dilatation of surface vessels relieving the heart of the burden of compensation. A compensating heart often thought to be disordered.

Myocarditis and nephritis generally ~~occurxwith~~ begin with degeneration of the blood-vessels. First functional, then organic. First the coronary arteries, then the heart-muscle and the larger vessels. Should watch carefully the arterial system.

May have high blood-pressure with weak heart, shown by feeble heart tone. Blood-pressure maintained by peripheral heart. Test for this condition: Take blood-pressure. Inhale amyl nitrite. Take blood-pressure again. Blood-pressure result of two factors: ventricular force and vasoconstriction. Amyl nitrite relaxes the arteries and shows up the ventricular force.

Vasoconstrictors act as a prop in feeble heart. In healthy persons amyl nitrite, while removing vasomotor factor, causes increase of blood-pressure. When the heart is weak amyl nitrite causes fall of blood-pressure. In arteriosclerosis blood-pressure may fall from 240 to 180 by inhalation of amyl nitrite if there is feeble heart.

The sphygmomanometer determines the force of the left ventricle. Condition of the right ventricle determined by pulmonary sounds and examination of the lungs.

Arterial tension may be very low with circulatory disease. May be relaxed arterioles. Patient generally very feeble, lacking nerve force. Cannot endure strain. Some patients live many years with low tension.

Secondary low tension with Bright's disease a very grave condition. Nothing gained by drugs which increase tension.

Constitutional low tension not cured by drugs. Tension becomes normal with exercise or fever.

Exercise the best remedy. Horseback riding, rowing, etc. good exercise.

Very hot baths useful. First effect immediately after the bath relaxing; beneficial effect comes later.

Cold bathing not good in constitutional low tension, since patients do not react well. (Very hot baths are best in these cases. J.H.K.)

Prostration of the Circulation. These are cases not serious enough to be called myocarditis or arterial degeneration. Relation the same as between neurasthenia and insanity. Marked liver symptoms; congestion from stagnation, feeble blood-current. Circulation regular. In myocarditis and arterial degeneration circulation is irregular.

Nitrites should not be used in a routine way.

CHAPTER IX.

Nitrites should not be used in a routine way.

Early symptom of approaching age a rise of blood-pressure.

Use of vasodilators without hygienic measures to lessen the irritability of the heart and restore nerve centers, a bad practice.

In Bright's disease there is probably some substance circulating in the blood which irritates the muscular coats, causing contraction. This brings high tension. In high tension all strain should be avoided. Violent exercise is bad. Slow exercise is good.

Food. Moderate in amount. A little at a time. Avoid sugar and alcohol. Use little meat (None at all.--J.H.K.)

The final effect of vasodilators is dilatation and paralysis of the heart through the breakdown of inhibition.

Nitroglycerine stimulates the heart and dilates the blood-vessels.

Digitalis slows the heart and contracts the blood-vessels. Digitalis sometimes beneficial in nephritis with high tension and rapid pulse, relieving the congestion of the kidneys and increasing the urine.

In high pressure with Bright's disease remember that increased pressure is necessary. The greatest danger is secondary low pressure. Must be careful not to produce this by remedies. Drugs likely to do this.

Symptoms of disturbance of cerebral circulation: numbness or awkwardness of one of the extremities, or slight difficulty in speech. In such cases vasodilation needed. Sodium iodid postpones paralytic attacks.

Can patients with disease of the heart and vessels recover?

With myocarditis combined with chronic nephritis blood becomes poor in quality.

Such patients become worse and finally die. Heart tone may be recovered and kidneys may be improved in action. May go on for years. Use of nitrite should be limited. Iodide of sodium the best remedy.

ABSTRACT OF "THE CLINICAL STUDY OF BLOOD-PRESSURE",

by T. C. Janeway, M.D.

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FACTORS WHICH DETERMINE BLOOD-PRESSURE.

(a) HEART ENERGY.

1. Increased volume.

2. Increased frequency of beat.

3. 1 and 2 combined.

Peripheral stimulation (strong) of vagus slows heart and lessens output.

Stimulation of augmentor nerves may increase pulse volume and raise blood-pressure without increasing the rate.

Explanation: Sudden strong contraction giving longer diastole for filling.

Increased frequency raises pressure only when supply of venous blood is abundant and peripheral resistance is adequate.

Slight change in rate has little effect on pressure. Greatest pressure at moderate rate. A change either way lessens pressure. (average)

Raising pressure slows pulse. Lowering pressure hastens pulse. Due to reflex action through centripetal nerve on vagus center. Connects ventricular wall with the center. Stimulation of central end of cut nerve lowers blood-pressure and slows heart. Fall of pressure due to inhibition of vasomotor center. Slowing due to stimulation of the vagi. This does not occur when the vagi are divided.

The depressor nerve is protective, being excited by the stretching of the ventricular wall in high pressure. Its stimulation inhibits vasomotor nerves and lessens the grasp of the splanchnics on the portal vessels.

EFFECT OF BLOOD)

Effect of Blood-Pressure on Volume Output.-- Volume output depends first on the amount of blood supplied the heart by the veins, and in this way abdominal massage increases blood-pressure by increasing the supply of venous blood. With high resistance the heart does not empty itself. Blood-pressure is thus limited, first by a reflex depressor mechanism, and second by diminishe volume output.

A great lowering of blood-pressure diminishes heart energy because the ventricle is not filled. This further lowers blood-pressure in causing a vicious circle which leads to death, the certain result of complete vaso-motor paralysis.

Increased abdominal pressure raises arterial pressure up to a certain point. Abdominal pressure increases blood-pressure until it is extreme. Blood-pressure then is diminished by compression of the abdominal arteries.

(b) PERIPHERAL RESISTANCE.

The portal vein has tonus(Mall).

Increased tonus raises pressure and diminished tonus lowers pressure, when heart force remains the same. (Mall compressed the aorta above the celiac axis; then caused contraction of the portal vein by stimulating splanchnic nerve.

Tonus of vessels depends on balance between vasoconstrictors and vasodilators. With cord cut below the medulla all arteries dilate with great fall in blood-pressure. Stimulation of peripheral end causes rise of blood-pressure seven times the original, even after division of cardiac nerves; hence due to vessel tomus only.

Tone may be recovered after dividing cervical cord through action of lower centers of the cord. If cord is destroyed, vessel tone is completely lost and blood accumulates in the veins, resulting in death of the animal.

Vasomotor centers also in peripheral sympathetic ganglia. Shown by recovery of tone in dog's legs several days after destruction of the lumbar cord, which contains the spinal centers for the lower extremity.

these peripheral ganglia cannot suffice for recovery of general vasomotor tone throughout the body when the cord is destroyed.

Vasodilator nerves have no tonus. Section causes no narrowing of the corresponding arteries.

Splanchnics and some other nerves contain both constrictor and dilator fibers. Dilators affected by currents of weaker strength than constrictors, respond more slowly, but continue longer in action.

The vasodilatorx centers are found at least in the spinal cord.

Vasomotor tone constantly changing in local vascular area in response to special local needs.

Vasomotor tone, general and local, is influenced by reflexes of remote origin.

Stimulation of any centripetal nerve raises blood-pressure. The only exception is the depressor nerve of the heart. Sensory nerves contain some depressor fibers. If sciatic nerve is cooled to freezing central to point of stimulation, the pressure falls through vasodilatation instead of rising through vasoconstriction. In regenerating sciatic nerve vasodilatation in response to stimulation occurs before vasoconstriction is recovered. Mechanical stimulation of muscles, and of vaginal and rectal mucous membranes causes fall of pressure. This may happen under ether, chloroform or chloral.

In surgical shock depressor, or dilat, reflexes take the place of normal pressor, or constrictor, reflexes.

The chief factor in reflex pressure rises is vasoconstriction in the splanchnic area. The arteries of the muscles show least reflex variation, except the arteries of the brain, in which none is observed.

The abdominal vessels have the greatest effect of any on blood-pressure. Both in man and warm-blooded animals the chief control of general blood-pressure is located in abdominal vessels. Portal vein may hold all the blood in the body.

Splanchnic nerves are of all vasomotor nerves most easily influenced by reflexes from sensory centers. Section of splanchnic nerves causes fall of blood-pressure of 30 to 50 mm.

Abdominal vessels, and most other artieries, have a double innervation, the splanchnic and the sympathetic.

The normal splanchnic circulation may compensate for most extreme narrowing of the rest of the arterial system.

Reflex raising or lowering of the blood-pressure does not usually involve all the arteries of the body. Generally there seems to be an antagonism between the portal vessels and the vessels of the smin and the muscles. The vessels of external organs and those of the skin and muscles also antagonistim. One is relaxed and the other is contracted. However, it is possible for all to be constricted together(Tigerstedt).

(Q) ELASTICITY OF THE ARTERIAL WALL.

Vessels very strong but distensible and elastic.

Lowest pressure causing rupture of human carotid 50 inches of mercury (Quinquard). This is eight times ordinary carotid pressure. Dog's carotid resisted twenty times the normal pressure without rupture.

Elasticity and distensibility diminish as pressure rises. As arteries lose elasticity, the influence on systolic pressure increases.

(R) VOLUME OF CIRCULATING BLOOD.

~~Blood-pressxxxxxxxx~~ Blood-volume is small when compared with capacity of vessels. This difference is somewhat balanced by the continuous contraction of the smaller arteries (vasomotor tonus). When this tonus is lost the blood passes into the veins and the animal dies.

Diminished blood-volume from hemorrhage causes temporary lowering of pressure, soon followed by rise to near normal. After loss of one-fifth of total blood-volume pressure may in short time rise to a height sufficient to sustain life (Tappeiner). The rise after hemorrhage is due to vasoconstriction. Blood-loss is compensated for by increased heart rate, and probably more

complete emptying of the heart.

Loss up to two-fifths of blood-volume may affect blood-pressure very little.

Saline solution greater than total blood-volume may be injected into vessels without dangerously increasing blood-pressure. The vessels dilate to accommodate the increased volume, perhaps under influence of depressor nerve.

It is apparent that blood-volume has only a temporary and subordinate influence upon blood-pressure.

Pulse volume diminished after hemorrhage; hence pulse pressure diminished.

M E A N A O R T I C P R E S S U R E .

Animal	Bl.Pr. in mm.Mercury.
Horse	120 - 320
Dog	100 - 170
Sheep	98 - 200
Rabbit	90 - 108
Calf	133 - 177.

In general blood-pressure in animals seems to be about the same as in man.

Direct determination of blood-pressure during amputation showed 100 to 160 mm. in femoral and brachial arteries.

BLOOD-PRESSURE IN DIFFERENT ARTERIES.

Blood-pressure is practically the same in all the large arteries as in the aorta. Pressure in pulmonary circulation is one-fifth aortic pressure. No definite relation between mean pressure in systemic and pulmonary circulation. There may be wide variation in the systemic with no chang in the pulmonary. Pneumonia and pneumothorax amount to nothing mechanically in raising the work of the right heart (Tigerstedt).

PERIODIC VARIATIONS OF AORTIC BLOOD-PRESSURE.

Difference between the systolic pressure and the diastolic pressure is the pulse pressure.

Average difference between systolic and diastolic pressures in dogs equals one-third of the diastolic pressure.

Mean pressure is approximately the arithmetical mean of the systolic and diastolic pressures.

A rise of blood-pressure due to increased heart beat(division of both vagi) affects diastolic more than systolic pressure.

Fall of blood-pressure due to vasodilatation(division of both splanchnics) affects systolic and diastolic pressures equally.

It is possible for systolic and diastolic pressures to be affected in opposite directions by division of both vagi simultaneously, with loss of blood.

Respiratory Variations.-- In normal breathing, inspiration aids diastole and hinders systole.

Vasomotor and vagus centers of medulla act rhythmically and synchronously with the respiratory centers.

Greater tonus during expiration. Heart rate slower and peripheral resistance higher, influences thus being antagonistic.

In quiet breathing no variation of blood-pressure. With forcible rapid breathing pressure rises during expiration and falls during inspiration.

With deep slow respiration, pressure is maximum at beginning ~~and~~ of expiration, and minimum at beginning of inspiration. Pulse rate also increased during inspiration. (Tigerstedt).

Pressure test should always be made with quiet breathing.

Traube-Hering Waves.-- Periodic rise and fall of blood-pressure embracing several respiratory periods. This variation coincides with rhythmical variations in depth of respiration. Due to changes in tonus of vasomotor and respiratory centers, occurring periodically.

Variations of blood-pressure may occur without apparent cause. May be due to unknown changes in the central nervous system.

Asphyxia causes rise in blood-pressure. Pressure falls only during last seconds of life.

ATMOSPHERIC PRESSURE

Rise of atmospheric pressure increases blood-pressure,--diastolic more than systolic (Crile). This is purely mechanical.

EXERCISE.

Zumst observed blood-pressure doubled under violent exercise. Muscular work raises blood-pressure.

MEASUREMENT OF BLOOD-PRESSURE.

In taking blood-pressure tests, observe the following directions:

1. Arm and hand must be at heart level.

2. It is better that the patient should be ~~sit~~ lying down.

3. Muscles must be perfectly relaxed. Contraction of muscles may cause an error of 5 to 80 mm. Accurate observations impossible in tetanus and spasm of muscles and increased muscular tone.

4. Edema a source of error. May cause error of 20 mm. or more.

5. The armlet should have a width of 12 cm.(5 inches).

Maximum error with sphygmomanometer, 12 centimeter armlet, is 10 mm., lost in the tissues.

6. Moment of pulse return is best criterion with sphygmomanometer. The whole observation must be made within two or three minutes.

One-one hundred and sixtieth of the work of the heart is used in giving blood-stream its velocity (Tigerstedt). The balance required for overcoming aortic pressure.

Difference between lateral pressure and end pressure in vessels is , hence, one millimeter.

Compression of a limb raises general blood-pressure. Due to central vasomotor reflex causing increase of peripheral resistance. (Protective, to force blood into compressed limb).

This may be a source of error in taking blood-pressure, as under continued compression a rise of 5 to 10 mm. may result. Hence, the test must be taken quickly.

For systolic pressure, the test should be taken in half a minute. Diastolic takes longer, as the test is more troublesome.

Criterion with Gärtner's tonometer, change of color. Two flushes. Second flush 5 to 20 mm. lower than the first flush. Gärtner's instrument does not measure accurately below 70 mm.

Criterion does not operate satisfactorily unless the fingers are warm.

Maximum pulsation of arterial wall determines diastolic pressure. This is most accurate indirect measure of blood-pressure. Accuracy demonstrated by Mosso.

There are three criteria: (1) The return of the pulse. (2) The flushing of the blanched finger. (3) The tracing of Erlanger's instrument.

N O R M A L P R E S S U R E .

For young adults 90 to 80 mm. is the lowest limit normally. The upper limit is 145 mm. Blood-pressure rarely exceeds 130 in young adults.

Normal average blood-pressure is about 110 to 112 mm. for young persons. Women 10 mm. less than men.

Children under two years 75 to 90 mm.

After fifty years blood-pressure is 130 to 145. Increased blood-pressure in old age is due to narrowed arterioles and increased viscosity of the blood.

Exercise raises pressure more in old than in young persons.

DIASTOLIC PRESSURE.--

This is 25 to 40 mm. below systolic pressure during rest.

Diastolic pressure varies less than systolic with pathological rise of tension.

Difference between systolic pressure and diastolic pressure called by Erlanger "pulse-pressure."

Product of pulse-pressure by pulse-rate tends to be constant, as shown by Erlanger and Hooker. This is more reliable than Marey's dictum that pulse-rate and pressure vary inversely.

Blood-pressure may rise 5 to 10 mm. from respiratory waves.

Diurnal variations may amount to 60 mm. Rarely so much as this.

INFLUENCE OF POSITION.--

Lowest blood-pressure in lying position. Standing and sitting raise systolic and diastolic pressures 5 to 10 mm.

Diastolic may rise more than systolic in changing from lying to standing position.

Active men have a fall of blood-pressure after a few days' rest in bed.

Blood-pressure lowest during first hours of natural sleep, slowly rising about time of waking.

Diastolic pressure falls 20. mm. after meals (Mosso). Due to vasodilatation of the splanchnic areas,--in some cases compensating superficial vaso-constriction. Systolic and diastolic pressure probably equally influenced by eating.

"Alcohol, contrary to the usual belief expressed in the language of daily life, is not a stimulant, at least so far as the circulation is concerned. The pharmacologists agree that it produces no rise in blood-pressure or in cardiac energy when injected directly into a vein. On the contrary, if a considerable dose be given, arterial pressure falls from weakening of both vasoconstrictor centers and heart (see Cushney). In man there seems no good reason to doubt that its effect is the same. Swientochowski, Schüle, and Wren and Oertel have, in fact, demonstrated that no elevation of systolic pressure follows its administration. Observations on the pulse-pressure are lacking."

"Tobacco, on the other hand, or its alkaloid nicotin, have a powerful action on the circulation. Nicotin, in less than overwhelming dose, produces an immense augmentation of blood-pressure in animals, due to stimulation of both central and peripheral vasoconstrictor mechanisms(Cushney). Cook and Briggs have called attention to the temporary elevation of arterial tension during smoking. They found it most marked when a strong cigar or old pipe is used, and continuing an hour or more after the smoke is ended."

INFLUENCE OF PSYCHICAL STATES.--

A heated argument may raise blood-pressure 40 mm. Diastolic pressure increased less. Pressure falls after excitement is over to below normal.

INFLUENCE OF MUSCULAR EXERTION.--

Muscular work increases blood-pressure. It may increase the pressure 50 mm.

Diastolic pressure rises less than systolic pressure during exercise.

Fall of pressure after exercise likely to be accompanied by dilatation of the heart, shown by increased heart dulness.

Prolonged exertion causes fall in pressure.

Rise of blood-pressure of shorter duration in aged persons and in very young persons.

EFFECTS OF TEMPERATURE AND BATHS.--

Cold baths produce vasoconstriction followed, if long continued, by vasodilatation, due to vasomotor paralysis.

Short application of cold followed by hyperemia through active vasodilatation.

Warm baths produce vasodilatation with passive hyperemia due to diminished vasoconstriction.

Thermal applications to the surface produce reflex vasomotor effects in internal parts, especially parts supplied by the splanchnic nerves. Vasoconstriction of the surface may be accompanied by reflex dilatation of the splanchnic vessels.

Bruck found that a bath at 8°C (46.4°F) caused a rise of pressure in one half minute. At 13° to 16° C(57.4° to 59.2°F) there was a rise of pressure in one minute. At 20° to 22°C (68° to 71.6°F)there was a rise of pressure after two minutes or longer, fall occurring when bath was discontinued sooner. (This evidently due to reflex dilatation of the vessels). He could find no constant relation between the pressure and pulse-rate, or body temperature. There was always a striking relation between duration and effect.

Müller reached the following conclusions:

(1) Water baths at a temperature below 33° to 35° C (92° to 95°F) produce a rise in blood-pressure, with slowing of the pulse, throughout the whole duration of the bath. The lower the temperature the greater the rise.

(2)Water baths from 92° to 104° F. cause a short rise, then a fall to normal, ~~followed~~ or below, followed by another rise. Below 37°C(98.6°F) pulse was diminished; above, increased.

(3) Baths at 40°C(104° F)and upward cause a rise in pressure, lasting during the whole bath.

(4) Steam baths at 50°C(122°F) cause pressure and pulse to rise in normal persons. In patients with weak hearts the rise in pressure is short, followed by a fall, or pressure may fall from the start.

Janeway concludes that the general effect of cold baths is to cause a rise of systolic pressure. Neutral baths have no effect. Hot baths have the same effect as cold baths, but produce more rapid pulse/

Menstruation probably causes lowered tension.

NORMAL PRESSURES.--

In the majority of healthy adults normal pressure is 100 to 130 mm. Diastolic pressure is 25 to 40 mm. lower.

After middle life, 130 to 145 mm. is not uncommon.

In childhood, 90 to 110 mm. after the second year; 75 to 90 mm. before the second year.

Regard with suspicion a pressure above 135 in a young person, or 145 mm. in an older person. Above 145 before middle age or above 160 after middle age, when always present, is doubtless pathological.

Ninety mm. is pathological in adults, for the lowest normal pressure, and 80 mm. in children.

Pulse-pressure is greater in old men. It may be 50 mm. A pulse-pressure less than 20 mm. is abnormally small. A pulse-pressure over 50 mm. is abnormally large.

The systolic pressure is the best guide when one only is obtainable.

PATHOLOGICAL LIMITS OF BLOOD-PRESSURE.

Pathological limits of blood-pressure, 40 to [illegible] 300mm.

Usually in high tension cases the reading is from 200 to 220 mm.

Lowest pressure at which circulation can continue is 75 mm.(5 cm), or 55 mm. absolute value.

All pressures below 90 mm. (12 cm.) are subnormal. Patients have recovered from traumatic shock after pressure of 50 mm. for a brief period. Kapsammer cites case of woman who lived thirteen hours after a fall with tonometer reading of 40 mm. Cases observed in patients dying of phthisis of tension of 35 to 40 mm. a few days before death.

A tension of 40 mm. sometimes observed momentarily during surgical operations.

Diastolic pressure rarely observed above 180.

When high systolic pressure is present, 220 mm. or over, diastolic pres sure is usually 60 to 80 mm. lower.

ESSENTIAL ELEMENTS OF BLOOD-PRESSURE.

Vaso-motor tone compensates for disproportion between between blood-volume and the capacity of the vessels. Tension of 50 mm. necessary to overcome the resistance of the arterioles.

The lower limit of pressure represents the pressure required to overcome the resistance of the arteries due to vasomotor tone. In high blood-pressure the lower limit of pressure necessary to life must be above 75 mm.

Pressure just before death in a case of chronic nephritis was found to be 180 mm.([illegible]Hensen).

Continuous fall in pressure is significant of danger. Graphic records are on this account important.

HIGH BLOOD-PRESSURE.

Of greater significance than normal or low pressure.

Sphygmomanometer the only method of telling the difference between high internal tension and a thickened artery with low tension.

FUNCTIONAL HYPERTENSION.--

(1) From excitement.

(2) From muscular activity.

(3) Labor pains.

(4) In nervous affections, from reflex vaso-constriction; as in melancholia, visceral crises of tabes, biliary colic, and other acute pains.

(5) Rise in pressure at the beginning of acute peritonitis, from reflex vaso-constriction.

(6) From drugs which stimulate the circulation, as digitalis, which increases heart energy and also vasoconstriction; ~~xxxx~~ adrenalin; strychnia and ergot raise blood-pressure by arterial constriction. Camphor, caffein and atropin increase cardiac energy and contract arterioles. Nicotin contracts the small vessels, and increases the hypertension. ~~Tension may be 175 mm.~~

(2)

Tension may be still higher than 175 mm. in asphyxia, as there is obstruction of the air passages. High tension also found, in a less degree, in cardiac and respiratory diseases causing deficient oxygenation of the blood.

Toxic hypertension seen in uremia and eclampsia.

Acute Cerebral Congestion and Anemia.-- Highest arterial pressures occur in cerebral compression, as in fractures of the base of the skull and apoplexy. The brain is anemia from compression, preventing the entrance of blood. The symptoms are those of anemia. In the final paralytic stage of compression, blood-pressure falls, with low, running pulse, and death speedily follows. The high pressure in cerebral compression is thus protective.

Essential, or Permanent Hypertension.-- This exists in cases of increased peripheral resistance with hypertrophy of the left ventricle. Found in arterio-sclerosis and diseases of the heart and vessels accompanying kidney disease. There is an apparent hypertension in aortic insufficiency; but the systolic alone is high, the mean and diastolic pressure being normal or below.

Causes of Essential Hypertension.-- Normal blood-tension is very constant, being regulated by splanchnic circulation, largely.

When blood-pressure rises too high, the depressor nerve opens the visceral arterioles.

Permanent high blood-pressure cannot exist without injury to the regulating power of the visceral circulation.

Increase of general peripheral resistance not sufficient to cause permanent high blood-pressure.

Permanent high blood-pressure requires hypertrophy of the left ventricle.

In arteriosclerosis, high pressure exists only when the splanchnic arteries are diseased. Hypertrophy of the heart occurs in arteriosclerosis only when the splanchnic arteries or the aorta above the diaphragm are greatly diseased.

Damage to the splanchnic circulation usually found in kidney disease. This is the cause of the high blood-pressure. Hypertrophy of both ventricles and auricles found in most cases of kidney disease.

Splanchnic arteriosclerosis very frequent in renal disease.

Parenchymatous nephritis due to irritant in the blood, which damages the vessels of the kidney and of the general circulation. If the irritant disappears, the kidneys may heal, heart and blood-vessels become normal, edema disappear. Chronic continued irritation causes hypertrophy of the heart and thickening of the blood-vessels. Left ventricle suffers most because pressure in general circulation is much higher than in the pulmonary circulation.

In chronic interstitial nephritis the irritant is weaker in character(Senator). Nitrogenous excretion not greatly diminished until much renal epithelium is lost.

Angiosclerosis.-- Cases of permanent high blood-pressure, but neither nephritis nor discoverable arterial thickening. Symptoms: high blood-pressure, cardiac hypertrophy, relative cardiac insufficiency, occurring in middle-aged or elderly persons. Cases quite frequent. Cause: early sclerotic changes in the splanchnic vessels.

Effects and Dangers of Hypertension.--

(1) Danger to the heart.-- Increased work, especially during exercise. During exercise heart work may be increased thirteen-fold. Hence, hypertension, like valve lesions, lead to failure of compensation, especially in persons whose occupations are laborious.

A hypertrophic heart is not so good as a normal one. Compensation is sure to fail sooner or later.

Increasing high blood-pressure more serious than any absolute value.

High blood-pressure is especially serious when treatment does not modify it.

Fall in pressure with heart symptoms due to cardiac failure.

Symptoms are:

Shortness of breath on exercise, or cardiac asthma; precordial distress; tightness of chest; angina pectoris; subjective or objective disturbances of the heart's rate or rhythm.

(2) Danger for the arteries.--Distensibility of the arteries decreases with increased tension.

Pulse-pressure (difference between systolic and diastolic pressures) is high in high tension. A pulse-pressure of 50 to 80 mm. has been cited. General dilatationof the larger vessels, due to the high systolic pressure. A degenerate artery may rupture. Healthy artery can stand strain beyond extreme tension. Cerebral hemorrhage is a common cause of death in Bright's disease.

Aneurysm may result, due to local lesion of vessel with high blood-pressure.

Nose-bleed may be due to high pressure.

LOW BLOOD-PRESSURE (HYPOTENSION).

CAUSES.-- Lower limit of normal tension is 90 mm.; 70 mm. is very marked low tension.

(1) Wasting diseases. Phthisis, carcinoma of the stomach, general paresis. Blood-volume reduced. Tissues contain little blood after death.

Brown atrophy of the heart in these cases.

(2) Hemorrhage. Reduces pressure rapidly. Typhoid fever and other acute diseases show hypotension. Pneumonia less than others. Drugs which paralyze vasomotors produce hypotension. Chloroform produces this effect.

(3) Terminal hypotension. Blood-pressure should be closely watched. Hemorrhage produces low pressure. Hypotension falls rapidly just before death. Terminal hypotension may exist for a few days or only for a few hours or a few minutes.

(4) Collapse and Shock.-- Collapse occurs in acute diseases at height of infection. Occurs in surgical operations (a) after manipulations of intestines; (b) after injury to large nerve trunks; (c) after hemorrhage.

Shock is the fully developed condition to which collapse leads.

Symptoms of infection collapse often resemble hemorrhage, patient bleeding into his own veins.

Irritation of the nasal mucous membrane with faradic current causes extreme reflex vasoconstriction.

Short asphyxia (30 seconds) exites medullary and spinal vasomotor centers, and causes vasoconstriction.

Sensory stimulation affects vasomotor center of the bulb only.

(The above statements are taken from Romberg and Pässler).

Abdominal massage may cause rise in pressure when sensory stimulation fails, showing that the heart is still functionally capable, but the vasomotors paralyzed.

In Romberg's experiments in animals showing impending shock, when sensory and asphyxial stimulation failed, pressure was restored to normal by abdominal massage.

Death at the acme of infection from diphtheria and pneumonococcus infections not due to heart failure but to vasomotor paralysis.

Crile showed that on animals in profound shock (pressure 20 mm.) strychnia produced no effect.

In most profound shock normal blood-pressure or

In most profound shock normal blood-pressure can be produced by intravenous injection of adrenalin and salt solution (1-50,000). A decapitated dog was kept alive ten and a half hours in this way. Showed that central vasomotor paralysis was the real cause of the hypotension.

Crile applies the term collapse to conditions of rapid fall of blood-pressure, and due to hemorrhage and other causes in which the vaso-motor center has not become exhausted and will still respond to peripheral or central stimuli. In shock the centers do not respond, for they are exhausted.

Effects and Dangers of Hypotension.--

(1) Accumulation of blood in the veins with slowing of blood current in arteries. Disturbance of nutrition and secretory processes.

(2) Accumulation of blood in the abdominal veins, affecting general blood distribution, and causing retention of heat, thus increasing fever.

(3) Danger to the heart. Heart energy is weakened by diminished blood-supply.

Hypotension usually exists throughout acute febrile diseases.

Adequacy of the circulation determined by comparing systolic and diastolic pressures. The difference is the pulse-pressure, which measures the adequacy of the heart.

Heart may increase its output fivefold in an instant. Power may be increased even thirteenfold.

With normal or high pressure, absence of dyspnea on exertion indicates perfect cardiac function at the time. Symptoms of disturbed circulation due to low pressure may exist when the heart is sound.

Vasomotor system should be attacked with this is at fault, and thus protect the heart from secondary damage and from needless or harmful stimulation.

BLOOD-PRESSURE IN DISEASE

BLOOD-PRESSURE IN INTERNAL DISEASES.--

N e p h r i t i s .--

(a) Chronic Interstitial Nephritis (Contracted Kidney). Pressure of 200mm. systolic, and 60 to 80 mm. diastolic common. Pressures of 300 to 350 reported. (Case in the Sanitarium at the present time with pressure of 270 standing, and 250 lying down).

In some cases of contracted kidney the tension is low. May be 120 to 145 mm. Even when combined with phthisis, tension is usually high.

High tension most common and constant evidence of kidney disease. With 200 mm. systolic pressure, kidneys almost certain to be affected.

Pressure rises as the disease advances. Danger of cerebral apoplexy, in extreme hypertension.

Sudden rise of pressure indicates developing uremia.

(b) Other Forms of Chronic Nephritis. High tension may occur in diffuse or parenchymatous nephritis. In amyloid kidney pressure subnormal, and cardiac hypertrophy absent. The same is usually true in chronic hemorrhagic nephritis.

If phthisis is present, blood-pressure is usually low.

- (c) Acute Nephritis. Acute nephritis covers a somewhat miscellaneous group of diseases. In mild cases the pressure is not high.

At onset in scarlatinal nephritis pressure may rise 50 mm. in twenty-four hours. Pressure falls with recovery.

Acute nephritis is often an exaccerbation of chronic nephritis. In such cases high blood-pressure is common with the acute symptoms.

Edema prevents accurate measurements of blood-pressure.

(d) Uremia. Symptoms increase with rise of tension, and disappear as the pressure falls, except in terminal hypotension.

Laqueur reports that in his cases pressure rose from 15 to 20 mm. whenever the symptoms became worse. Pressure fell after xxxxxxx packs which

had a beneficial effect. Pressure fall in his cases began a few days before death. Pal believes that headache, vertigo, disturbed sight, coma and unconsciousness are due to high tension of the cerebral circulation.

CYCLICAL OR PHYSIOLOGICAL ALBUMINURIA.--

Due to disturbed circulation. Peculiar condition present.

Rising from bed and cold baths cause fall of pressure and the appearance of albumin in the urine. Normally, rising from bed and the application of cold produce a rise of pressure.

In these cases warm baths cause first a rise, then quickly followed with albuminuria. The same is also true after light exercise.

These facts indicate the necessity for physical training.

Erlanger and Hooker found the amount of urine increased and the albumin decreased on increase of blood-pressure. Pulse-pressure greatest in recumbent position, hence the influence of rest in albuminuria, causing its disappearance.

The increased albumin depends upon the rate of blood flow through the kidney. The greater the blood flow, the less albumin,and viceversa.

ARTERIAL DISEASE.--

According to Hasenfeld and Hirsch arteriosclerosis causes permanent high blood-pressure and hypertrophy of the left ventricle only when the splanchnic area is involved.

Angiosclerosis.-- There may be cases of too high blood-pressure without external evidence of arteriosclerosis. Find degenerations in splanchnic circulation or narrowing of the large visceral arteries.

Arteriosclerosis affecting the larger superficial vessels has no marked influence on blood-pressure.

High blood-pressure indicates disease of the small arteries, especially of the splanchnic circulation.

Disease of the cerebral vessels cannot be determined by a study of blood-pressure.

Some persons live to old age with extreme arteriosclerosis. Others with little general disease die early of apoplexy.

Hemiplegia usually associated with sclerosis and at least some elevation of tension.

High blood-pressure follows intracerebral hemorrhage. May be ~~5~~ 350 to 400 mm.

Thrombotic softening the most common cause of hemiplegia, even with high blood-pressure.

Medicines to reduce blood-pressure very dangerous in cerebral hemorrhage.

Thrombosis and aneurism, also compression by mediastinal tumors, cause difference in pulse-pressure on the two sides.

DISEASES OF THE HEART-MUSCLE.--

Formerly called "fatty heart" Now called myocarditis.

May be extensive changes in the heart without much loss of efficiency(Rolly, Pässler, and others).

Cases of dyspnea, precordial distress, cardiac asthma, edema and disturbed rhythm, may be either high tension or low tension. The first group include hypertrophied hearts. The second group include the primary uncomplicated forms of myocardial disease.

When hypertrophy is present, cases are those of cardiac hypertrophy with failing compensation, due to increased peripheral resistance. These cases may be secondary to kidney disease, arteriosclerosis, angiosclerosis or myocardial disease, which have taken on Bright's disease or arteriosclerosis.

Cases of hypotension more likely to have edema and failure of the right ventricle.

Cases of uncomplicated cardiac insufficiency may have rather high blood-pressure. May be 135 to 145 mm.

VALVULAR DISEASE OF THE HEART.--

(a) Aortic insufficiency. Diastolic pressure always ~~xixhx~~ low.

Systolic pressure may be high. Pulse-pressure may be over 100 % of diastolic pressure.

Sphygmomanometer may distinguish between a mitral stenosis and the so-called Flint murmur complicating aortic regurgitation.

Pulse-pressure may be high with marked cardiac insufficiency, with dilatation, dyspnea and cardiac asthma.

(b) Other Valve-lesions.-- Pulse-pressure low in aortic stenosis. Lowest in aortic stenosis with mitral insufficiency. May be only 16 % of the diastolic in such cases.

Aortic and mitral murmurs in old people often due to sclerotic changes in the valves which are likely associated with changes in the vessels causing high pressure.

(c) Endocarditis.-- Low pressure.

CARDIAC NEUROSES.--

In exophthalmic goiter there is usually high pressure. It may be low also.

Paroxysmal tachycardia (pure neurosis) normal or low pressure between attacks. Hypertension with dyspnea and other cardiac symptoms indicate beginning vascular disease.

ANGINA PECTORIS.--

High pressure. Pain under the sternum on walking, especially after meals. Low tension with pallor during an attack a grave indication.

Normal blood-pressure a good indication in thesecases when exercise occasions no cardiac distress.

CARDIAC ASTHMA AND OTHER CARDIOVASCULAR SYMPTOMS.--

Paralysis of left ventricle with the right ventricle still beating, a cause of edema of the lungs.

Cheyne-Stokes breathing due to variation in tone of vasomotor center from anemia of the medulla.

In cases of irregular pulse it is difficult to measure the diastolic pressure/

EFFECT OF EXERCISE ON BLOOD-PRESSURE IN CARDIOVASCULAR DISEASE.--

Initial rise of pressure which is greater than normal, but a fall quickly follows.

In normal persons a steady level of pressure continues throughout unless the work be very excessive. This test determines the amount and kind of exercise a patient should take.

THERAPEUTICS.--

Hensen, Potain, Gross and others who are authorities all fall to find any relation between arterial tension and the circulatory improvement from digitalis.

Care must be taken to avoid excess of hypertension.

Effect of nitroglycerin and amylnitrite on lowering pressure is great but very transient.

Sodium nitrite causes a lowering of pressure for an hour or two.

The effect of iodid of potash is in dispute. Relieves anginal pain on exertion, when used in small doses, lowering the tension. (This is ascribed to the effect of iodid in diminishing the viscosity of the blood one-tenth).

Sweating reduces high pressure; hence useful in uremia. Also eliminates poison.

Purgation assists in the same way.

Blood-letting assists in the same way.

Depleting treatment questionable in acute cerebral compression.

ACUTE INFECTIOUS DISEASES.

TYPHOID FEVER.-

Pressure low and variable. The fall in pressure begins in the first or second week and goes hand in hand with the development of the toxemia.

In 115 cases, Crile found the pressure, by weeks, as follows:

First week .....115 mm.

Second week .....106 mm.

Third week.....102 MM.

Fourth week ..... 96 mm.

Fifth week ..... 98 mm.

Perforation causes a sharp rise. In one case from 116 mm. to 165 mm. in two hours. In another patient the pressure rose from 116 mm. to 190 mm. in four hours. In hemorrhage and acute collapse there is a fall of pressure.

Therapeutics of Typhoid Fever.--Mercandino found a more uniform rise of pressure from the cold bath than from any drug.

Influence of the bath on the vasomotor system is more important than its effect on temperature.

One-tenth of a grain of digitalin or strychnin required to produce marked effects in raising blood-pressure. A combination of the two seemed more useful. Camphor and caffein preferred by Mercandino and others.

Pässler found that strychnin only acted on blood-pressure when taken in toxic dose. The effect of strychnin was only temporary. Caffein and camphor caused a considerable rise of pressure.

Alcohol least deserving of the name of stimulant of all drugs. It does not strengthen the heart or raise blood-pressure. This is proven by Mercandino, Cabot, Schüle, and many others. Cannot be relied upon for fighting cardiac or vasomotor collapse. In fact, some danger seems possible from its use under such circumstances.

Ether acts the same as alcohol.

Adrenalin produces its effect for so short a time as to be of no use in acute disease. It must also be injected into veins to act at all. Crile's pneumatic suit also failed in a few cases.

Late Effects of Typhoid Infection.-- Pressures higher than normal found in persons who have had typhoid fever (Thayer). Cardiac vascular changes seem to follow this infection in later years.

PNEUMONIA.--

Subnormal pressure, as a rule. Absent in one-third of the cases.

Collapse comes without warning in pneumonia more then in any other disease. Hence, greater need of watching the blood-pressure.

Pressure rises by asphyxia when cyanosis is marked.

OTHER ACUTE INFECTIONS.--

Subnormal pressure in la grippe.

Subnormal pressure in disorders of children, blood-pressure falling with change for the worse.

THERAPEUTICS IN ACUTE INFECTIONS.--

Saline infusion worthless as stimulant in acute disorders of children.

Beneficial on general principles on account of elimination of toxins.

In collapse with cyanosis, hot mustard baths work well.

CHRONIC INFECTIOUS DISEASES.

TUBERCULOSIS.--

Low pressure. Occasionally find normal pressure accompanying arterial disease

a. Pulmonary hemorrhage. Low pressure after hemorrhage. Moderately high pressure before.

CHRONIC DISEASES ASSOCIATED WITH IMPAIRED NUTRITION.

DIABETES.--

Extreme high pressure (Potain). Sometimes low pressure.

ANEMIA.--

In secondary anemia pressure is generally low.

CACHEXIAS.--

Low tension in the majority of cases.

MISCELLANEOUS DISEASES.

MISCELLANEOUS DISEASES.

Gout is associated with high tension.

Emphysema, chroninc bronchitis and asthma have comparatively high tension,--135 to 180 mm. (5 cm.).

Quirin, on tapping, found initial pressure 14 to 28 mm. At the end of tapping, pressure fell to 4 to 14 mm., a fall of 10 to 14 mm.

Blood-letting of moderate amount causes fall temporarily, followed by rise.

NERVOUS AND MENTAL DISEASES.

DISEASES OF THE SPINAL CORD.--

TABES DORSALIS.--

Fall of pressure in connection with lightning pains. (Pal).

In severe gastric and abdominal crises there was a great rise in pressure. The rise may be more than double.

Pal believes spasm of the splanchnic vessels causes the pain in gastric crises.

DISEASES OF THE BRAIN.--

With high pressure great danger is cerebral hemorrhage.

With low pressure, greater danger is thrombosis.

In extensive hemorrhage into the brain, danger is from high pressure.

Traube-Hering waves with high pressure (280 mm.) indicate compression of the bulb. Traube-Hering waves may be measured by holding the pressure just above the diastolic level(in the sphygmomanometer) and noting if large pulse waves come through periodically; also by watching the oscillations of the mercurial column at the diastolic level, the rhythmic variation indicating Traube-Hering waves.

High and rising blood-pressure indicates failure of circulation to the medulla and increasing hemorrhage. In such cases operation recommended by Cushing, even if the hemorrhage is not otherwise indicated.

Hemorrhage into the posterior fossa has greatest effect on pressure.

Pressure similar in uremic coma and apoplectic coma.

Normal blood-pressure early after paralytic stroke indicates thrombosis as probable, rather than hemorrhage.

In thrombosis measures which lower pressure are injurious, because they diminish the speed of the cerebral circulation and favor an extension of the clot.

TUMORS.-- Tumors do not cause increase of blood-pressure.

GENERAL PARESIS.-- A normal tension with falling pressure, as disease progresses. Rapid fall indicates impending death.

MELANCHOLIA.--

In simple melancholia, no marked elevation of pressure occurs.

In the acute passive type, pressure is always high, falling with improvement.

Chronic melancholia associated with low pressure

Pressure is variable in agitated melancholia.

Alexander thinks the cause of the high tension is toxemia from retained waste products.

MANIA.-- In acute mania the tension is regularly low.

Rosse found rising pressure from continuous bath of long duration, the rise amounting to 20 mm. Patient quieted. Craig made the same observation on baths seven to eight hours long. When baths failed to quiet patients, pressure remained unchanged.

CIRCULAR INSANITY.--

In circular insanity, pressure low when the patient is restless and excited. Hypertension found in the stupor of circular insanity.. Hypertension absent in catatonic stupor of epilepsy.

EPILEPSY.--

Hypertension absent during the catatonic stupor.

Rise of blood-pressure during the fit, as in other convulsions. Rapid fall when muscular relaxation sets in, reaching normal in a few minutes.

TRIGEMINAL NEURALGIA.--

This neuralgia, like other pain, causes a rise in blood-pressure.

INSOMNIA.--

Two forms:-- (1) With high blood-pressure, 130 to 150 mm.

(2) With normal or low blood-pressure.

High pressure patients always showed a fall when they went to sleep.

Drugs that produce fall in pressure induce sleep.

Sleep was possible with high tension, but always produced some fall.

Sleep of great value in cardiac cases, giving the heart rest.

NEUROPATHIC INDIVIDUALS.--

In neuropathic individuals pressure may be either high or low.

BLOOD-PRESSURE IN SURGERY.

Ether raises blood-pressure in first and second stages, but pressure falls to near normal in full anesthesia. Never produces ~~xxx~~ hypotension except in shock or cardiac failure. Pressure rises as the patient comes out of narcosis.

Chloroform produces a fall in pressure from the very start except in labor. In rare cases there is a rise of pressure with chloroform.

Nitrous Oxide causes hypertension. Due to the partial asphyxia induced. Given with ether induces primary rise of tension, and eliminates the ~~xx~~ hypertension of the second stage of excitement, the patient passing directly from the primary rise to the lower pressures of deep narcosis.

Spinal anesthesia with cocain causes a dangerous hypotension.

INFLUENCE OF OPERATIONS.

Operations involving irritation of peripheral nerve-endings causes reflex vasoconstriction and slight rise in blood-pressure.

Generally a slight rise of pressure accompanying the primary incision, amounting to about 10 mm. This is absent in shock.

A greater rise follows ~~stretching of~~ irritation of nerve trunks

as stretching the sciatic nerve.

Stretching the sphincter ani causes vasoconstriction and rise of pressure.

Rupture of a diseased cerebral vessel by the sudden hypertension caused by these slight operations may be the cause of sudden death which is often reported.

Severe manipulations of large nerves, as tearing away large tumors, will cause a sharp fall in blood-pressure. Most marked in the superior laryngeal, causing slowing of the heart.

Kapsammer reports a fall of 110 to 40 mm. with profuse sweating from traction on sciatic nerve during operation on femur.

Section of large nerve trunks produces a serious depressor effect with great fall of tension. Such an occurrence has been noted in operations on the brachial plexus.

Little variation in pressure in operations on bones.

Rough sponging, blunt dissection and strong retraction most likely to cause lowering of pressure. (Crile). These effects due to the depressor fibers in mixed nerves (knowledge of which is as yet incomplete).

OPERATIONS ON ABDOMEN.--

Opening the peritoneum causes much sharper rise in pressure than the skin incision.

Increased pulse rate.

Sponging the intestine, flushing the abdomen, and manipulations of the bowels cause fall of pressure. Upper segment of the ~~intestine~~ abdomen more sensitive than the lower.

All irritation of the peritoneum after the primary incision causes fall of pressure. Due to irritation of the splanchnics (Cushing). May also be due to increase of respiration which occurs at the same time.

Tapping causes slight fall of blood-pressure. Due to lessened ~~intra~~ intra-abdominal tension.

OPERATIONS ON PELVIC ORGANS.--

Manipulations of pelvic viscera, whether vaginal or peritoneal, causes rise of blood-pressure.

A secondary fall, after initial recovery of pressure after operation, of serious prognostic significance.

OPERATIONS ON CHEST.--

Removal of pleural exudate causes marked lowering of tension.

OPERATIONS ON BRAIN.--

Incision of dura mater has no effect on blood-pressure, if a sharp knife be used; but irritation of the dura, either cerebral or spinal, causes a fall of pressure, most marked from sponging.

Operations for relief of cerebral compression after hemorrhage or fracture of skull, cause great drop in arterial pressure as soon as the intracranial pressure is released.

OPERATIONS ON GENITO-URINARY ORGANS.--

Traction on spermatic cord causes fall of blood-pressure.

Removal of a large carcinomatous kidney caused marked hypotension.

Prostatectomy caused a marked fall in blood-pressure in a patient with a contracted kidney.

SURGICAL ACCIDENTS AND DISEASES.

Severe hemorrhage causes a fall of blood-pressure. The great danger is from shock, to which the hemorrhage predisposes.

Treatment: Tendency of blood-pressure to return unaided to normal level. Intravenous or subcutaneous saline solution increases blood-volume, and hence raises pressure. In hypodermoclysis, peripheral irritation causes first rise. Best solution is sodium bicarbonate 0.25%, sodium chloride0.8%. This has been proved to be superior to simple saline solution (Dawson). Head low. Abdominal compression. Crile's pneumatic suit.

COLLAPSE AND SHOCK.--

Fall of blood-pressure first and best evidence of these conditions

Crile applies the term "collapse" to sudden fall in pressure; "shock" to progressive falls in which vasomotor center fails to respond to stimuli.

Sensory irritation causes vasoconstriction by stimulating vasomotor center. This is the usual result of sensory irritation.

Repeated or too forcible stimuli, or stimulation after primary or secondary anemia, produced by profuse hemorrhage, cause the centers to respond in the opposite way. The sensory stimulation then causes a reflex fall in blood-pressure. Each stimulus produces a lower fall.

Danger is in hypotension, not in cardiac failure.

Crile found he could produce as profound shock by repeated doses of strychnin as by reflex stimulation from peripheral injury (burning dog's paw).

Prophylactic Treatment.-- Save blood. Avoid manipulation of abdominal organs. Avoid injury of nerves. Avoid rough handling, blunt dissection and unnecessary loss of time. Avoid chloroform. When large nerve is involved, inject cocain into nerve trunk before division. Crile always injects superior laryngeal nerve in neck operations.

Treatment.-- During operation if blood-pressure falls, stop chloroform. If giving ether, push ether rather than let patient out and then begin again. Complete operation as quickly as possible. Crile considers strychnia harmful and dangerous. Saline infusion in shock is worthless, also alcohol and ether. Nitroglycerin and amyl nitrite are absurd. Adrenalin produces only fleeting effects. Best results in shock are from Crile's pneumatic suit.

HEAD INJURIES. --

After head injuries hypotension indicates no necessity for operation for relief of compression.

Hypertension is direct evidence of anemia of the medulla from compression.

With blood-pressure at 300mm. after paralytic stroke, operation

for removing the clot is indicated (Cushing).

Should make blood-pressure measurements in cases of injury.

ACUTE PERITONITIS. --

Always moderate hypertension. (Crile). Due to reflex vasoconstriction from peritoneal irritation. Highest observed 208 mm.; lowest 156 mm.

Late in the disease, as collapse develops, pressure sinks.

BLOOD-PRESSURE IN OBSTETRICAL PRACTICE.

Blood-pressure should be taken before and after labor.

General rise in blood-pressure during pregnancy. Fall on descent in the ninth month.

Rise in systolic pressure accompanies painless contractions of the later months.

Increase of intra-abdominal tension probably causes the increased arterial pressure.

Marked increase of tension during pregnancy an indication of danger, probably kidney disease.

In labor, rise during each pain. Marked fall immediately after birth. There may be a drop of 100 mm.

The small danger from chloroform during labor probably due to the hypertension.

Use of forceps causes rise of blood-pressure. Also a rise from introduction of hand, so-called pelvic reflex.

Hemorrhage and exhaustion cause hypotension.

Any complicating disease--peritonitis, pneumonia, grippe--causes rise of arterial pressure.

PUERPERAL ECLAMPSIA.-

Hypertension invariably present, as in acute uremia.

High pressure during pregnancy a warning of possible eclampsia. This is more important than the finding of albumin in the urine. When pressure does not fall after labor, eclampsia should be considered imminent.

Postpartum hypertension almost certain to be followed by convulsions sooner or later.

During convulsion pressure goes very high. It may be 280 mm. If relieved by chloroform or otherwise, the pressure falls. Blood-letting does not reduce the pressure.

B L O O D P R E S S U R E

A Lecture to the Junior Class of the American Medical Missionary College, Battle Creek, Mich., Thursday, January 18, 1906,

by

J. H. Kellogg, M.D.

In the first place, what is blood-pressure? We must have a correct idea of what blood-pressure is before we can understand the relation of hydrotherapy to blood-pressure, and of what hydrotherapy can do in the regulation of blood-pressure.

What we call blood-pressure is the tension that is required in the arteries in order to force the blood over into the veins and thus supply the tissues with the nutrient material; and the determination of the blood-pressure is the measure of that energy.

Now, in order to understand the various elements that enter into this problem, we must have a correct idea of the mechanism of the circulation. We will start with the heart. Suppose the heart is a pump. Here is a pump; here is the piston in the pump; here is a reservoir. The pump forces fluid into this reservoir. Every time the pump makes a stroke forward it drives fluid into this large reservoir while the pump continues to work; but of course when the pressure gets up to a certain point where the pressure in the res rvoir is equivalent to the force of the pump, then the pump will cease

to work.

Byt the contents of our reservoir are continually leaking out into other reservoirs. Here is a reservoir that has a capacity equivalent to that of the main reservoir, and the blood is leaking out into this reservoir through small tubes. We call these tubes the arterioles and the capillaries. Here is another reservoir that has a capacity equal to two-thirds the capacity of the main reservoir, and the contents of the main reservoir is continually leaking out into this.

Here is another reservoir that has half the capacity and will hold half the contents of the main reservoir, and its contents are continually leaking out into that through these small tubes; and all these reservoirs are connected.

There is another set of tubes leading from the last reservoir

We have a diagram here which we will allow to represent the general circulation. Here is the pump, which represents the heart. This large reservoir is the arteries. Here are these other reservoirs which represent the great venous systems. This smaller reservoir which holds half the contents of the large reservoir represents the venous system of the muscles. The muscles hold half of all the blood in the body; thatis, they are capable of holding half of all the blood in the body. The larger reservoir has two-thirds the capacity of the large reservoir, and it represents, if you please, the

skin, the subcutaneous tissue. A still larger reservoir, which has a capacity equal to that of the large reservoir, is the aorta and the portal circulation.

From the portal circulation the blood leaks out through another set of tubes~~xxx~~, the capillaries of the liver into this large vein, into this hepatic vein; and this enters the general venous system. This line here represents the diaphragm. Here we have another pump connection which we have not before indicated, which comes into the lungs, to assist in drawing the blood back to the main pump, the heart. The lungs assist the diaphragm to make a suction to draw the blood through the main pump, the heart.

Now the purpose of the heart pump is to maintain pressure in the large reservoir. That is one of its purposes. But there are other things that come into this question of blood-pressure. The reservoir itself is elastic, so that when the heart is forced up, the blood is forced up into the reservoir, and has filled it full, the elastic walls contract upon themselves, upon their contents, and serve as a storage for latent energy which forces the blood onward after the heart ceases to do it.

Suppose we have an elastic bag here and pump water or air into this bag. When we cease pumping it in, the elasticity of the bag will force the air or water out. That is what this reservoir is. When the blood is pumped into it, it becomes distended, contracts, keeps forcing the blood on.

But there is something more than that. The arteries

have contractile walls, especially the small arteries. As these walls contract, rythmically and independent of the heart, they have a sort of milking action. The small arteries force the blood on out of this main reservoir. The small arteries become a part of the main reservoir in the storage of the blood, and they keep forcing the blood on.

Now thereis still another element in the blood-pressure, and xat that is the tissues themselves; for the blood-vessels are surrounded by tissues, and the elasticity of these tissues compressing the blood-vessels help also to force the blood on into the arteries. So they become a source of energy, and the blood is stored up.

What are the various sources of energy which move the blood on, which maintain the pressure of the blood in the arterial reservoir? These sources are, first, the heart; second, the elasticity of the walls of the arteries; third, the contractility of the arterial walls, of the muscles in the arterial walls.

The circulation consists of a pump and reservoirs in which the blood is stored. Now there are two reservoirs, the arterial reservoir, and the venous reservoirs. There is one arterial reservoir, and there are several little venous reservoirs. This idea of venous reservoirs is xxxxxxxxxx old. The world has understood about that, the medical profession have understood about that a long time; but the idea

of an arterial reservoir is new. It is not original with me. A New York doctor suggested the idea, and it helps out very greatly this conception of the circulation.

Here is the arterial pump which pumps blood into one of these reservoirs in which the pressure is high. In one of these reservoirs there is high pressure maintained all the time, and in other reservoirs it is low, almost nothing at all, because they are simply receiving reservoirs. One of the great reservoirs is a distributing reservoir in which material is stored for distribution. This is quite necessary, because the blood is a viscous fluid, a fluid that is hard to distribute; it is thick, and it flows slowly, with difficulty. It is like muddy water in some respects. It is very different from water. It is viscous, and it is difficult to get it through the small openings through which it has to go, so there has to be a power behind it.

The blood does not move by capillary action. Water will go by capillary action, soak through; but blood does not move easily by capillary action; it is viscous; it is sticky, adhesive; it clings to the surface where it is, and when it gets into the small tubes, the natural tendency is for it to stagnate there. The natural tendency of blood is to stagnate, to adhere to the surface it is in contact with; so, in order to move it on, there has to be a power behind it to push it on. You know that lessening the viscosity of the blood will influence the circulation. You have heard that iodide of

potash is a good drug in high pressure. Why? It diminishes the viscosity of the blood; that is all. It diminishes the viscosity of the blood ten per cent, so it has the effect to lessen the amount of work that has to be done to the extent of ten per cent. That is why iodide of potash is helpful, or seems to be helpful in some cases,--because it diminishes the work of the heart by diminishing the viscosity of the blood.

Here, then, is the reservoir in which pressure is to be maintained. What is the normal pressure of the blood? 110 to 112 mm. 25 mm. make an inch, and we use from four to six inches of mercury, so it would be 100 to 130 or 140, or 150 in early adult life. How much would that be in pounds? You know the barometer colum is about 760 mm. or about 30 in. high. Mercury weighs about two pounds to the inch, or half an inch of mercury is a pound; so four to six inches would mean eight to twelve pounds. So that is the pressure the heart has to exert upon the blood-circulation in general, the arterial system--is eight to twelve pounds.

So what are the forces that maintain the pressure in this reservoir? They are, first, the heart, exerting a force of eight to twelve pounds. That is quite a pull, but it is not so great as you might think. You can make that amount of pressure with your breath, or pretty nearly so. To what height can you blow a column of water? Two and one-half feet of water make a pound of pressure. You can raise a column of water to five or six feet easily, and perhaps even more than

that by strong pressure with the lungs. With a little hand bulb you can raise a column of water a good deal higher than that. With a little atomizer bulb you can throw a small column of water sixty feet high. So the heart is able to maintain this amount of pressure continually in the arterial system.

But there are other forces which enter into it, because while the heart furnishes the power to begin with, the arterial walls being elastic, store up some of this energy, and so help to make the pressure continuous. Then there is the pressure of the tissues outside the vessels. The tissues are compressed by the arteries as the arteries are dilated; and as the arterial reservoir swells it compresses these tissues, and they contract again after the heart ceased to beat, and return this energy which has been used in compressing the tissues, return it to the heart, provided the tissues are elastic; but suppose they are not elastic; suppose they are edematous, full of water, hard from exudate, inelastic. Then you do not have that force helping the circulation. It depends, then, upon the condition of the tissues. Suppose the tissues are relaxed, lose their elasticity, then they do not have that force; but if they are firm, strong, then you have a force which helps the circulation all the time.

The elasticity of the vessel walls, the elasticity of the tissues is a subject which has been entirely overlooked until a few years ago when tissue tonous was shown by landaur; it has been entirely overlooked until quite recently.

There is one other thing--muscular contraction; contractility of the small arteries, the peripheral heart. So there are four causes in operation:--

1. The heart contracting naturally, filling the reservoir.

2. The arterioles, represented by these little tubes, contracting contracting at the other end of the reservoir.

3. Elasticity of the vessel walls, and

4. Elasticity of the tissues outsid e of the vessels, serving as a source of latent energy, helping to propel the blood current.

Air pressure is in the heart as well as outside the heart. It is the medium in which we live, so that does not have any bearing except during changes of air pressure, when it might be influenced.

We have the arterial system, the reservoir in which the blood is under pressure.

The venous system consists of reservoirs in which the blood is not under pressure.

Here is the muscular system, and the tonous system--the skin with its vessels. Then we have the portal system, which is a very interesting thing. There is a venous reservoir which has muscular walls, and in it the force of the blood-pressure is reinforced. The portal veins ~~xk~~ contain a store of blood which must all be forced through the liver, and in

passing through the capillaries of the liver, represented by these arterioles here, it has to have a system; so this portal system of vessels that have muscular walls which are naturally controlled by the splanchnic nerve, forces the blood onward to the hepatic vein, and the hepatic vein enters with the rest of the venous blood just below the diaphragm that comes in below; thus the movement of the diaphragm downward, rarefying the air in the chest cavity, lessing the pressure upon the veins, moves the blood back toward the heart.

In this way, it is very easy to understand the mechanism of the circulation, the therapeutics of blood-pressure; but it is very, very necessary to have this conception of the circulation. I was never able to understand it well until I got this thing into my mind.

The arterial circulation--a reservoir in which blood is under pressure in order to be forced through the small arteries into the tissues where it is needed. Then after it is through with the work of the tissues, passing on to a venous reservoir, carried up into the large vessels of the vena cava, and carried to the heart.

So now we have the force of the circulation, and the source of it, and the mechanism of the circulation; and now we have another thing--the regulation of the blood-supply. We will take that up tomorrow, when we will talk also about the therapeutics of the blood-circulation. When we get through with this question so that we thoroughly understand this mechanism, we will see that hydrotherapy is the most beautiful

thing in relation to the blood-pressure; it is one of the most beautiful chapters in the whole subject of hydrotherapy, as it is also one of the most important.

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B L O O D - P R E S S U R E .

A Lecture to the Junior Class of the American Medical Missionary College, Battle Creek, Mich., Friday, January 19, 1906,

by

J. H. Kellogg, M. D.

We will review briefly the mechanism of the circulation. We have first the pump, then the arterial reservoir. The pump is the heart, the heart-pump,--the arterial reservoir. The venous reservoirs, divided into three sections, ~~three connected~~ which communicate more or less closely,-- the muscles, the skin, and the portal circulation.

These reservoirs are connected by small contractile tubes, the arterioles and capillaries.

Then we have the double pump, the right heart and the left heart. The venous reservoirs, connected by the right heart whichpumps theblood from the lungs where we have the same sort of distribution again, andarterial reservoir containing intravenous blood. The small tubes connected withthe venous reservoirs contain, in this case, arterial blood, by which the blood is fed back to the left side of the heart.

Now, we have another thing, a little side show, we might call it, the portal circulation here. The portal circulation is connected with the liver by a series of tubes which connect the portal reservoir withthe secondary venous reservoir. Here are two venous reservoirs connected.

The first portion of the venous system is connected with the second venous reservoir by a set of small tubes.

We have in connection with the portal reservoir muscular walls. The portal veins have muscular walls, and the special nerve which controls

its circulation, the splanchnic nerve, which forces blood through the small tubes into the second venous reservoir, the liver. Part of the blood from the portal circulation finds its way through this second set of tubes into the liver; thence throughthe hepatic vein into the general venous system; but a small part of it passes through in the usual way into the general venous system along with the blood from the skin, from the muscles, and from other parts--a small portion because the portal circulation is connected with the systemic circulation at several points.

This diagram makes the thing reasonably clear. I have given quite a lot of thought to the working out of this diagram so as to make it show all the different things, and it shows them pretty well.

There is one point more: that is that the pump is within an inclosed cavity which is subjected to fluctuating pressures. The pump and part of the venous reservoir are in a closed cavity, the chest, and this is fluctuated by the change in the size of the chest contantly, so that the pressure to which the blood is subjected in the pump, the outside pressure, is continually varying; which is an exceedingly important fact, for when the pressure is diminished in this closed cavity, it exercises a very great and important influence over the whole venous reservoir, over all of them, but most particularly over the portal reservoir. The portal reservoir has the most work to do to get its blood back to the heart again. The portal blood has to go through this set of arterial tubes, and then through another set of tubes to the liver before it gets into the general circulation. So it is reinforced at both ends. The splanchnic nerve and the muscular walls of the portal veins combine to help the blood through; then besides there is the suction of the chest in front.

I had a letter yesterday from a man that I saw in Chicago a few

years ago. Some one had been using the X-ray on him for leukemia. He had an enormously enlarged spleen. Senn had been applying the X-ray over the sternum and the ends of the large bones with the idea that it might help it in some way. But the man was getting worse all the while. He told me he paid Senn one hundred dollars to look at him, and was paying twenty dollars a week for his treatment at the Presbyterian hospital. He wanted to know what might be done. I was interested in this man because I first saw him down at Customhouse Place twelve years ago. He was a drunkard, in the gutter; but he got out, became a good man, is a good man today, living a straigh, upright life. Of course, it was intemperance that brought this thing upon him/ He wrote me an interesting story about two weeks ago, saying that after I saw him in Chicago he went back to Iowa for several months, and seemed to be getting worse. He had given up all hope, thought he was going to die, but a doctor down there somewhere in Iowa took it into his head that he might remove his spleen. He did so, the man recovered, and is now in splendid health, and has been in excellent health for two years. That is a very interesting case. He has been in good healthfor two years after he had been given up by everybody; but he has a discharging fistula in his side which he is anxious to get rid of. It was Mr/ Haines.

In this diagram the venous reservoir for the other organs like the brain and the kidneys is represented along with the skin and the muscles. They are comparatively small. They take but little space, and they are thrown in. They are included in the large vena cava. We might put on another reservoir if we wanted to make our diagram completek in that way, but these three are the ones we make use of.

Now, in order that the blood should circulate, it is necessary that pressure should be maintained in the arterial reservoir. The conception

of the circulation is a reservoir in which the blood is under pressure; the arterial blood forced through a series of small tubes into the reservoirs in which there is practically no pressure. Under normal conditions there is no pressure in the venous reservoir.

Now, what are the forces which maintain pressure in the arterial reservoir? They are:--

1. Heart Energy.
2. Vessel Tonus.
3. Vessel Elasticity.
4. Tissue Elasticity.

Vessel tonus relates to the muscular walls of allthese small vessels, the arterioles, and the capillaries. They are under the influence of the vasomotor nerves, and the sympathetic nerves.

There are two sources of nerve supply of the arterial walls,--vasomotor, and sympathetic. They are two separate, distinct things, under separate, distinct control. So, if the vasomotorm is disturbed, the sympathetic will take up its work after while. Cut the splanchnic nerves, and the pressure in the portal vein will fall speedily, because it is dilated; but after two or three days that pressure will return through the influence of the sympathetic.

Vessel tonus means the contractility of the small arteries, because of their muscular walls. Vessel tonus exists always during life; it is never absent. This is true also of the capillaries. The capillaries have a certain tension, or tone. How?--By the nuclei of the cells which compose their walls. The nuclei can contract, and that contracts the capillaries, so that must be remembered. That may be or may not be--I think it is not particularly--under the influence of the nervous system; but it is a thing

that exists at any rate.

Tissue elasticity. Is there anything else?

Blood volume is the other important thing that has an influence upon blood-pressure. Heart energy is the prime source of blood-pressure.

Now another thing that is essential to blood-pressure is vessel tonus. Here is the heart pumping blood into this large reservoir. Suppose the reservoir was open at the far end so that the blood would run out as fast as it was pumped in, would there be any pressure in it? If the blood ran out as fast as it was pumped in, there would be no pressure at all. There must be a constricted outlet. A constricted outlet is just as important, really, as pressure. Tonus is destroyed entirely by cutting the cervical cord; the blood-vessels relax immediately, and the blood-pressure falls to practically nothing. That is the condition in which we find a patient in the operating room who is suffering from shock. Inhibition was so great, pressure fell to nothing. It was so low we could not measure it with the sphygmomanometer, but I do not suppose it was absolutely nothing.

Vessel tonus and heart energy together maintain pressure.

Vessel elasticity is the elastic tension that is maintained by the vessel walls.

The carotid artery of a dog was found to have sufficient elasticity so that a pressure twenty times the normal could be brought to bear upon it without bursting it. The human carotid has been found to resist eight times the normal pressure; so this elasticity of the vessels is very great.

Tissue elasticity is the elasticity of the tissues outside of the vessels. In these tissues, for instance, there is no elasticity in the bone. It does not yield; it does not stretch, so it does not help the circulation through the bones at all; but in the muscles it has some influence/ In the

liver, the kidneys, and in all organs that have muscular capsule, it has some influence. Are there any muscular fibers in the capsule of Glisson?

The skin is the most important of al, because there is a large amount of muscular structure, and the arterioles of the skin have very thin muscular walls. The muscular structure of the arterial walls of the skin is deficient. But there are muscular fibers all about the arterioles, and by the contraction of these musaular fibers the vessels are compressed; so, though the vessels of the skin are rather deficient in muscular fibers, the skin itself being so full of muscular fibers--that is what makes the gooseflesh appearance/ Do you ever notice any difference in the feeling of the skin after a hot bath and after a cold bath? After a cold bath, the skin is smooth, hard, and firm because of the effect of cold upon the muscles.

The actual volume of blood is much smaller than the capacity of the vessels to hold. The capacity of the vessels is very much greater thanthe volume of blood. There is a surprising discrepancy. So if the vasomotor tonus is entirely destroyed by division of the cervical cord, all the blood leaves the arterial system in a very short time.

What happens after death with reference to arterial tonus, vasomotor tonus? It disappears entirely. Just before death, at the very end, the blood-pressure fals, the heart gets weaker and weaker and weaker, and the same power that weakens the hand weakens the heart, and weakens the tonus, you see. So the arterioles open up; and as the arterioles open up the large arteries contract, and after death all the blood moves on into the veins so that after death the arteries are found empty. The elasticity of the arteries contracts upon the contents, and the arterioles open, and the blood moves on until the arteries are absolutely empty.

Now this blood volume my fall as much as one-fifth; a man may lose one-fifth of all his blood without his pressure falling very much. The blood

may be increased ee-fifth of its volume, or more, mey be evendoubled without increasing the blood-pressure to a dangerous degree. It is important to remember that thing--if a person has a great fal of blood-pressure from hemorrhage, in a very short time the blood-pressure rises again. It falls at once, but quickly rises again, and it can be at once restored by introducing liquid. The amount of liquid that can be introduced is very great. There are a great number of interesting questions with referace to blood-pressure that come up.

What is high pressure? Normal pressure is from nine to twelve or fourteen. It varies with age, of course. Below nine or ten, or 90 or 100, much below that is hypotension. Above twelve or thirteen, much above that is hypertension. I have known tension as high as twenty-four--240. A tension has been recorded as high as 400; but the record was made with a narrow band of five centimeters instead of twelve. The armlet should always be twelve centimeters, and that makes a difference of thirty or forty millimeters. That is because when it is arroe it takes harder compression than it does when it is wide. Suppose youhave a rubber tube with water in it, if you just put a knife blade on it, you have to press much harder than if you put the back of the knife onit, because in the latter case you press on a longer area. The pressure we are considering is hydrostatic. It does not make any difference what the temperature is. It is the hydrostatic principle in physics, you remember. It will help you immenselyin your mind to get these few things figured out.

Capillary suction has scarcely anything to do with it because of the viscosity of the blood. In taking blood-pressure, the armlet must be twelve in order to give you the best results. The blood-pressure will seem to be much lower with a twelve-centimeter armlet than with a five-centimeter armlet. Just within a year or two that has been discovered. They have to correct all

the old records by that fact. For instance, two hundred and forty with the narrow armlet is reduced to two hundred with the wide armlet.

I want to get some of you to volunteer to work awhile in doing a lot of new work on this questia that has not yet been worked out. Nobody has the opportunity that we have here to work this thing out. A number of years ago I did a lot of work withblood-pressure, but I have been so busy lately building sanitariums and getting into trouble in various ways, I have not had time. I might have beentaking blood-pressureinstead. But we are going at it again now; we want to learn some scientific facts. Truth is the thing that is of greatest value to the world. Now, truth is worth a whole sanitarium and a lot of other things.

A pressure was recorded as high as 400, but when that was corrected for the armlet it was only 300. Pressures of 300 have been observed for a year or two at a time. The highest pressure I have observed for any length of time was 240. We have a lady at the Sanitarium now with a pressure of 240--a case of Bright's disease. This pressure might rise very much higher than that before there is any danger. As I said before, the carotid will resist eight times the normal pressure. The arteries of the brain, the smaller arteries are exposed to the same pressure, but they won't resist so much. However, you can believe that the blood-pressure of the arteries,--that the arteries will resist any pressure that can ever be brought to bear upon them under ordinary conditions. They are not likelyto rupture/ Theyhave astonishing power of resistance.

The sphygmomanometer is a measure of blood-pressure throughout the entire arterial system. Why?--Because the thing that makes the blood-pressure is the resistance at the end. Now, if the blood-pressure was at the heart alone it would get less and less and less and less the further you get away

from the heart. Suppose you have a long tube, and we are pumping water into the end of thi tube, and it is open at the othe r end, whe re will the pressure be the greatest? It might be tendpounds, or four, according to the length of the tube. The pressure is used up in friction. It might be so much here, and ten at that end. Suppose we close this tubeup so that there is just a little orifice here, would there be very great difference betweenthis end and that? It would be the same, you see. Pressure in the blood-vessels is due to closure of the distal end of the vessels. That is where the resistance is/ It is the resistance, the tonus of the vessels that raises the pressure. The heart furnishes the energy, but the regulation of the vessel tonus is the thing that maintains the pressure in the vessels; so it is practically the same throughout the whole arterial system. It is due to closure of the distal end of the tube. It is uniform you see. If we find, then, the pressure in the brachial artery, that will indicate what is the pressure everywhere else.

Suppose we have a patient lying down, and have his hand up this way and get the pressure at the end of his finger, would the pressure be the same as it would be at the finger of the other hand held down? No. It would be the difference in the weight of that column of blood. So, for convenience, blood-pressure is always taken with the limb at the level of the heart. That makes the records uniform. The blood-pressure is different when you are standing from what it is when you are sitting down, or lying down; but theblood-pressure in the carotids, whether you are sitting up or lying down, or standing, will be essentially the same, because the blood-vessels of the legs, the regulation will control the tonus.

Now, it is important to be able to control circulation in various pathological conditions, to control theblood-pressure; for there are morbid conditions in which pressure is too high, and conditions in which it is too

low. When the pressure is too high, how may we bring it down? When the pressure is too low, how may we bring it up? There are a great many ways in whichthis canbe done? It can be done with drugs, with a great variety of mechanical measures, movements, exercises of various sorts, various kinds of irritants, and it can be done with water.

The most important of all the things which control the circulation is the splanchnic nerve. That is the nerve which controls the circulation of the portal system. Here is the nervecenter; here is the nerve which controls the portal circulation. This great reservoir is capable of holding the entire volume of blood. How do we know that? If the hepatic vein here is tied, the animal will bleed to death. An animal bleeds to death by simple ligature of the hepatic vein; all the blood simply runs into the portal circulation, and the animal is bled to death. It has been proven by various experiments that it is capable of holding the entire volume of blood.

Now, the peripheral circulation is maintained bymeans of the splanchnic nerve. The splanchnic nerve causes contraction of the portal vessels to such a degree as to force the contraction of the vessels of the periphery. The tonus of the peripheral vessels would have the effect, if there was not some other resistance to it, to drive all theblood into the portal circulation. If the peripheral vessels only were contracted, the tendency would be to drive the blood internally. But this splanchnic controlling these great portal vessels maintains a tone there by means of which the tonus of the peripheral vessels is balanced off.

We may say that the whole vasomotor system is under the influence of the sensory nerves to a large extent. Every sensory nerve has a direct relation with the vasomotor system. Every time a sensory nerve is stimulated, it produces a vasomotor reflex somewhere. The sensory nerves which are

all-important in this xxxxxx work are the nerves of pain, especially import- and are the nerves of pain, and the temperature nerves,--the heat nerves, and the cold nerves, and the pain nerves. In fact, all the sensory nerves; but thesenerves in particular are in direct relation with the vasomotor system in such a way that there is a reflex response whenever a sensory nerve is stimulated. Do not forget that. That is the reason why operations which may give great pain may cause the patient to die of shock. Why? Because there is such a powerful influence upon the vasomotor system/ For instance, if the sciatic nerveis pulled, or pinched, or other great sensory nerves areinjured to a very great degree, the result may be a complete inhibition of the vasomotor nerves tosuch a degree that the patient dies, and the blood all runs into the venous reservoir, so the patient dies from bleeding into his own veins. That is what shock is. That is why a personfaints away when he is scared. Psychic influences have the same effect. A person suddenly turns pale. You see a little shade of pallor on the face. Then usually he gradually recovers.

Some time ago a lady received a letter from home while she was eating dinner. The letter contained somebad news. She turned suddenly, stepped from the dining-room, vomited the moment she got out. That whole thing was purely reflex, and it is due to theinfluences upon the sympathetic, vasomotor system. So that is a very important thing to remember.

Applications to the skin of an irritant character, anything that stimulates the painnerves, or the eld nerves, or the heat nerves, the thermic nerves, anything which does that makes a most powerful impression upon the vasomotor system. It stimulates to a moderate degree. Too strong an application inhibits. We find that with massage. Light massage should stimulate, cause contraction of the vasomotor; but strong massage will inhibit.

A light pressure will lessen the flow of blood; light stroking will lessen the flow of blood in the skin, but hard rubbing will cause redness of the skin. Hard rubbing causes redness while light rubbing has the veryopposite effect. So if a person has too much blood in his head he may relieve it by gentle stroking; but if a personhas not enough blood in his head, is anemic, youcan improve the condition by hard massage. So we have this point again: that one way in which the vasomotor system can be brought under control is by stimulation of the sensory nerves. That is the all-important thing to regulate the tonus and the heart action.

Another fact of great importance is tht the splanchnic nerve is, of all the vasomotor nerves, the most sensitive to sensory impressions. That is a fact that has been worked out by investigators along this line--that the splanchnic nerve is more sensitive than any other nerve to sensory impressions, and the splanchnic nerve is more important thanany other nerve in the regulation of the blood supply. The blood supply of the brain depends more upon the splanchnic nerve than upon any other nerve of the body. The Chinese have the idea that the man's soul is in that part of the body. Some people's souls seem to be pretty near that region from our standpoint; but the Chinese believe that a man thinks with his stomach. When a man gets very bad news of some sort, it seems to strike to his stomach; he feels it in his stomch. Strong emotions of various sorts are felt in the stomach, and the reason why is because the psychic effect operating upon the splanchnic nerve, affects the circulation of the stomach. That is the reason. These emotions which are sensory affect the sensory system; our emotions are sensory and theyaffect the sympathetic cells, and there make an impression. So much for the mechanism and the general facts.

Now, how can we influence blood-pressure as we maywant to do

therapeutically? As I said, there are various drugs which will contract the vessels. For instance, here is alcohol; it will dilate the vessels. When a man takes alcohol, his face is flushed; you feel his pulse, and it is a full, bounding pulse. Alcohol lessens tonus; it dilates the vessels which lead out of the high pressure reservoir into the low pressure reservoirs, and opens up the arterioles. While it opens up the arterioles, it also lessens the power of the heart, the actual working power of the heart; lessens the force of the pump. It lessens the resistance, and lessens the force behind. Now, it is the resistance that causes the rise of pressure to start with. It is the resistance in front that makes it possible to have a rise of pressure. Then it is the power behind that makes the pressure rise. Resistance in front makes pressure possible, and the resistance behind causes a rise of pressure.

Alcohol lessens the power in front of the blood-stream, and also lessens the power behind the blood-stream. That makes lower blood-pressure, and that is what it always does. But if a person faints away, and you give him some alcohol, or brandy, it revives him. Put a little brandy in the mouth and the patient revives, but he feels faint. It is a fact that it does. But why does it? It is simply the irritating effect in the mouth. But some brandy into the mouth, and it smarts; it makes the stomach smart; but shortly after the alcohol gets into the blood and reaches the nerve-centers, then the actual constitutional effect appears; but the first effect is simply an irritant effect; the irritation of the thermic nerves.

Years ago I had to settle that question--whether I would use alcohol in surgical shock or not, or inanesthesia collapse, and I decided I would not do it. I said a hot bag to the back or a hot iron would do just as well as alcohol. That is nothing in the world but sensory stimulation; it is simply

the first effect, but afterwards the effect would be detrimental. If the patient were not going to faint again, it might do; but there is something better. You cangive the patient a good spanking. Just percuss them on the face as hard as you can, box their ears--anything that will smart will do the same thing. Then they will not have the bad after effect.

The doctors have beenrecommending for a long time that the old man should take wine to keep his arterioles dilated; but there is an objection to that. Alcohol in the blood accelerates the arteriosclerosis, you see, and so keeps on hardening the arteries; so there is no defense for alcohol; it falls down at both ends.

Digitalis is another drug. How about digitalis. Digitalis is a cardiac excitant, and it increases the power of the heart, but it increases the work of the heart. What does it do to the arterioles? It contracts the arterioles, so increases resistance, raises blood-pressure. If that is the only thing you want to do, it might be all right, but tellme, does digitalis cause the heart to do more work? Does it actually give the heart any more energy with which to work? It is a poison; so the ultimate effect of digitalis must be damaging. It is just like a whip to a tired horse. The whip makes the horse dance around a little while, he will act as though he is rested, fresh, and young, but the more you whip him, the less strength he has got. Whipping does not put any strength into him. Does it lessen the work of the Horse?

Now, as a matter of fact, the conditions which demand increased pressure are not common. There is little danger from low pressure. The great danger is in high pressure. The low pressure that we have danger from is the secondary low pressure that we will talk about prettyquick.

How about strychnia? It is another drug which excites the heart,

and also increases the tension. Digitalis contracts the openings leading out of the reservoir. The principal effect is supposed to be on the heart, but, as a matter of fact, it does increase the amount of work the heart has to do. The question of strychnia, of course, is settled experimentally in the laboratory. It is generally conceded that digitalis contracts the vessels and the heart both.

Strychnia stimulates the nerve-centers, raises the tone, increases the irritability of the nerve-centers, and it increases muscular tension everywhere in the body. I examined a man here some time ago, and I found his muscles shaking. Everytime I touched him, his muscles would twitch. I found that man was several times a day subject to little fits of twitchings, convulsions. It is the universal effect, becauseof its influence on the nerve-centers. I said to this man, "What is the matter with you?" "I don't know." "Have you been taking medicine?" "Yes." "What have you been takigg?" "Strychnia." I at first thought it might be tetany, but doubtless it was strychnia poisoning.

There are various other kinds of drugs which will raise blood-pressure, and have a certain influence upon the heart and upon the blood-vessels, wwhich operate by contracting the small vessels and stimulating the heart, or by stimulating the heart alone without contracting the small vessels. Generally the drug that stimulates the heart stimulates also the small vessels; and the reason why is this: The vessel tonus and the heart action are bothmaintained by the same sort of nerves, by the same set of nerves. What is the nerve of the heart that excites the heart? The sympathetic nerve is the excitor of the heart. It is a non-medullated nerve. The constrictor nerves of the arteries are non-medullated. The dilator nerves are medullated. We do not know so much about thedilator nerves, but

they are believed to be medullated nerves. The inhibitory nerve of the heart is mudullated also. The compressor nerve of the heart and the compressor nerves of the vessels are medullated nerves, and the constrictor nerves of the vessels, and the accelerator nerves of the heart are non-medullated. They are both the same kind, so it is reasonable to suppose that what affects one would affect the other. When you go far enough back in history, the heart is simply a little dilatation of the aorta. The vessels are a part of the heart and anextension of the heart. The blood-vessels are simply an extension of the heart. When youthink of the heart, think of the vessels of the circulatory system, the heart, the arteries, think simply of the heart as an organ which ramifies throughout the whole body. The brain is an organ which reaches out its long fingers into all parts of it. The heart does just the same thing. The heart and the arteries are one organ, so their different functions correspond. The contractive power of the heart, and the contractive power of the vessels are all under control of the same kind of nerves, come from the same group of centers; so the medicine that affects one ought to affect the other, affect them all; and the influence of any sort that affects the heart ought to affect also the constrictors of the vessels. You will find that rule holds true. If there is an exception in digitalis or strychnia, it seems to me it is not an exception that will hold. Further investigation will show that it is not true, because it must be an anomalous thing if it is true.

Now, by what means can blood-pressure be increased therapeutically? Suppose we want to increase the blood-pressure. If we should increase the heart energy that would increase the blood-pressure, would it not? It would pump more blood into the reservoir. The volume of blood put into the reservoir will determine the blood-pressure to some degree; so the more rapidly the

heart beats, provided the heart empties itself at each beat, the higher will be the pressure. The more completely the heart empties itself, other things being equal, supposing the rate does not change, the more completely it empties itself, the larger the larger the amount of blood which will empty the arterial reservoir, hence the pressure will rise.

Then, if we can increase the rate of the heart without lessening its efficiency, or if we can increase its efficiency without increasing its rate, we shall in every case raise the blood-pressure provided the tonus remains the same. Suppose the heart is emptying its ventricals; the ventrical is three-quarters empty; each time it beats it forces out of itself three-fourths of its contents. Increasing the rate tenper cent, we would increase the pressure proportionately. If we donot increase the rate at all, but cause the heart to contract with greater vigor and firmness so that it will completely empty itself, we would see that by the fuller pulse. The volume of blood sent out to the heart would be larger, and a fuller, stronger pulse even though it were no more rapid than before would indicate a rise of pressure. Can we do either one of those two things? Can we increase the efficiency of the heart in this way? Can we increase the rate of the heart? If we can do either one of those things, we can increase blood-pressure.

BLOOD PRESSURE

Lecture to the Junior Medical Students A.M.M.C., Battle Creek, Mich.,

January 22, 1906

By J.H. Kellogg, M.D.

The question we will consider today is how to increase and how to modify blood pressure physiologically. In order to know how to make use of measures therapeutically we must first know their physiologic effects; so we were studying the other day the question of how hydriatic measures might influence blood pressure. We were studying how the blood pressure may be regulated physiologically, by what means. We will consider the heart energy for a moment. When it is increased the blood is pumped into the blood vessels more rapidly, fills the blood vessels more completely, and thus increases blood volume. In necessarily increases blood pressure, because the amount of blood in the reservoir is increased. Suppose the heart contracts more rapidly, but does not send out any more blood with each beat, but there are beats more often, so there are more beats in a minute. That would result in introducing more blood into the arterial system. How much does the heart hold? We will suppose it is 2 1/2 ounces. Suppose the heart sends out of itself, out of its cavity, an ounce and a half at each beat, and it beats 70 times a minute. Now if we cause it tobeat 80 times a minute, and it sends out the same quantity of blood, more blood will be introduced into the arterial system in a minute than before; and if it leaves the arterial system at the other end at the same rate, the blood vessels would all be full. So if we increase the efficiency of the heart rate the efficiency of the pulse rate remaining the same, the result would be increased blood pressure. If the heart contracts

more slowly , say sixty times a minute, and empties itself completely, so as to send out two ounces and a half at each beat sixty times a minute, what would be the result? The heart beating sixty times a minute, contracting more completely, beating more slowly, so that the ventricles contract more completely, empties itself more completely, and thus introduces more blood into the arterial system in a minute than a heart beating seventy times and contracting with less vigor.

Can we tell what the heart is doing in that regard? Can we tell approximately the condition of the heart as regards its efficiency? We can tell by the pulse. A full pulse means more blood. A large full pulse means larger blood volume. But it is very deceptive. In fact you can not tell that very accurately with a patient that is very fat. The patient who has a very fat skin, especially if a person is edematous, it is very difficult to tell by palpation. A sphygmograph is such a deceptive instrument that you can not tell accurately by that. I have taken many hundreds of tracings with the sphygmograph. I got all the different kinds of sphygmographs there were, had nearly every one of them that was made, and they all have the same defect. You can hardly take two tracings alike on the same patient. You can get almost any kind of a tracing from almost any kind of a case. But there is another instrument that is reliable. That is the sphygmomanometer. You can use the sphygmomanometer in such a way as to give you an idea of the amount of blood issuing through the heart at each beat. If you use Mosso's modification of the sphygmograph, in which you confine it to the fingers only, you can get some idea from that. But that is not so good as the sphygmomanometer. How can you tell with the sphygmomanometer? Suppose you have got high pressure. Say one man has a pressure of 120, another of 150. The heart of the man who has a blood pressure of 150 is doing more work than the other man's heart. But what does that high blood pressure tell us as to the volume of blood which the heart is sending out? When it

is beating the least rapidly, sending out the least blood? We may know this by comparing the rate with the pressure. We may have high pressure and a rapid pulse. If you put a man in a hot bath he will have both a high pressure and a rapid pulse. A man who is running has a rapid pulse and high pressure pulse at the same time. How can we tell this? We can determine it by ascertaining the diastolic pressure and the systolic pressure. We may have a diastolic pressure of 80 and a systolic pressure of 120. That is a difference of 40. In the same patient at another time we may have a diastolic pressure of 100, and a systolic pressure of 120. In which case would there be the largest volume of blood? The diastolic pressure is the pressure between the beats, which is residual pressure, the pressure that is in the arteries between the beats. The heart beats enforce blood into the arteries, and blood gradually leaks out at the other end before the next beat, and the pressure falls. There is another beat, the pressure is raised; then the pressure falls again. Diastolic pressure is the pressure which is left after the pulse wave has passed off and gone on. It is taken in this way.

The sphygmomanometer is placed upon the arm, and the systolic pressure is determined--the pressure at the highest point. Then the pressure is allowed to fall, and when it begins to fall it goes down a good ways; the mercury begins to oscillate. It is allowed to fall until it reaches a point where the oscillation is the greatest; so when you go above that the oscillation is less than it was, and the point of greatest oscillation is the diastolic pressure. The point in each heart beat in which the biggest lift of mercury occurs would be the lowest point, or the point of diastolic pressure. Then if you go below that the wave gets less. This is because your pressure upon the artery is so small you don't get your impulse from your artery. You have got the instrument over the artery, and all pressure is transmitted through the instrument. If the instrument is loosened up you won't get any indication at all of what is going on in the artery; but ifyou tighten up the instrument

until you get to the point where you get the maximum of oscillation, then you have diastolic pressure. Now if you have a diastolic pressure of 100 and a systolic pressure of 120, the difference is 20, and that is the pulse pressure. It is the rise in pressure produced by the weight of the blood sent through the arteries by the heart. The amount of blood pressure through the heart is sufficient to make that rise in pressure. The larger the volume of blood, the greater will be the pressure produced by each beat, the larger the amount of blood forced into the arteries at each beat, the greater would be the change of pressure; then the greater the change of pressure the greater the difference of pressure between systolic and diastolic, the greater the difference would be in pulse volume. So we have in this pulse pressure, or the difference between the diastolic and the systolic pressure, a very important means of determining the efficiency of the heart and the amount of blood that is being sent out through the heart.

A high tension pulse is more likely to have a small volume than a low tension pulse, because the heart has to work harder, and the arteries will offer greater resistance. The higher the tension the greater the resistance of the heart, and the smaller the pulse volume is likely to be. I have just this morning ordered an instrument that will do this with accuracy. This instrument is connected with a mercural column, a rotating drum and a writing stilus, and you can watch the variations as the drum rotates. The stilus records the oscillations of the mercury, and you can mark the pressure at each point. As it gradually comes down you can find the point of highest pressure, and that is the point of diastolic pressure. This instrument that I have ordered is the only absolutely accurate sphygmomanometer. It that is made for both diastolic and systolic pressure. It is connected with a mercural system in such a way that it is proportional all the time. It has a mgnometer connected with it, and you get the pressure from the mgnometer. You notice what the record is on the mgnometer. The mgnometer says, for instance, a difference of 40. If you get a maximum

pressure of 150, then you let the pressure off until you get the widest excursion, and then notice the record. If you read it there ought to be a difference of between 80 and 120. That would be 40, so you put 40 down as the difference. When we get the instrument we want to begin making a whole lot of studies of the subject. We want to study it so that we shall know it, and know it in such a way that we shall never forget it. It is more important to know that we are getting hold of the subject than it is to have simply a college presentation.

As far as the heart is concerned, the heart is generally ready to furnish more energy than is required of it. So long as a man is in ordinary health the heart has a great surplus of energy, more than is required. For instance, suppose a man starts out to walk or to run. How much more energy is required of the heart than under ordinary circumstances? How much larger is the output of energy required? It is 500 per cent. In the case of a man taking the ordinary amount of exercise the heart is required to do five times as much work as when the man is ordinarily quiet, and it is possible for the heart to do thirteen times as much work as is ordinarily required. It is possible for the heart of a healthy man to do thirteen times as much work as it ordinarily does. It is important to remember a few fundamental facts of that kind, because they place before us prominently the actual fact in relation to the reserve power of the heart.

Now we see the same thing is true of the lungs. How much do we ordinarily breath in respiration? A little less than a pint. We will say a pint. We ordinarily take in at one respiration from two-thirds of a pint to a pint of air. How much do the lungs hold? Three hundred cubic inches,-- a little more than the colon. There is 100 cubic inches of residual air. That is, 100 cubic inches of air that you can force out after an ordinary breath. After you have taken an ordinary breath you can get in 100 cubic inches more, so the actual amount of tidal air is from 200 cubic inches up. So the

lung capacity, the amount of tidal air, the amount of air which a man can breathe while he is running, is eight times as great as what he ordinarily breathes. So the available lung capacity is eight times the ordinary lung efficiency. The possible lung efficiency is eight times the ordinary, and the possible heart efficiency is from five to thirteen times the ordinary. If a person of sedentary habits takes vigorous exercise for a short time he will wear his heart out very much quicker than if he did it regularly. He would be more liable to heart disease later on than if he took such exercise regularly. If a person takes violent exercise he is liable to overstrain the heart. Not that he wears it out, but he may damage it. He is likely to break something in the heart. The heart is not prepared for violent exercise. It is just as it is with a muscle. If you lift an enormous weight, and are not accustomed to lifting, you will strain the muscle, and be very sore the next day. You may rupture some fibers or tendons. Here is a man for instance who does not do anything but play the piano. You see his joints are very small. He has long tapering fingers. Here are two men who start out as boys--perhaps brothers, born of the same father and mother, have just the same physique, twins perhaps; one of them becomes a laboring man, the other becomes a piano player, or a literary man, an artist, or something else. Examine these men at twenty-five years of age, and you will see that one has large knuckles like mine, while the other will have long slender tapering fingers like some of yours. That means that one has subjected his bones and his tendons to hard strains, to hard pulls; and when you pull hard on the tendons the tendons spring out and becomes permanently hard, and gets a larger attachment upon the bone; so you will see the entire system--muscles, tendons and bones adapt themselves to the work they have to do.

Exactly the same thing is true of the heart. The heart muscles and tendons control the valves, and the valves themselves, if they are subjected to hard work, adapt themselves to the work that is required of them.

The probable reason why valvular disease is more common in the hard working man than in others, is that these men subject themselves to exposures and get rheumatism. Valvular disease comes from rheumatism more often than from any other cause. These men smoke tobacco and expose themselves. Why do these men get attacks of rheumatism more than others? Haig has called attention to a very interesting fact, that is the relation of the solubility of uric acid to disorders of that kind. Uric acid is soluble in cold water in the proportion of one part in a thousand. It is very insoluble in cold water, very insoluble. Here is the blood completely saturated with uric acid. It is circulating through the hands and feet. The hands and feet get so cold perhaps that they are nearly frozen. They do get a little frosted, so that they are chilled. They have actually reached the zero temperature. What would be the effect of this on uric acid? It would precipitate the uric acid, you see. That is probably the real cause of chilblains--the precipitation of these waste products in the tissues, which afterwards become the cause of irritation. Now this is the reason why laboring men are perhaps more subject to rheumatism than others, also to general troubles. They are exposed to cold. Indeed exposures to cold are very likely to produce damages of all kind, and the heart becomes involved in it. The heart is a serous membrane, and is very likely to suffer along with the rest. When we find a man's blood pressure low, it may not mean at all that the heart is weak. It may mean something else entirely. What else might it mean? It might mean vasodilatation. The blood pressure is low, and the blood pressure then does not indicate anything but the actual energy of the heart except in certain conditions.

Here is a man who has high blood pressure. Is going around feeling pretty well. What does that indicate? It indicates that he has got a good stout heart. That is a thing that is worth thinking about. When you have a man with high blood pressure going around feeling pretty well, it means he has a good strong heart, which is able to do that work well. Otherwise, he would be sick. He would have edema, or he would be short of breath, have

dyspnoea; have variour other troubles. But if you find a man going around feeling all right with a high blood pressure, a pressure of 200 perhaps, you may be sure that man has a pretty good streng heart. It may last that way for some time; you can not say how long. It won't last that way very long if he goes on smoking, drinking whiskey, eating condiments, mustard, pepper, pepperssauce, roast beef, etc.,--he will go down quick. But when you find that sort of a patient, there is time to do something for him.

Suppose you find a man with a blood pressure of 200, and his arteries are getting hard. He says "I am all right." You ask him if he is not short of breath, and he says No. Then you ought to be thankful that you have gotten hold of that man at that time. Lay right hold of him, explain this whole thing to him; let him see what a fortunate thing it is that you have gotten hold of him in time to save him. The fact that this man's heart is doing such good work is proof that there is energy behind. The heart is not so seriously damaged as yet but what, if you can lessen the work, save the heart energy, the man may go on for a long long time. The thing for that man to do is to lessen the blood pressure as quick as he can, and to keep it down, and so save his heart. What will be the best way to do that? --By giving the man some kind of a drug to weaken his heart? Is high blood pressure in disease an unfortunate thing? No. High blood pressure is the only thing that saves that man's life. The arterioles are closed up, and the high blood pressure is due to the response of the heart to meet the emergency, you see. There is a stronger demand for blood in the distant parts of the body, so the heart is doing hard work to get the blood through these small arteries. When that is the case, you do not want to give that man anything to weaken his heart.

Just think what an enormous amount of mischief is done by drugs that weaken the heart. The Materia Medica that you study is a museum of antiquities. Nobody ever thinks of using more than fifty of the drugs that are mentioned in that art collection. It has hundreds which have been thrown

into that sort of limbo in which have been cast all the drugs that have been used in the experience of medical men during the ages. You find mentioned there remedies that were used 2000 years ago, and have been used scarcely at all since, are not in use at all now, that nobody ever thinks of using. Prof. Fisher was telling me about a doctor in New Haven who called the other day to see his little boy. He said "Give him some calomel." He could not practice medicine upon children without calomel. Prof. Fisher objected. "Well," he says, "you will have to go to another doctor." He said, "I don't believe much in drugs; don't use but three or four drugs, and calomel is one of them." He only used three or four out of the whole materia medica, you know, so you can see what the rest of them are worth. As far as we are concerned, we can dispense with thos three or four that he is using, and get along better than he does with the three or four.

If this heart is doing more work that it can safely do, if the man has a blood pressure of 200 when it ought to be 100, if we can lower the blood pressure by removing the cause of this high blood pressure, then we shall help the patient.

Is it ever the case that a high blood pressure is the cause of too strong a heart? No, it is never the case. There is sometimes excessive compensation, excessive hypertrophy of the heart, and certain cases of valvular disease. It is undesirable, because it is certain to be followed by degeneration . That is, the difficulty with compensation which comes from cardiac disease. But that compensation is certain to be followed by and by by degeneration, and so the more the compensation is the greater is the likelihood of degeneration, and the earlier it will come, because the heart will get worn out too quick, you see. Every organ has its life, and the strength shown is the strength of the weakest link.

There is a great triumvirate of life--what is it? The brain, the lungs, and the heart: the nervous system, the respiratory system, and the

heart. These are the three great things upon which life immediately depends. If one of them fails, you die right away. The liver can fail, and you can live two days and a half. The kidneys can fail, and you can live a week. The stomach may fail, and you can live a month or two. But if the heart, or lungs, or brain fails, it means death at once. So the heart is never too strong. So if you have got a high blood pressure, you never should think of such a thing as doing something to weaken the heart or to bring down the blood pressure, because the heart is only working extra hard to keep the blood pressure up in order to feed those starving tissues away out on the remote borders of the body, that can not be reached except through the narrow contracted channels which are the result of the degenerations taking place.

What do you suppose is the principal cause of high blood pressure? Here is a man who has got arteriosclerosis. We will say he has kidney disease. We feel of his arteries, find they are hard, and we say there is a general arteriosclerosis. Is that sufficient to give that man high blood pressure? Suppose we have a patient here exposed to cold, put into a very cold bath. That cold bath won't raise the blood pressure very much. It may raise it about twenty-five or thirty millimeters, but not more than that. In some experiments several years ago the patient was made to drink five glasses of ice cold lemonade, one right after the other. How much do you think that would raise the blood pressure? Just ten millimeters, that was all.

There are three great venous reservoirs here, the muscles, the skin and the portal circulation. The muscles will hold half of all the blood in the body, the skin will hold two-thirds of all the blood in the body, and the portal circulation will hold all the blood in the body. Here are the superficial arteries of the body, the arteries which go to the skin and to the muscles. Suppose their arteriosclerosis is quite marked, so that we can feel them under the finger, so that you can feel the radial artery between the beats. Ordinarily we should only feel the radial artery at the time of

the beat, but should not feel it at any other time; but when you can roll the radial artery under your finger, and feel it a little between the beats as well as during the beat, that means a hard artery, or a rigid artery at any rate. Then if you can feel that it is twisted, a little tortuous, that shows that its elasticity is gone. It is like lead pipe. Some years ago I put in a lead pipe gutter in the bath room. On looking in there a couple of days afterwards the lead gutter was twisted into the shape of a snake, or of a worm, because every time the hot water went into it it stretched a little, and contracted when it cooled off, but it didn't go back into place. It kept stretching and stretching until it was nearly two feet longer than it was when we put it down. I used lead on the recommendation of the carpenter, I am sorry to say. Now these arteries are just the same thing. An artery which is relaxed expands and contracts, but when it becomes rigid it loses the power to contract and get back again, and keeps stretching until it becomes tortuous in that way.

Suppose you have that kind of an artery in the wrist, in the superficial arteries, is that sufficient to make high pressure! Something more is necessary, and this is extremely important. The trouble is not in the large trunks chiefly. What we feel in the radial artery is not the cause of pressure at all; it is simply an index to the state of things in the body. That condition causes changes in the arterioles. The arterioles are shriveled up, so they are disappearing,-shriveling and withering away. The nkmd little ones are drying up. The arterioles run off here. [redacted] This becomes infected by and by so that it closes up the pass. Babies often die with croup. Grown people do not. Why is it? Here is a baby's lungs, here is a false membrane that forms on the inside of its lungs and closes them up completely. Here is a man's lungs. The same false membrane forms in his lungs, and the membrane in the baby's throat is just as thick as it is in the man's throat, but the baby's throat is smaller, so it shuts it up.

That is the way it is with the arterioles, you see. There is an arteriole which runs over here, divides, and as it comes down the smaller ones thicken, the larger ones thicken in just the same way; but when the smaller arterioles thicken they are closed up completely, so of course all these little twigs are blown about, and the tissues in that part fail. That is why an old man shrivels up, why he gets shorter,--his brain shrivels up, his liver shrivels up, his muscles get smaller, shorten up because of starvation.

Now there is another thing present. Here is a man with high pressure. Feel his pulse, and his radial artery feels all right. You may not find any evidence of arteriosclerosis at all, yet he has high pressure. He has arteriosclerosis just the same. It is generally believed at the present time that there is no such thing as high pressure without arteriosclerosis. Arteriosclerosis of the arteries of the skin would not be sufficient to make high pressure; or of the arteries of the muscles, or the arteries of the kidneys would not be sufficient. It is the visceral arteries. Here is the place where arteriosclerosis does its mischief, down in this region. Please don't forget that thing--that you can not have such a thing as very high pressure without changes in the portal circulation. Recent studies of that subject have shown that in cases of kidney disease, cases of renal disease, that condition is always found by changes in the arterioles of the visceral circulation. Just remember that. That will clear up a whole lot of things. This whole subject has been awfully blind. It has been hard to get anything out of it until within the last few years. In the last few years there has been such a constant study of the subject by such a great number of eminent internists that the facts have been brought forth. The collaboration of laboratory men with pathologists and internists all together have brought together a mass of facts which are harmonious, and we can see now the reason why a man with kidney disease has high blood pressure, and we know it is

not because it is hard work to get the blood through the kidney of that man, we know that the mechanical resistance is not sufficient to make high blood pressure. It is impossible, because the area involved is not sufficient. There are several reasons. There is an accumulation of urea in the blood. The heart works harder reflexly, and protectively the heart is made to work harder, in order to get more blood around through the kidney, so that it will eliminate urea, and toxines accumulating in the body have doubtless an effect upon the heart to produce a compensatory hypertrophy in order to enable it to do the work required of it. But back of it all there is mechanical contraction of the portal circulation through degeneration of the portal arteries in the liver and the other viscera.

Now we see what an important work that is down there. Voix has shown that alcohol produces sclerosis of the liver. Everybody knows that. But he has shown that pepper has six times the power that alcohol has to do that. Pepper has six times the power of alcohol to produce sclerosis of the liver. Mustard, pepper-sauce, horseradish, ginger, all these things have the effect to produce sclerosis of the liver; and when this condition of sclerosis is present in the liver it is found in the spleen also. He gives his cuts there, gives the microphotographs to show the facts, and they are wonderfully interesting. Uric acid has the same effect. An extract of the feces has the same effect to produce sclerosis of the liver. The toxine products of the colon bacillus, beef tea cultures of the colon bacillus, produce the same effects, produce sclerosis of the liver and of the spleen, and of all of the viscera; so there, you see, is the cause of the high pressure. It is very apparent, isn't it? It is plain enough, and how important it is that people should know this thing. How important it is that people should know the facts. I once heard an old Irish doctor say that "people dig their graves with their teeth;" and you can see they are actually doing it. People are making high blood pressure by the things they are

putting into their stomach all the while; so the thing to do is to remove the cause by regulating the diet. But the regulation of the blood pressure, so far as the heart is concerned, will depend not on weakening the heart, if the pressure is too high, but on lessening the resistance. Suppose we have a heart that is too weak. When there is a defective heart the man has high blood pressure. What can we do? Can we energize the heart and make it do more work? We certainly can. What can we do? Apply cold water over the heart. Apply cold friction to the surface. How does that increase the output of energy by the heart? It stimulates the accelerator nerves.

Suppose the blood pressure should get too high. Suppose the bath gets too cold, so that the energy would be raised too high and the blood pressure raised too high. Is there are remedy for that? Is there any great danger? What will happen?. There is not so much danger as there seems, because there will be a reflex from the heart. When the pressure rises to a certain point there is an automatic reflex that comes in. It is a safety valve. What is that automatic reflex? It presses on the depressor nerves of the heart, and the depressor nerves of the heart cause slowness. It opens up the splanchnic area, you see, and relieves the pressure in front of the heart, and so diminishes the volume of blood and lessens the work the heart has to do.

Now there is vessel tonus. Suppose we have low blood pressure. We know that the patient needs high pressure. What is the first thing we should do when the blood pressure is low? Would you say to yourself, Now this patient has got a weak heart; I must stimulate his heart? What would you say about that? The vessels may be dilated too much, so that to begin with you will contract his vessels; you will make an application that will contract the peripheral vessels, the arterioles. What effect will that have? Suppose you should do that. The blood pressure is low. You make a cold application, and you find that the blood pressure instead of rising, does not

rise at all. What would you do? What might bring about such a state of things as that? A dilated heart. When we make a cold application, that drives the blood inside, and still further distends that dilated heart, so that its work is still more inefficient than it was before. The heart is not able to contract itself and get the blood out of itself into the arteries. The pressure is already so high, because the heart is so weak, and that weak heart is not able to get the blood out of itself into the arteries. Now then suppose we make a cold application, drive the blood into the veins, and you distend the heart still more, then what? Then the heart is able to do less than it did before. Now then that is a very very important thing, and I have seen great damage done by attempts to stimulate the heart; and it is exceedingly important for us to understand this thing, so we won't do our patients harm instead of good. That is a particularly important point, for there are plenty of cases which come to the Sanitarium in which that very state of things exists. Where the heart is already so weak it is not prepared to respond to a cold application, a cold application will lower the pressure instead of raising it. I have seen that thing done. I saw a patient once die as quick as though he had been shot. The attendant put on a cold application, and he died just as quick as though a bullet had been put through his head. He had a dilated heart, you see, and before that cold application was put on something else should have been done. They ought to have gotten that blood out of his heart. One way to do that is to drain it into the skin. A moderately warm bath would be the best way. A warm bath has a depressing effect uponthe heart, so it would not be the thing in all cases. Friction is the thing. Which way? Centrifugal friction--friction toward the heart. Then there is another thing. We can unload the heart by raising the patient up in bed. That is one way to do it. These patients can not breathe lying down, because the blood runs out of the portal circulation into the chest, you see. Raise the patient up, and he can breathe all right. That is why the patient

wants to sit up in bed; why he can not breathe lying down. You see the reason for that, don't you? The patients do better sitting up. We may ligate his legs, or put hot compresses on his legs. That is an excellent thing to do. Put on a heating abdominal compress, a wet girdle covered with mackintosh, so that we can regulate the blood in his portal circulation. That will help him. Then after doing that we could apply the cold application. Many and many a time, in ~~many~~ many of my prescriptions for an ice bag over the heart I put in a little note "Precede by friction; precede by friction." Why? or" Precede by cold mitten friction." In many cases cold mitten friction is the best thing, because it is applied to a small area at a time. One area is rubbed until it is red; that draws the blood into that part and fixes it there. If you get a friction reaction, the mechanical reaction, and also a good thermic reaction, you have a double reaction, which will fix the blood in the skin, and hold it there very much longer than either one alone; . so cold mitten friction preceding the cold application draws the blood into the skin, and then we can apply the ice bag over the heart to stimulate the heart a little, and everything will go well. But the cold friction must come first. You can easily see the importance of that. I hope you will never forget it, because some patient's life will depend on it sometime. Do not fail to remember it, and teach it to your nurses. Your nurses learn that an ice bag is good for a weak heart, and they put it on everybody. They learn cold friction is good, and they apply it to everybody. What would you think of such a case as that sent down to take a cold morning spray? The man might drop dead--go headlong on the floor. The worst thing in the world in hydrotherapy or physiologic medicine is routine. It is positively a deadly thing to have a routine method of treatment. We must know the physiology of things, know the foundation facts; and when you have got them, then you are intirely independent of anything. You must learn your patient's

condition, but you don't have to know what it is he is suffering from. You don't have to make a diagnosis. You can't always make a diagnosis. Here comes a man with a weak heart. You can not always tell. He may be so fat you can not tell anything about his heart. A man who has three inches of fat over his chest, you absolutely can not tell what is the nature of his heart. Even Dr. Babcock could not tell if he had a weak heart, with three inches of fat over it. With all his acuteness he could not make a diagnosis on the heart and be sure that he was right. But if you find the patient has a weak heart, and he takes the sphygmomanometric test, you see what his blood pressure is, and you notice that he has dyspnea, whether he has edema or not. You just see what his condition is, then you know what to do for him; and then perhaps you can tell what is the name of his disease, because you know what his conditions are. But it does not make any difference whether you make a diagnosis or not, you know his heart is not able to do the work, and the blood pressure is low. You must do something to encourage the heart and help it by lessening the work it has to do. Then the heart will take courage and begin to pick up. We want first to get a clear view of the ground, and then we will take up the treatment a little later.

JHK v--m 2/9'06

BLOOD PRESSURE

Lecture by J.H. Kellogg, to the Junior Medical Students, Tuesday, Jan.23,1906.

In what ways can we increase vessel tonus? It may be increased thirty or forty millimeters by cold baths. We can see this thing, and it all seems very easy. It has also been found that hot baths increase blood pressure, while warm baths, neutral baths, baths from 90 to 100°, in fact you find baths from 90 to 107° will lower blood pressure at first, but later the pressure rises, so that all baths increase blood pressure, but they do it differently. Cold increases blood pressure very much at first, but later there is a fall of pressure.

Why would you expect a fall of pressure? Cold stimulates the vasomotor centers very powerfully, just as pain does. But after a time the center becomes exhausted, and then there will be a fall. Paralysis comes from very long continued stimulation. Heat produces a rise of pressure at first, but later a fall of pressure. Why? Because heat powerfully stimulates the reflex action. That is, a very hot bath powerfully stimulates the vasomotor centers, causes contraction of the peripheral vessels, and of the splanchnic vessels, the splanchnic area as well; and when the pressure rises very high the depressor nerve is brought into action later by ~~suffusion~~ retention of the heart. That opens up the flood gates into the splanchnic area, the portal circulation, and lowers the pressure.

How does the neutral bath operate? The neutral bath is warm; shuts off all the peripheral stimuli which stimulate the portal circulation, reddens the skin, shuts off the reflexes from the surface, being neutral; so the vasomotor stimulation is diminished. Sensory stimulation is diminished by the absorption of water by the cutaneous nerves, so that the sensory stimulation of the vasomotor centers is lessened, and that causes a fall in pressure. But if the patient stays in the bath a long time, an hour or two hours, or three hours, six, eight, or ten hours, water is absorbed, and the

absorption of water into the blood vessels at this temperature, the temperature of the body, raises the pressure by increasing the volume.

We have another evidence of that. What is one of the marked physiologic effects of the neutral bath? There is one very distinct effect produced by the neutral bath--a distinct positive effect, the dieuretic effect of the neutral bath. The neutral bath increases the urinary secretion to a very marked degree. That is one thing certainly to be remembered. That is one of the positive effects of the neutral bath--it increases the urinary secretion.

Under what conditions is water absorbed by the skin? When the temperature of water is less than that of the skin. When the temperature of the bath is less than the temperature of the skin, then water goes in. When the temperature of the water is greater than that of the skin, water comes out. That is natural, isn't it? When the temperature of the water is less than that of the skin, the skin is warmer than the body, then it will be absorbed. Why? Because the skin vessels will not be over-filled, will not be distended. When there is a vasomotor paresis, dilatation of the surface vessels, or stimulation of the sweat glands, the water flows out; but when the temperature of the bath is less than that of the body, then the water is absorbed.

Now we have three kinds of baths: cold baths, hot baths, and neutral baths. Cold baths increase blood pressure, and sustain the increase of blood pressure for a long time. Afterwards, after quite a while, there is a slight tendency to a fall. If you found a man freezing to death you would very likely find his blood pressure very low. A hot bath produces a rise of pressure at the start, and afterwards a fall of pressure. Why? It dilates the surface vessels, stimulates the vasomotor centers at the beginning, and increases the volume of blood poured into the arteries, and later it dilates the vessels.

Three or four years ago I gave a man an electric light bath. When he went into the bath his blood pressure was 90. At the end of twenty

minutes it was 70. At first his blood pressure raised a little. Put the patient into a very hot bath, and his temperature will come up considerable.

What is the effect of the cold bath upon the pulse? It slows the pulse. What is the effect of very hot baths on the pulse? Try the experiment, and see what the actual effect is. Cold is a therme stimulant. Heat is a thermo stimulant. Both stimulate the vasomotor centers. When cold is applied to the skin it causes a rapid movement of the heart at first-- the stimulation of the heart for just a moment; but pretty quick the vasomotor centers cause contraction of the blood vessels, and just the instant the blood vessels contract, then the heart is slowed. There may be two or three jumps of the heart quickly, but the real effect is to slow the heart; that is the real effect of it. First the patient makes several rapid movements of the chest when cold is first applied. It is simply the first instant effect, but as soon as there has been opportunity for contraction of the small arterioles, that raises the blood pressure, and that slows the heart. Just like putting sand on the rails under a locomotive when the engineer finds the wheels slipping around on the track. When he puts sand on the wheels, the wheels then catch and go slower. As soon as the blood vessels are contracted, the end vessels, then the pressure will begin to rise and the heart will go slowly. Apply very hot water, and see what the effect is. The cardiac center is stimulated, but the arterioles are opened. The first effect is to cause the heart to beat with greater force and greater volume, so that blood pumped into the vessels fills the vessels. For the first moment the vessels become filled. A larger volume of blood is put into the vessels, and the vessels become distended, and a much larger volume of blood will be the natural effect of it.

What would be the natural effect of that? That would have the effect to raise the blood pressure and slow the heart. But the arterioles quickly dilate, and soon after the arterioles have dilated, then what would be the effect? It would be to quicken the heart movement. The general effect would be to increase the rate of the heart. But we must remember that pulse rate and pressure do not always go together. There are some observers who claim that the pulse is quickened with high pressure, while others claim that it is slowed when there is high pressure; so we must determine the pressure by actual observation.

VESSEL TONUS

How can we increase vessel tonus? One way is by cold water. That is one means by which we can increase vessel tonus--by making cold applications to the surface. A general cold bath will do much also, by contracting the peripheral vessels. Cold mitten friction will do much. General massage has the effect to lower the pressure. Reflex stimulation of the skin, as friction upon the skin, lowers the pressure. Very light friction raises pressure, but heavy friction lowers pressure. The injection of normal saline solution will raise it. A neutral bath does not increase vessel tonus. It increases volume. I introduce that has a means of contrasting the effect of each of the different kinds of baths.

Our work must be on a strictly scientific basis. We must not apply a remedy to a patient unless we know the effect it is going to have. We might waste a lot of time and money for the patient, and waste your own time and energy, and do harm besides, by not knowing the effect of a certain application. It would be idle to waste time with electricity. I don't know of any way that electricity could be applied that would really raise the vessel tonus of the general surface. You can do it locally with electricity, if you know how to do it. Pässler found that strychnia only raises blood pressure a very little, and it takes a poisonous dose. One-tenth of a grain of strychnia

is required to raise blood pressure. The heart will be slowed by the strychnia without the blood pressure being raised. When you come to test the blood pressure with the sphygmomanometer you find there is no increase of blood pressure. Crile experimented on 243 dogs. He killed 243 dogs in his experiments in order to test that thing out, and he found that strychnia was absolutely useless as a means of raising blood pressure. You must raise the general blood pressure by applying the sinusoidal current in such a way as to contract the mesenteric circulation and apply it to the splanchnic nerves. Apply it is such a way as to contract the abdominal muscles, and the vessels in control of the splanchnic nerve will raise blood pressure. Electricity increases vessel tone. It will contract the mesenteric vessels through the splanchnic nerve.

Now the question is, How can we get the best effects from its application? Where do the splanchnic nerves come from? How many splanchnic nerves are there? How many different dorsal nerves are there, and how many branches. There are three splanchnic nerves. What are they called?--Greater, lesser, and least, is a good way to get at it. What is another name for the least one? It is the renal splanchnic. But I always put it this way to remember it: There are three splanchnic nerves, the greater splanchnic, the lesser splanchnic, and the least splanchnic. The greater splanchnic comes from the sixth to the tenth dorsal. From the upper sixth also. Really the greater splanchnic has filaments from the first ten dorsal centers. Where does the lesser splanchnic come from? The tenth and eleventh dorsal centers. Where does the least splanchnic come from? There is just one left, and it comes from that one--the twelfth.

So remember the greater splanchnic comes from the sixth to the tenth dorsal centers, the lesser from the tenth and eleventh, and the least from the twelfth. So you see these splanchnic nerves are controlled principally by the lower half of the dorsal cord. Then if you are going to

make an application to control the splanchnic nerve, how would you make it? Make it over the lower half of the dorsal cord and over the abdomen. That is very easily demonstrated. Have the patient sitting in a chair, put two sponge electrodes on the dorsal spine just below the shoulder blades on either side, and you will see the abdominal muscles drawn in very hard. And at the same tim e the abdominal muscles are contracted the inner branches produce some centers which contract the vessels of the viscera and the whole splanchnic area. That is the best point to reach it. Apply one electrode to the lower half of the dorsal region, and another electrode below the sternum, down below the umbilicus, right down below the spine on either side--an electrode about a foot in diameter in front, and an electrode about a foot long behind, and make the current just as strong as the patient can bear it, strong enough to cause contraction of the external muscles. If you do that you get the contraction in the internal muscles and vessels as well, and get a rise of blood pressure. You can see the hepatic areas actually diminish.

I remember some time ago I demonstrated that fact to Dr. Riley and the rest of the doctors in the electrical department. We had an enlarged liver. After making this application the liver had diminished actually a whole finger-breadth in thickness. So electricity is one way of raising blood pressure. It is possible to raise the blood pressure about twenty millimeters with the high pressure current, but it is a question how much of that is due to psychic effect. Anyway a change in blood pressure of twenty millimeters does not amount to very much. Unless you can demonstrate the change greater than that, the change might be due simply to excitement of the nerves; but you can demonstrate it, because the blood pressure will go up immediately, and then down again. If the blood pressure rises, then immediately falls when you withdraw the application, then it is reproduced again as soon as you make the application, that would be of course a demon-

stration. But if a patient comes in, you take his bloodpressure, set your X-Ray machine going, your high frequency current, and all the pyrotechnics of the electrical department there, I am inclined to think the psychic effect might be enough to account for that. If you take the blood pressure of two people, and apply the current to one of them and not to the other, you can demonstrate a slight rise of blood pressure. It might be the sensory effect, it might be the excitation of the skin, which of course would have some effect. But how much comes specifically from the electricity, I do not think we know yet. We ought to get more than twenty millimeters if the electricity really is effective.

In hypoder~~mic enema~~moclysis the volume is increased, but not the tonus. The cold enema will raise the blood pressure. How will it do it? It will contract the vessels of the splanchnic area. Water will be absorbed later, but immediately it would increase the volume of the abdominal contents, and would have an effect similar to that of mechanical compression of the mesenteric vessels in raising blood pressure.

There are some other splendid methods of raising blood pressure that we have not yet mentioned, more practical than any that have been mentioned. Suppose you have a patient suffering from typhoid fever. His blood pressure is low. Cold mitten friction raises blood pressure, but in typhoid fever you always apply the cold abdominal compress. What does that do? It reflexly stimulates the splanchnic nerve. The great value of the cold abdominal compress is that it stimulates the splanchnic nerve, which is the most sensitive of all the vasomotor centers of the body. It is the most sensitive to sensory impressions. So that is why we operate on the splanchnic. There is another very sensitive vasomotor area in the skin, and that is the soles of the feet; and that is a very important thing to remember. That is the reason why we use the hot foot bath. I called to see a patient yesterday who was suffering terribly from pelvic pain--a lady

cold, and the nurse thinks she is very faithful and efficient by keeping that cold compress on the abdomen constantly; so she overdoes the thing, and does great harm instead of good. That is just the way to promote hemorrhage, to produce stasis, and it is the very worst thing possible.

We must take the blood pressure of every sick patient. We shall soon have our new Erlangers instrument, which is more accurate than anything we have now, and we must take the diastolic pressure as well as the systolic pressure. There are a whole lot of things about blood pressure that are all ready to be discovered.

JHK

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suffering from some terrible pelvic pain. There was acute inflammation of the rectal tenesmus, and there was very severe pain and acute pelvic congestion. This lady had been doing various things, but had not gotten any relief, but really felt worse. I ordered for her a very hot foot bath, with the water to be made hotter, and hotter and hotter all the time. Only a short foot bath--three minutes long, but the water to be made very hot. And at the end of that hot foot bath she got relief and went to bed, and I heard this morning that she slept well all night. Very hot water, and very cold water, act alike. In that case there was too much blood in the pelvic area, and we want to get the reflec effect and the derivative effect both, so we used hot water, which dilated the vessels of the legs by contact with them, and reflexly by means of very great heat, thus producing such a strong sensory impression as to contract the pelvic vessels, and so the patient was relieved. There was also the inhibitory effect of the heat.

What a wonderful thing hydrotherapy is! It works so beautifully when you make the proper application of it. Suppose you are applying a cold compress to the abdomen, how often would you change it in order to get the reflex effect, and alternate it with the short hot application? If we should apply cold continually the nerves would become benumbed, and the vasomotor centers become exhausted . The powerful stimulus all the while would exhaust the vasomotor center, and when that gets exhausted, then what happens? The vessels relax, and the very opposite effect is produced; the very effect you do not want to produce is produced. So continuous cold, left on for an hour or half an hour, is a bad thing. The way to apply your cold application in typhoid fever is this: As soon as the compress gets a little bit warm take it off, so you will change it about once in twenty or thirty minutes. Once in twenty minutes is a good rule. You must carefully instruct your nurses with reference to this. The nurses are apt to think if cold is good, more cold will be better, so they will say we will keep it

B L O O D P R E S S U R E

Lecture to Junior Medical Students, Jan.26,1906

By J.H. Kellogg, M.D.

Last time we ended up with cold applications to the abdominal surface as a means of increasing blood pressure. How can we intensify this pressure? The shallow cold foot bath will have a little tendency that way. Suppose we should put on a fomentation and then rub the part with a piece of ice. Would that intensify it? We might apply it in such a way as to get the greatest possible contraction in the splanchnic area. A very short cold application, left until it gets warm, would raise the blood pressure, but an hot and cold application to the abdomen, an ice rub applied in the usual way, would intensify this cold application.

Is there any other way in which the portal circulation can be influenced? A very hot and cold foot bath, with a general ice rub, would contract the vessels of the splanchnic area. Hot and cold water to the dorsal region is another good way to influence the splanchnic area. It is very satisfactory to see the rationality of things. When we put on a fomentation over the liver, or a compress over the liver, say that is good, and do that with a sort of vague hope that it is somehow going to do some good, but you don't feel quite sure of it, and you don't feel quite established in your therapeutic method, it is not so satisfactory. But when you know the rationality of the thing, when you know you are doing somehhing that has a positive influence upon the splanchnic circulation, you feel then that you have got hold of the crank and are turning the wheel yourself, and you can just make the thing go, and it does go.

We have patients coming to the Sanitarium continually who are suffering with congestion of the splanchnic area. How can we tell if a patient has congestion of the splanchnic area? The patient has got catarrh of the stomach. If you have a patient who has catarrh of the stomach, you know he has a congested stomach. You are sure of it. Wash the stomach out and find catarrh; that means congestion. Suppose the person had jaundice. Would you think the liver was congested? It would be passive congestion certainly. If a patient has jaundice he has a congested liver, because when there is restriction of the flow of bile, the next thing in infection, and with infection there may be congestion. If the patient has chronic infectious jaundice, or intestinal catarrh, you know he has congestion of the splanchnic area.

But suppose you don't have any of these symptoms at all,--how could you tell? When a patient has general chronic indigestion he has probably got congestion of the splanchnic area, but there may be chronic indigestion with a spasm of the vessels of the splanchnic area. For instance, here is a patient who has no appetite--a hysterical woman, who has amenorrhea, with absolutely no appetite, and has high blood tension. What would you think of that case? You would think very likely there is a spasm ~~xxxxxxxxxx~~ anemia. In amenorrhea there is usually a spasm of the vessels of the uterus and ovaries. There is an enemic condition there. Suppose we have a patient who has very weak relaxed abdominal muscles, just like a piece of cloth, and a pendulous abdomen. What would you think of that case? There is certainly congestion and lack of intra-abdominal pressure. I have talked to you quite a little about the intra-abdominal pressure, and you will see more and more importance in that as you go along. You will know the minute you put your hand on the abdomen of such a patient that there is passive congestion there, a relaxed condition of the vessels of the splanchnic area. I saw a case yesterday, with Dr. Eggleston, in which the abdominal muscles

were drawn in very tense and hard and tight. What would you think of that? Is that a case of congestion? The muscles were drawn in clear down to the backbone, just like a board. There was no room in them for any breakfast or dinner. There was not any blood there. The man could scarcely eat anything. His space was all taken up by the tense, drawn condition of the abdominal muscles. You could not palpate the viscera any more than as though they were enclosed in a case of iron. You could absolutely form no idea of what was underneath the muscles. They were just as tense as a steel bandage. You could see the aorta throbbing. The abdominal wall lay right on the aorta. The gas was all forced out of the intestines. In such a case there could not be congestion. It is impossible. That is why there is an intense condition of the muscles in peritonitis. When a person has peritonitis there is always a tense condition of the abdominal muscles. When a person has appendicitis there is tension of the muscles of the appendix. He has to hold the bowels still to hold the appendix still. All the parts compress and drive the blood out. This is a constant protective action that is present. The same thing is true of a diseased gall bladder. The muscles over that region will be tense, firmly contracted, pressing down on that region and drive the blood out of the diseased congested area. So when you have hypertension of the abdominal muscles you know that in that case there is not congestion. There is a tendency to congestion, but it is being relieved.

A very interesting observation has been made. Patients who die of peritonitis have wonderfully clear heads. Their brains are very clear up to the last minute. The brain is very rarely ever clouded until almost the last minutes of life. At the very last end the tension falls. Before that tension is high. That shows the importance of taking the blood pressure. Suppose we have a case of typhoid fever. In typhoid fever how about blood pressure? It is low. In pneumonia it is high at the start, for a little while, then quickly falls. It is always low at the crisis.

It is only a little high anyway. In all infectious diseases it is hypotension. The tension is low in all acute infectious fevers, and in chronic infectious diseases two. Sometimes it is high at the beginning but it falls and [redacted] becomes low.

What are the two worst things that happen in typhoid fever?

They are hemorrhage and perforation. When hemorrhage occurs what happens to blood pressure? It falls. If perforation occurs, what follows perforation? The perforation itself does not do any harm. It is infection and the peritonitis that follows the infection. That peritonitis would be high pressure. That is one thing in which you have high pressure. When we have peritonitis, and infection occurs in the course of typhoid fever, and that sets up a tension of the abdominal muscles, and the abdominal muscles compress the viscera, the heart and bowels still too frail to antagonize that disease, what is the effect of that upon the tension of the splanchnic area? It compresses and drives the blood out into the general circulation, so the pressure rises. You see this has a protective process particularly, that acts against the local infection, which is so great that it overcomes the tendency to acute infectious diseases, so that makes an exception to the rule that in all infectious diseases tension is low. You have to learn that from clinical observation.

Of what use is blood pressure in typhoid fever? A sudden fall in pressure would tell one hemorrhage had occurred. Of what use is the sphygmomanometer in taking blood pressure in typhoid fever? It indicates when the heart is weak, when the heart is failing. Suppose you take the blood pressure, and find it low. Does that tell you anything about the heart? That is just what it does not do. The sphygmomanometer does not tell you anything about the heart. The systolic pressure tells you nothing at all about the heart, only it is thought if you find a high blood pressure, and

find the patient feeling all right, you know he has got a good heart, must have a good heart to work against the high pressure. When you take blood-pressure and find it low, that may mean simply that the blood has not gotten away into the splanchnic area.

What is the difference between collapse and shock? With collapse the nerve centers are weakened, and the blood has run away into the splanchnic area, and the vasomotor centers are not yet exhausted. They are not exhausted. Sp here is a patient --suppose we have a patient who collapses: we apply these various fomentations that we have been talking about, follow with cold applications to the skin, and there is a response. The vasomotor centers are still in a state to respond. But if that condition goes on so far that by and by the vasomotor centers are paralyzed, cease to respond, then the patient is in a state of shock. You see that is the real difference between shock and collapse. Throw water in his face and he wakes up right off. There is an immediate response, you see. The patient quickly rallies from his collapse. But suppose we have a patient in a state of shock? Cold water in the face, cold mitten frictions, and all that sort of thing apparently does no good at all. The vasomotor centers do not respond, so you have got to do something else. You may have collapse from loss of blood, or from stimulation or injury to the sensory nerve. If it goes far enough, so that the nerve centers are exhausted, then the patient is in a state of shock. There has been great confusion about these terms. Some still regard collapse and shock as two terms that are just the same. The best authorities still regard collapse and shock as two names for the same condition, and one is in advance degree over the other; and I think that is the best way to differentiate the two. That agrees with Crile's experiments and the best authorities, so I think that is the best way to settle it.

In typhoid fever the blood pressure should be taken four times a day, every six hours. And when you take the blood pressure, if you find it has suddenly gone up to a high point, what does that mean? The patient will look bad. The patient has pain. Sometimes is pale. The pulse becomes very rapid, and you don't know what the matter is. Something has happened, you see. It may be perforation, it may be hemorrhage; you don't know; but now if you take the blood pressure you find the blood pressure has gone up. What an important thing it is to be able to differentiate. If the temperature has risen, you absolutely know it is not hemorrhage. When it goes up it is peritonitis, and that is the only means you have got for determining between those two happenings. And a sudden fall of temperature frequently accompanies hemorrhage. Why? If you had a small loss of blood, just enough to lower tension, there is an accumulation of blood in the splanchnic area, then you would have a rise of temperature, because the blood would be retained in the interior of the body. If you had very profuse hemorrhage, then a general depression of the vital powers would produce a lowering of the temperature. You would have a lowering of the vital activities. It depends upon the combustion taking place in the muscle. If there is a small amount of blood, less blood circulation, the temperature must be less, of course. In peritonitis the temperature may go up until it is extreme, then it may fall.

What other ways are there in which we can control blood pressure? As I stated before, there is contraction of the abdominal muscles, and compression of the viscera, by which the blood is forced into the general circulation. There are a whole lot of things that come in to influence a rise of blood-pressure in peritonitis. The same thing that causes contraction of the abdominal walls will cause contraction of the splanchnic area also. The splanchnic nerve is stimulated, excited, and the sensory nerves, and the abdominal wall. There is tenderness of the skin also. So that the nerve center is excited, and that is why the abdominal walls contract. You must look upon the nerve center that controls this particular segment of the

body as being an independent affair. The nerve center that is opposite this segment of the body has charge of the entire segment of the body. It has charge of the blood vessels, and of the skin, and of the viscera, of everything that is located in that particular spot.

With reference to vasomotor centers. There are two sets of vasomotor centers: the general vasomotor center, the medula-oblongata, and the spinal centers, which are located along the spine. Give a person a cold bath, and at first there will be a rise, but after a long time there will be a fall. The patient may get a shock from cold or collapse. The ~~cold~~ cold sitz bath is one of the very best means of raising blood pressure. It is a capital method of doing it, of contracting the vessels of the splanchnic area. A rubbing shallow bath is a splendid means of raising blood-pressure of the splanchnic area. The cold sits bath is the one we rely upon more than any other one. We usually start it at 80°, and lower it to 75, 70, 65, and 60. I remember a dyspeptic patient some time ago who begged to have her sitz baths made colder; insisted that they should be made colder and colder. She finally thought she felt better and better all the time. She wanted the baths longer. She had them twice a day at 55°, and wanted them longer and longer, 15 or 20 minutes. One day she came into my office, and she said "Now then, I am sick. I am going home." And home she went. She had overdone the thing, and had got to the point where reaction had set in, and she was very much depressed. So you must be careful about that. If the bath is not continued too long, it is a most valuable remedy, but it must be long enough to accomplish something; that means eight to fifteen minutes. A bath from one to five minutes will have the very opposite effect. Why? Because the reaction which immediately follows has a greater effect than the direct effect. The direct effect is less than the reaction effect, if the bath is short. So it is very important to remember that. The bath must be from eight to twelve minutes in duration to get the good effect if you want to cause contraction of the vessels ~~of the vessels~~ of the splanchnic area.

If it is only from one to five minutes long it will have the opposite effect. So when you want to stimulate the circulation of the blood through the splanchnic area, the very best means of doing it is the very cold bath. A tonic sitz we call it. And that bath will stimulate peristalsis temporarily, so it is a capital thing to start peristalsis and move the contents along, and it is a capital thing to relieve constipation. But the opposite effect is produced when we employ the prolonged cold sitz bath. That produces such a strong spasm of the intestine that the fecal matters are retained in place, so constipation is generally aggravated by the prolonged sitz. The cases in which it is not aggravated are cases of an extremely dilated colon. I saw yesterday a case of colon disease, in which the colon, instead of being in normal shape, was in this shape. The cecum came away over here beyond the median line. I could palpate it. The stomach clear over here. The segmoid flexure was here, and that gave a high pitched note right along at the side. By palpation you can ascertain the position of the patient's colon and stomach. When you get accustomed to differentiating the tone, you can easily mark them out. Percussion is a sort of palpation.

Is there any other way in which we can influence blood-pressure? We have considered already the heart, the vessel tonus, the portal circulation, and the elasticity of the tissues. Now there is something of some importance, although of comparatively little importance. The effect of a cold bath upon the tissues is to contract the tissues, though this is a thing that chiefly affects the skin, and by the application of cold to the skin the skin is rendered firmer. The blood is forced out of the sub-cutaneous tissues into the general circulation, so the blood pressure is raised. The cold bath acts reflexly by stimulating the splanchnic, and it acts directly upon the superficial vessels. This thing is important to remember,--that the splanchnic area has a far greater influence upon blood-pressure than the skin area. The skin area is an area capable of holding about two-thirds of

all the blood in the body. The muscular area pulls half of all the blood in the body. The muscular area can not be influenced so much by baths or anything else as can the skin area and the splanchnic area. The skin area is of less importance than the splanchnic area, because it is smaller in extent, and its influence upon the general blood-pressure is much less. There is another reason, and that is that the splanchnic area is so sensitive--it is under the control of the depressor nerve, you know, which inhibits the splanchnic--so the splanchnic area is so ready to respond continuously, the sensory impulses and central impulses is so constantly responding to these influences all the while, that any influence upon the skin, raising blood pressure and lowering blood-pressure, may be easily compensated, or more than compensate the action of the splanchnic nerve. You see that. For instance, give a man a cold bath when you want to raise his blood pressure. Sometimes it ought to be raised. Just the minute the heart becomes distended, just the minute the ventrical walls become distended, the right ventrical, and the walls of the right ventrical, and the heart fails, and the stretching is increased, and the blood pressure is increased, there is an impression made upon the depressor nerves. How did these depressor nerves reach the heart? Through the vagus. And these sensory impressions are transmitted by the depressor nerve to the center, and they have a depressing influence. And vasodilator impulse is sent out, and how does that operate? It operates in two ways,--through the splanchnic nerve and through the vagus. The vagus is the inhibitory nerve of the heart. By these impressions the heart's action is slowed through the depressant effect, and the splanchnic area is opened. So in both ways less blood is put into the arteries, and the splanchnic area is opened to take blood out of the arteries, you see, so blood is let out of the artery more readily into the splanchnic area, which is stored up in the splanchnic area, withdrawn from the circulation, and the heart is slowed in activity and in vigor; so there is less blood put in by the heart, and more taken out by the arterioles. Thus the pressure is lowered at both ends, you

see. The force is operating at two ends of the arterial reservoir, so blood pressure is lowered. That great compensatory vacuum more than balances all you can do in the way of appliances to the skin. I mention this because we are likely to depend too much upon what we can do to the skin. Suppose a man's circulation is weak. We may say, "Well, put an ice bag over his heart." See what an improper procedure that is. The heart may be doing all the work it ought to be doing already. It may be there is a great leak in the splanchnic area. The splanchnic vessels are all open, and the blood is running away into the abdominal vessels, and the heart is working as hard as it ought to work, and the blood-pressure is low.

The difference between systolic pressure and the diastolic pressure is an indication of the amount of blood-pressure that is due to the volume of blood forced into the arteries. That is the thing that raises the pressure at each pulse beat,--the amount of blood forced into the arteries. That means one of two things, either that there is a large amount of blood forced into the arteries, or that the arteries are so rigid that they do not yield, and doubtless have lost their elasticity.

The average of the systolic and diastolic pressure is practically the mean pressure. The mean pressure is the average of diastolic and systolic. A mean pressure is probably a little less than that. The pulse pressure is the difference between the diastolic and systolic. The mean pressure is the mean of the two. Suppose we have in an old man a systolic pressure of 220. What is his diastolic pressure likely to be? We are talking about an old man now. It would be 70 or 80 millimeters less than the systolic pressure because the diastolic pressure does not rise with the systolic pressure. The systolic rises with increasing age and arteriosclerosis. The diastolic pressure does not rise so rapidly. It lags behind, and it is fortunate that it does, because you can see what happens. Suppose the diastolic pressure was 200, then when the heart began its beat it would have a pressure of 200

to start with. Have all that pressure to work against. But instead of that it is less. It is perhaps 140 to start with, instead of 180, and so the old man has a little leaveway at the beginning of the heart beat, in which there is a chance to get the blood out without working against the blood pressure. I heard of a case of a man who went on for years in good condition with a blood pressure of 300. The man who reported the case said that he had observed the patient for three years, and his blood pressure was 300 and he was still in good condition. As high a diastolic pulse as 180 has been observed in old people, and that means that the heart is getting very weak, that the arteries are getting very small, and that the degeneration has advanced so far the outlets are almost all closed, you see, and the pulse volume is very small. There is only a little blood dripping in through the arteries, and that means heart action is rapidly failing. When you have your arteries in such shape that there is room for blood to be forced in by the heart, that shows there is a good movement of the blood still through the arteries, because there is large pulse volume or beat.

Here is the reason for the difference between diastolic and systolic pressure in old people. Suppose this is a rigid tube of brass, and there is a pump to force a gallon of water at each stroke in at this end of the tube, and it goes out at the other end. It is forced in quickly at this end of the tube, and in the case of the arteries the blood-pressure would ~~nat~~ quickly rise to the force of the pump. Suppose the pump is 150 pounds: there would be a pressure of 150 pounds for an instant, but it would very quickly fall to almost nothing, fall perhaps from 150 to 50 pounds, so there would be 100 pounds difference. We will suppose instead of that, this was a rubber tube. In this case, when the water was forced in, instead of having to go the whole length of the tube to the other end to get out before the pressure could be realized, the tube would suddenly dilate. The pressure would not rise to 150. There would be a gradual expansion of volume, which would spread out

pressure, and the pressure would not be perhaps more than 100 pounds or 75 pounds. Then the walls would gradually contract. The pressure is not so high for it is distributed, and it is maintained in the interval between the beats, and so keep up continuous pressure. That is the way in which the elasticity of the arteries aids the circulation. The arterial walls become a source of latent energy which operates between the beats to keep the arterial current moving. The difference gets greater all the while. In very far advanced disease in decreases as the arterial twigs gradually shrivel up, so that the output becomes smaller, and it gradually diminishes, so that in very old age you find a very small pulse volume. Pulse pressure is a measure of the pulse volume, and that is an indication of the adequacy of the heart. It is very important to know what your heart is doing. The best measure of the adequacy of the heart in an old man, when you have an old person with high blood pressure, the best measure is not the sphygmograph. The sphygmograph tells you something about it; you know the high pressure, the systolic pressure and the distolic pressure--know what it is; then you ask this old man a question, or subject him to an experiment; you say to him, Do you get short of breath when you go upstairs? That is the question I always ask--Are you short of breath when you go upstairs? He says, No, not particularly. Then you know the heart is doing good work. It is adequate, because if it was not adequate the moment a little extra work was brought upon it by the muscular exertion, it would begin to show the effects of the accumulation of venous blood which the heart was not able to get out of itself. The force of the venous blood accumulating in the left oracle crowds upon the left ventricle, forcing itself upon the circulation, causing high blood-pressure. An extra exertion would produce congestion immediately, dyspnea, the moment you take exercise.

A short cold bath is an excellent means of increasing blood-pressure. It is not the very best, because the skin is of less consequence

than the splanchnic area. But there is this advantage when you are making a cold application to the skin, that you are operating upon the skin area and the splanchnic area,--upon the skin area directly, and upon the splanchnic area reflexly. But if the pressure rises too high, higher than what is best for the body, then the depressor mechanism is set in operation, and the splanchnic area is opened up, and the blood runs off into the splanchnic area. So the pressure falls. It is very difficult in a normal man to raise blood pressure very much, because the body is continually adjusting things, and keeps the pressure what it ought to be. In a healthy man a cold bath does not raise the blood-pressure, because the influence of the depressor mechanism is set in operation, the splanchnic area is opened up, and the blood pressure is kept constant. The body has a regulating mechanism more delicate and exact than any automatic instrument you ever saw.

In making physiologic experiments we have to make very extreme applications. This is not true in the cases of failure to regulate mechanism . If you have very high pressure, or very low pressure, abnormal conditions of high or low pressure, it is very much easier to correct those, because that shows there is a failure of the regulating mechanism, and It is exactly as it is in fever. It is hard to raise the temperature, or lower the temperature, of the normal man. It is very difficult to do it. You can do it, but it is difficult. But in the case of fever it is easy, because in fever the heat-regulating mechanism has failed, and consequently if you bring something to bear which helps out the weakened mechanism, then the powers of the body go to operating with the applications which you make, if they are intelligent and properly indicated applications, the two ~~with~~ co-operating together will accomplish something which one alone would not.

Suppose you have a case of typhoid fever or pneumonia. What is the purpose of that fever? It is protective; it is curative. A temperature of 101 in typhoid fever is a good thing. Then suppose you tried to get that

patient's temperature down to 100. Would you be doing any good? I have seen doctors and nurses who thought they ought to bring the patient's temperature down to normal, and labor hard to get the fever of the patient down to normal temperature. You see what a great mistake that is. It is only when the temperature is abnormally high that we should accomplish that. The very same thing is true of blood-pressure.

Here we have a man, for instance, who has compression of the brain, an abcess on the brain, or a tumor on the brain, and the blood-pressure is high. What is the state of that man's brain? It is anemic, and it is because it is anemic that his pressure is high. The body has resisted all pressure to force the blood into the compressed area . Here is the brain, and there is the tumor that compresses the brain, so there is less blood than there ought to be in that brain. The vessels in this area around here are compressed, so the whole brain is anemic because of the growth of that abnormal body, and the heart has to work against that pressure in order to get the blood into it each one of these starved areas. Each one is crying out for blood. Each one of these little starved nerve cells is demanding of the heart some more blood, and so the heart raises the pressure, or rather the pressure regulating mechanism of the body raises the pressure. The pressure on the veins might make passive congestion. There may be passive pressure upon the vessels, retention of the blood,and then we will have passive congestion, for the blood is slowed.

When you go out and get your hands cold they get blue. Why? Because the arteries are contracted, so that the blood can not get through into the veins, so there is no movement of the blood, but a stasis there for the time being. The same thing holds in interstitial nephritis. There is a change going on in the kidneys; all the arteries are being obliterated and compressed, and in order that the blood should be purified, the blood pressure must be raised in order to get the blood around to the kidneys fast

enough so that those imperfectly diseased kidneys shall do the work necessary in purifying the blood. An increase of toxines in the blood requires the regulating mechanism to raise the pressure in order to get the blood through the kidney, for the same reason that the temperature is raised in fever, so that the blood may be circulated around the various mechanisms which fight infection, so that conditions may be established for combating all the infections successfully. Blood pressure is not always raised in perenchy nephritis, but it is in interstitial nephritis. The more you study this question of blood pressure the more practical you will see it is.

There is one more method by which we can increase blood pressure, and that is by increasing blood volume. There are five ways of increasing blood pressure: by an increase of heart action, by increasing the heart activity and heart energy, and increasing the vessel tonus, by stimulating the splanchnic area so as to force the blood out of it into the general circulation; and we can increase blood volume by some other method--by a saline injection into the veins, and by abdominal compression. Chile has invented a pneumatic armor which I have recently gotten hold of. It is a rubber suit which he puts on the patient, laces it up tightly around the arms and legs, and inflates it with air. This will have the effect to compress the arteries of the surface of the body, to compress the vessels of the surface of the body, to drive the blood in; and if we combine with that--I don't know that this is arranged so as to do it, but if we could combine that with compression of the abdomen, that would drive the blood out of the splanchnic area, you see that is the whole thing. Now what do you want when you want to increase the blood volume? We want to get more blood to the heart. Why? Because the heart depends for its action to some degree upon the stimulation, the distension of its walls, so if too much blood leaves the heart the heart fails, because of lack of volume of blood. If we get a large amount of blood to the heart by compressing the portal circulation--and that is the best way

in which to do it--the ventricles being better filled will contract with more force. That is the reason why increasing blood pressure sometimes helps the heart. The vessels fill more completely, the vessel walls are more completely distended, the stimulus of contraction is greater, so that each effort of the heart is more effective.

There are other things also that can be done. It has been shown by experiment that the application of electricity to the nerve cells is one of the best means of contracting the splanchnic area. I am having some experiments made now with the sinuscidal current to see what that does. I am also making experiments with hot and cold. If any of you would like to spend a little time that way you would be compensated for your time, and we shall be very glad to have you volunteer.

There are a number of questions we ought to investigate a little further, and I mean to spend a few weeks in doing that very thing. We are taking up all our different hydriatic applications, and measuring accurately in a number of persons the real results we get, so that we can know just what the effect is.

Next time I want to take up the application of these principles to the treatment of chronic and acute disease--the application of the general principles we have learned. We will do that on Monday.

JHK v--m 2/21, 1906.

BLOOD PRESSURE

Lecture to the Junior Medical Students of the A.M.M.C.

Monday, Jan.29, 1906.

By J.H.Kellogg,M.D.

The most important chapter in this subject of blood-pressure is the relation of blood pressure to cardiac disease. In cardiac disease we may have high blood pressure, hypertension, or low blood pressure, hypotention, or secondary low pressure. I like to put it this way: First, low pressure, second, high pressure, third, secondary low pressure. Low pressure, that is primary low pressure, in cardiac disease is almost invariably associated with disease of the heart. High tension in cardiac disease, or cardiovascular disease generally means disease of the blood vessels. Secondary low pressure means a weak heart with diseased blood vessels. Now what will produce low pressure---chronic forms of disease in which the matter of pressure is most important--- may be valvular disease, every form of valvular disease produces low pressure of the heart, and it does not so much matter what is the form of the valvular disease that produces low pressure. The important thing is the low pressure, for of that the heart is the cause, and not the vessels.

There is a chronic difficulty in certain forms of valvular disease, in aorta regurgitation, for example. The arterial pressure will be very low. Why? Specially the diastolic pressure will be very low, and the blood pressure generally may be high.

I met in the office yesterday an extremely interesting case, and I have asked Dr. Johnson to bring the lady over. First I will tell you about this case. You probably would not see another like it in a good while.

The arteriosclerosis is so very marked you can just feel a chalky deposit in the arteries, and in both sets, the radial artery and the ulner artery; so here you can get another pulse as well as a radial pulse. Outside you can feel it very distinctly. You can also feel it in the temple here. The pressure in this case is 270. I met the case in the office last evening. I am afraid the diastolic pressure in this case has not been taken. It was to have been taken at 12 o'clock, but they may have overlooked it. But if they have, we will follow it up and get it tomorrow, so we will know what the diastolic pressure is. Would you expect to see the diastolic pressure increased as much as the ~~dk~~ systolic? No. You would expect to see the systolic less. The pulse rate is greater than the normal. This woman's pulse pressure is 270. What is that a positive indication of? That is a positive indication of high resistance in a chronic case of arteriosclerosis. There is obstruction of the small arteries somewhere. It might be in the peripheral arteries or the superficial arteries; it might be in the splanchnic arteries. Dr. Johnson has just given me the report of the blood pressure. When the patient was lying down diastolic pressure was 230, and the systolic pressure 250. We will have it taken with the patient sitting up and standing up. What does that make the pulse pressure? It makes the pulse pressure 20. What does that indicate? It indicates an extremely weak heart. The volume is very small. In indicates the arteries are inelastic, and have become so rigid, and the heart so weak it can not stretch the arteries enough for the systolic beat, so that the difference between the systolic pressure and the diastolic is very great. The heart is working against that pressure, but it is not getting in but a little blood. It has the power to contract, but it is not able to contract with very much force. The pressure has got do great it can not overcome the pressure sufficiently to make a very high volume. The heart sounds are still distinct, and the heart is not greatly dilated, but this woman is just at the border land going to pieces. I would not be surprised

if this woman had a stroke of apoplexy any minute. She has albumin in the urine so you know the kidneys are diseased. She has a contracted kidney. That is interstitial nephritis, isn't it? Do you always find albumin in that case? No.

This woman certainly has very inflexible arteries, and her heart is working hard; and the aortic click is good and clear, almost ringing clear, so the heart still has some strength, but it is inadequate. The heart is not putting much blood into the vessels. It is plain, because the pulse pressure indicates the pulse volume, which indicates the amount of blood that goes into the arteries. The elasticity of the vessels sustain the pressure to which the heart raises the blood, you see, because the volume of blood forced into the arteries stretches the vessels, then they contract between the beats, so that stirs up the energy of the heart. If you have a rigid pipe here, a pump at one end, and the other end open, the pressure would rise if the water was forced in, and it would immediately flow out at the other end. The pump would pump itself into the pipe with great ease. As the pump forces its contents into the pipe, there is no obstruction in the way at all, and the liquid goes out at the other end. But suppose we close the end, so that there is only a small opening; then the amount of pressure in each beat will be less. If we have a rubber bulb here on the end of a short tube which is wide open; we contract the bulb, and it closes with great ease. But suppose we close the end of the bulb; then as we contract upon it we do not get all the water out, and as we close the opening more and more, and compress the bulb, we get less and less out of it, and the tendency would be to slow the emptying of the bulb. It would take a longer time to get out of it all there is in it, because we have to wait for the water to go out through a small orifice. There is a lack of supply of blood to the heart also.

Now this is the important thing. We see that the pulse volume is diminished. There is less blood forced into the arteries at each beat of the

heart. What is the consequence of that? Although the pressure is high, showing the heart is able to work still, the supply of blood to the tissues is cut off. Did you see any evidence of it, or did you get any hint of it in examining this case? You saw this lady stagger. Co-ordination is diminished. Yesterday she did not know my name. I asked her what State she came from, and she could not tell me the name of it. I tried to suggest it to her--"Were you born in Alabama?" and she said "No." "How long have you been there?" "Nine years." She had lived there nine years, and yet was unable to give me the State. She knew my name, but could not speak it this morning. She didn't like to speak it in the presence of all these people. She didn't want to own up to me that she could not tell my name.

The volume of blood forced into the arteries is so small that there is not enough to fill the arteries. If there is a large volume of blood forced into the arteries there would be a fall of pressure. That is why there is a great fall in many cases of arteriosclerosis. The pulse pressure is great, and in these cases the arteries have become so restricted the heart is not able to get blood enough into the arteries, so that the pulse pressure is very large. That is a very interesting case in that regard. I am going to take the diastolic pulse over again to see if there is any possible error in it. It is almost an unvariable thing to see the disatolic pulse getting lower in relation to the systolic as the disease advances. This patient will show edema by and by. It will come as soon as the heart gets a little weaker. Did you notice how wrinkled the skin was? What is the cause of that wrinkling of the skin? That is caused by a failure of nutrition. The skin is starved, so its structures are shriveled up, and there is not enough underneath the skin to fill out the arteries. It shows evidence of malnutrition, and often of anemia of the brain.

What is the purpose of high pressure? It is the vital response to the needs of the body, the demand for nutrition. This is a very

interesting case--a high disatolic pressure due to inelasticity of the arteries; it is lack of elasticity of the arteries. The arteries have become as rigid as pipe stems. Many of the arterioles are closed. Here is a pump at this end, and the other end is wide open. If the pump forces liquid in here at this end, there will be a great change of volume, because when it is first forced in we will take the pressure with the manometer. We get our pulse pressure, and we find it will be high when the liquid is forced in; with each beat the mercury will rise very high. If you close this up and have just a little small opening, then it will rise higher, and the pump is going quite rapidly. The variation will be very much less in that case. It will rise high, and won't get down to zero before there will come another stroke of the pump, which will raise it again. If there is a perfectly rigid tube this difference will be less as the pressure rises and makes the tube smaller, so the difference will be less and less and less. But suppose there is some elasticity, so that the walls can stretch. How will that be? The fluctation would be greater or pressure would not be so high, and the difference would be greater between the diastolic and systolic. For the opening is very small so the arteries fill. That is, they are rigid. Now the pump is laboring hard, and there is not enough of it that runs out between the strokes of the pump, there is not enough liquid running out to lower the pressure sufficiently to make a great contrast. The pump is putting but little in, and consequently there is very little going out, because the opening has become so contracted; consequently the difference between the systolic and diastolic will be very small. The pump is strong, because it is keeping the pressure up, but at the same time the opening has become small.

We will suppose the pressure is 100 pounds. Here is a pump that is able to force in 110 pounds; it is able to work against 110 pounds, but the pressure is so high it may not get in but a little liquid. Suppose one pint could get in. Suppose this reservoir is capable of holding 1000 liters,

and you can put in but half a liter, you can readily see that the change of pressure would be very small. If we only increase this pressure one two-thousandth part, the change in pressure would be very small.

Now if the walls were somewhat elastic, so that they would expand a little, the larger volume could be forced in. But suppose this had come to be a closed tube entirely, then as the pump was forcing the liquid in the change of pressure would not be very much, because the walls were absolutely inelastic; and when it gets full we can't make it any fuller, and the pump would make its stroke and raise its pressure very very little. It would be like holding it still. In fact the pump would stop entirely. But if we have an opening so that just a little will escape, the pressure will fall a little between the strokes,--just enough to let a little more in. But the measure of this pulse pressure shows us the state of things existing. This pulse pressure shows the arterioles are contracted and the arteries almost closed up. These problems of blood pressure are comparatively new; many are not yet settled. It is an important field for us to enter into to study, and to help find out the things that we need to know.

We have a case of cardiovascular disease. We have a patient who has hard arteries. Such a patient even without hardened arteries is short of breath. We feel sure there is something the matter with the heart or the arteries, or both, and we want to find out the real situation. In cardiac disease it is low tension. In disease of the aortic valves it will be low tention, because the blood pours back, and the arteries are not perfectly filled; and if they are well filled they are immediately emptied afterward so that the mean pressure is low. I want to say to you that in the study of blood-pressure it is the mean pressure we must consider. The systolic pressure alone is not sufficient to tell you the state of things. Take a case of aortic regurgitation. We have a systolic pressure of 150.

What might the diastolic pressure be? It can not be more than half that. It might be 80. That would give a mean pressure of 115. So although the systolic pressure is quite high, the mean pressure is only 115. That is rather low, but that would be normal , and the patient could get along quite comfortably.

Now in aortic regurgitation do we have cardiac hypertrophy--hypertrophy of the left ventricle? Certainly. Why? Because the systolic pressure must be raised in order that the mean pressure may be equal to the needs of the body; may be able to supply the needs of the body. The mean pressure is compensation. The degree of compensation is indicated by the mean pressure. We will suppose the systolic pressure was not raised, that there was no cardiac hypertrophy, that the heart remains at its ordinary strength, and produces a systolic pressure of 120, with a diastolic pressure of 60. The pulse pressure would be 60. Cases have been observed in which the pulse pressure was 90 percent of the diastolic pressure. You might find just such a case as this. The mean pressure is 90. That is low, and the diastolic pressure may be a good deal lower than that. It might go down to 40. That would give a mean pressure of 80. In order that the needs of the body may be met the systolic pressure must be raised considerably, so that the mean pressure may be somewhere near normal. It is an interesting fact that even in cases of arteriosclerosis usually the mean pressure is nearly the normal. And so long as the mean pressure is about normal the nutrition is not going to suffer very much: the patient's nutrition is not going to suffer very much.

I am very anxious to have the diastolic pressure taken again in this case that we have had here. It seems hardly possible that she should have so high a diastolic pressure. Her compensation must be good, or she could not be alive with such a high pressure.

Does high pressure indicate a strong heart? Suppose you have a tube that is thirty feet high, and the water is running through the tube here. The pressure is maintained by a bulb here at the bottom. Here is a reservoir, here is a bulb pumping water in, perhaps by a Davidson syringe, we say. Your hand in working that bulb puts the water through that tube thirty feet high. But cut that tube off in the middle, say it is fifteen feet high, will it require the same force to put the water through the tube as it will in the other case? The fact that the water is running through the top of that tube is evidence that there is a certain amount of power, so that is measured by the pressure in the tube. This is exactly the same kind of case. That pressure is maintained by the arterial reservoir. There is the reservoir. Pressure out there is 270. There can no blood be gotten into there until that pressure is overcome. The heart is working against that pressure and is putting blood in, and the pulse pressure is 20. So we know the circulation is taking place, as that would prove that the heart is doing its work. That would prove that the heart still has power to work. That is also true when you have high pressure, so you see how clear it is that when you have high pressure the pulse is in these vessels. When you have chronic low pressure, the trouble is at the other end. This case illustrates that very well indeed. The systolic pressure is the point at which the pressure is entirely taken off, the point at which the pulse disappears. The systolic is the measure of the disappearing pulse. That is a very interesting case to study. Blood pressure is full of problems that have not been solved yet. You can make some new discoveries yourselves. You can do a lot of original thinking in this case. Any case you get hold of is worth studying. You may find something new that no one else has observed. It is a great field, that has not yet been explored to any great extent. Why? Because we have had no instrument that is reliable. There is only one instrument now that is a perfect register of the diastolic

pulse, and that is the Erlanger instrument. We will have one here in a few days.

What is the difference in the use of the dynamometer and the sphygmomanometer? They are the same thing exactly, only the dynamometer covers the pressure a little further away from the heart; nevertheless it is the same kind of a test. The only difference is in the criterion. With the sphygmomanoter the criterion is the pulse. When the pulse disappears, or rather the point at which the pulse reappears, indicates a pressure which is equivalent to that which is within the vessels; that is, to outside pressure on the vessels, which is equivalent to the pressure inside, so that you are able to bring the pulse together, and the pressure is less. About ten millimeters is required to overcome the pressure of the tissues outside of the vessels. In a very bad state it takes more pressure, and consequently you should use a large armlet. The armlet should be at least 12 centimeters, or five inches, wide. With the dynamometer the criterion is the reappearance of the blood after it has been forced out, that is at the appearance of the second flush, but not the first one. There is a difference of five to ten millimeters between the first and the second flush. So the second flush, when the diffused redness appears, that is the criterion, and the indication is a little higher, and it is not quite so reliable, because Gaertner himself says that the dynamometer can not be relied upon ~~hi~~ below 70, while the sphygmonometer can be relied upon for all pressure. So that is the objection to the Gaertner dynamometer. But it is a practical and very useful instrument; practically a good instrument, because it is so rare you need a pressure ~~above~~ below 70. A patient can not live for any length of time with a pressure below 70 . Anything below 100 with the dynamometer is pathological. The dynamometer will generally indicate 40. It will indicate lower pressures than 70, but it will not do that accurately. That pressure has probably fallen below 40 or 50, but it is inaccurate below 70.

What can be done for this lady who was in here? Now with that case there is renal disease. That is the thing to be considered. There is progressive renal disease. And there is something more than that. That part of the difficulty is only a small part. That is not the primary thing. Renal disease is the result of the general arterial degeneration. The kidneys are just as healthy as any other part. The brain is disturbed just as much as her kidneys, for she has loss of memory. That is one of the indications of the disease of vessels in the brain, this loss of memory. It is failure of the nutrition of the brain, so we do not need to treat her especially for kidney disease. The thing we must consider is this arterial disorder. What is the first thing to be done in that case? Cut off all the causes of arterial degeneration.

I said to this woman, "Do you use a good deal of meat?"

"O yes, we have used a great deal of meat. We have almost subsisted upon meat. I ate it very largely until just recently, but lately I have not used so much."

"Do you use coffee?"

"O yes, indeed!"

"Do you use very strong coffee?"

"Yes, very strong."

"How much?"

"Two cups every meal."

"Two cups of very strong coffee?"

"Yes. You see my husband liked it strong, and I drank it with him. He drank one cup, and I drank two."

Adam was the tempter in this case. But even in this she ate two apples to Adam's one. I said, "How much coffee do you think you used?"

She said, "I used a cupful of ground coffee for each meal."

So she used a cupful of ground coffee for three cups of coffee, and at every meal she used all the coffee that could be extracted from between three and four ounces of ground coffee. So she took two-thirds of a cup of ground coffee at every meal. I wish some of you would weigh that out and see what it amounts to--just the actual amount of coffee.

I said to her "Did you use good coffee--strong coffee?"

"O, yes," she said, "we used Java and Mocha mixed. You see my husband is English, and he likes things good--you know the English have that way."

Now we see what is the natural consequence, the natural result of this woman's wrong doing. "Whatsoever a man soweth, that shall he also reap." It is plain enough to see the cause of this arteriosclerosis. But now the coffee is stopped. She took coffee for breakfast and dinner, and tea for supper. She did not take very strong tea. We have cut off the meat, and the tea and the coffee, but it is too late to save her. Here is a human being in ruins, a mechanism in ruins--an awful spectacle. I wrote her husband right in her presence, watching her carefully to see how she reacted from what I said. There was not any strong reaction. I told her husband all about her condition, that she was in danger of apoplexy, in danger of dying any minute. She did not seem to have any appreciation of it. It didn't worry her any. So you see what a terrible change has taken place. Her husband came with her and went away. That woman is liable to an attack of apoplexy any minute. We may wake up here some morning and find her dead in bed. That is the most likely thing to happen. She may have an attack of uremic convulsions at any time.

In cardiac disease, vascular disease, in cases in which you will find high pressure, low pressure, and secondary low pressure, what else can we do? If it is low pressure case, a chronic case, the difficulty probably is with the heart; so it may be trouble with the heart which is accompanied by low

pressure. It may be disease of the aortic valve. It may be disease of the mitral valve.

In what respect is disease of the mitral valve, regurgitation of the mitral valve, different from aortic regurgitation? In the aortic we have a very low diastolic pulse. What would be the effect of this upon the veins? What is the effect on the venous pressure in mitral regurgitation? In mitral disease there is increased venous pressure; but if there is increased venous pressure the relative difference would be the effect upon the systolic pressure. It is
The relative difference is the same. ~~xxxxxx~~ low pressure anyway. The systolic pressure is low. It will be higher secondarily, because the venous pressure is high. It is simply on a higher level, but the difference is the same. It has just the same relative difference. So that low pressure pulse means disease of the heart in chronic cases. It may be so-called fatty heart, so-called chronic myocarditis. If we find a case who has weak heart and can not find out anything about it, then it is chronic myocarditis. Suppose you have a very obese patient, with a layer of fat three inches thick over the body; and you examine the patient with the stethoscope--nobody on earth can tell what is the matter with that heart in that difficult case. Nobody can tell the state of the valves unless it is very marked. The heart is so far away, and the fat is such a non-conductor of sound, such a poor conductor, that the most acute diagnostitian in the world, even Dr. Babcock, could not tell the exact state of the valves of the heart. So you don't always know. But youdo know there is an incompetent heart; and it does not make any difference whether it comes from a weak muscles, or from a tired out muscle that has been over-working to support a crippled heart, damaged valves, to compensate for injury to the valves; or it may be the heart is crippled, being tied up by adhesions of the pericardium, you see. Anything that cripples the heart will make low blood pressure. We are talking now about low blood pressure.

In low blood pressure the heart is weak. What must be done in these cases? The first thing of all to be done in a case of low pressure is to lessen the work of the heart. Now the first thing in ordinary practice that is done is to give the patient a cardiac whip, strychnia, or something else to whip the heart up. Is there any sense in that? Suppose you have a horse pulling a load up a long hill, and he is staggering under his load, and you feel sure he will never get to the top. What is the thing to do? Put on the whip? No. Get behind and push. It is to lessen the load. And it is just so with the heart.

JHK v--m 2/25 '06-4

B L O O D P R E S S U R E

Lecture to the Junior Medical Students of the A.M.M.C.

Battle Creek, Tuesday, Jan. 30, 1906.

By J.H.Kellogg, M.D.

The sphygmomanometer does not help us very much in diagnosis of cardiac disease or valvular disease of the heart, except in the case of aortic disease, aortic regurgitation. The pulse pressure is so very large, and the diastolic pressure so very low, it is not a very accurate indication.(?) A fall in the pressure of the pulse can be recognized in the finger. What do we call that kind of a pulse? We are talking now about the pulse of aortic regurgitation, the water-hammer pulse.

Suppose you have a case in which there is both aortic regurgitation and mitral regurgitation, what would that be likely to do? It would lower the tension still more. Would it increase or diminish the pulse pressure? Would it increase or diminish the difference between the diastolic and systolic pressure? It would increase it. You must not think of the pulse pressure as high pressure, but as the amount of pressure, or rather the amount of blood which is raised by the pulse. That is the difference between the diastolic and the systolic. That is the pulse pressure. That is the amount of rise that comes with the pulse. So you may have a large pulse pressure with a very low tension pulse in such a case as this. A case was observed in which the pulse pressure was 113 percent of the diastolic pressure. The diastolic pressure was less than the pulse pressure, in other words. You see what a remarkable case that was. There was aortic regurgitation and mitral regurgitation both. That was a terribly leaky pump. The piston head of the pump has broken a

hole in it, so that when the pump forced liquid into the pipes water ran right down again around the piston. It was a very very leaky pump, so there was a momentarily high rise of blood pressure, but an immediate drop. That must have been a water-hammer pulse of the first water.

Now how are we going to test the efficacy of the heart? The pulse pressure is not a test of it. Is the diastolic pressure a test of it? We don't know now much energy there is left in the heart. How much reserve energy has the heart normally? It has 500 to 1300 percent reserve energy. In other words, the reserve energy of the heart is 5 to 13 times as great as the energy which it is using. Now can we tell in the pulse pressure how much reserve energy the heart has--how much more energy it might be made to manifest? Suppose you had a case of aortic regurgitation. The heart might be very strong, but might have a hypertrophied ventricle. The heart may be very strong for forcing the blood into the arteries, but it comes back, because there is a leak. The mean pulse pressure would be low. Yet the heart may have a tremendous amount of reserve energy. You can not tell by the diastolic pressure, because when it is high it simply indicates that the heart is still able to do the work required of it. But you do not know how long it is going to be able to do that. It may begin to fail at any time. The low pressure pulse certainly does not indicate a strong heart. It may be the heart is weak, or there may be another condition. There may be dilatation of the vessels; and the heart may be doing a large amount of work, putting out a large volume of blood, but may be able to do ten times as much as it is doing: so that does not tell. The pulse pressure tells simply how large a volume of blood is being sent out, but it does not tell anything about the adequacy of the heart. If the diastolic pressure does not tell, and the systolic pressure does not tell, how can the average of the two tell? You can not get it from those sources, because neither one tells. That is, if lead is not gold, and silver is not gold, a combination of lead and silver would not be gold.

There would be no gold in it, you see. But there is a way by which we can find out absolutely. The only way to find it out is to test it, and the only way to test it is by the person's ability to exercise. Here is the test. You don't know it, so it is not fare to ask you. When you have a normal amount of exercise, what is the effect upon the pulse pressure? It raises the pulse pressure. Now if a man has a strong pulse, the blood pressure will be raised so long as the exercise is continued, unless it is very excessive. When the stimulus of the heart is withdrawn, while the blood vessels are still dilated by the exercise, the heat and warmth dilating the vessels, the cardiac stimulus stops, but the dilatation continues for a while, so there will be a fall of pressure. When a person has a weak heart, in the case of a man with a very weak heart, an inadequate heart, the pulse pressure rises when the exercise begins, but almost immediately falls. The heart can not sustain it, you see, and with the fall of pressure comes dyspnea, shortness of the breath, and pain or oppression in the region of the heart that comes with the exercise. Such a man will tell you, "I can not go upstairs or downstairs. I can not go upstairs because it puts me out of breath." You see a man in your office, you ask him to walk up and down the office two or three times, and if when he sits down you see his chest heaving, you notice he is distressed, when he tries to speak to you he can not utter but two or three words until he must stop and take a long breath. You notice his rapid breathing without any exertion. The simple effort of talking will produce that dyspnea or shortness of breath. Here is another man who does not show these symptoms so distinctly. Then you must measure his heart; test it out. Make him take exercise, and test his pulse pressure while he is taking exercise. The usual way is to have the man lie down on his back and pull a weight up with his leg. I think a simple test would be to have the man rise on his toes. I made some experiments with that test, and I think we shall adopt it, because that does not require any apparatus at all. Take his pulse pressure before he begins,

while he is sitting, take it again when he stands, then as he rises upon his toes, bringing his heels up about two inches, he is lifting himself, and he is the weight that has to be carried around. That is a practical test. So we will note the blood pressure. Perhaps in a person who begins to show signs of rapid breathing you notice the pressure coming down. You know that man has a weak heart. He has no reserve energy. His heart can not respond to the great emergencies required by increased activity or work. That 500 percent, or 1300 percent of reserve energy has been reduced down to practically nothing at all. It is just barely able to do the work while the man is sitting up or walking along, or standing, and by and by it gets so low he can not stand erect, can not walk and maintain the circulation properly. What comes then? Edema comes. His ankles begin to swell. Then we must put him in bed, because in bed the heart can move the blood around in a horizontal plane. It can overcome the hydrostatic pressure from the heart when a man is down flat on his back. But when he is up walking around, the hydrostatic pressure can not be overcome, the reserve pressure is so low. That is a very important point to keep in mind. Künster, of Berlin, determined that. In the volume which he publishes he states this fact as the result of the experiments which he carried out in his Laboratory in Berlin. It is only necessary to estimate the amount of work that is being done, and that you can do. If a man takes very violent exercise, and you take the blood pressure and the number of beats of the heart, you can very easily calculate the increase. When a certain amount of blood is moving through an artery the heart is sending out that blood under pressure. The heart is lifting a certain amount of blood into the vessels under a pressure of 100 millimeters of mercury. Now if we make that man do such hard work that the pulse instead of beating sixty times a minute is beating 150 times a minute, and his pulse pressure has risen to 200 millimeters, we calculate the amount of blood which the heart is putting out. It is easy to make the estimate in that way. And we make an approximate

determination. When it gets down to the point where the heart is inadequate it may go down too low. In a case of arteriosclerosis, and even in some other cases, just before death the pulse pressure may go down very low. The blood volume gets very small, so small there is almost none at all. Then the patient's blood will lose its oxygen, the lips will get blue, and the patient will get almost to the point of asphyxiation.

ENDOCARDITIS

What is the usual condition in endocarditis? Low tension. In low pressure you expect to find endocarditis. So if you have cardiac trouble, take a patient's blood pressure and find it is low tension, that is an indication of the probable diagnosis, and will help you to make the diagnosis. If you have cardiac pain here, some disturbance in the region of the heart , you want to know whether it is endocarditis or something else. It might be angina-pectoris. If it is angina-pectoris the pressure will be high, and during an attack the pressure will rise still higher. But in a very bad case during an attack the pressure falls. When there is low pressure during an attack of angina-pectoris the outlook is extremely doubtful. That case is a very grave case, and the patient is liable to die very soon. It shows the heart has lost its reserve energy, has reached nearly the end of its career. It is like an old man tottering on his last legs. You know you have that sort of heart to deal with.

If a man has a weak heart he does not get a second wind. That second wind, however, is not so much from the heart as from the lungs. It is the lung reflex coming into play, filling out the air cells, getting the lungs' blood into play. In case of weak heart exercise could not continue long enough to get the second wind. Suppose a person has precordial pain in his heart, which runs down his arm, and we want to know whether he has true angina-pectoris or not. If it is associated with organic changes in the

heart itself, that is true angina. You have all the symptoms of angina. But how can you find out whether it is true angina or not? Take the blood pressure. If it is true angina there will be high pressure. If you have a pressure of 180 or more, then you can just be sure it is organic disease. When you have got a blood pressure of 180, and the patient has precordial pain, anginal pains, you may be sure the difficulty is organic in this region, and not simply functional angina, due to indigestion or some other trouble.

Now there are also neuroses of the heart, as in exopthalmic goiter. What is the other name for that disease? Thyroid cachexia. In this disease blood pressure is usually high, and the pulse will indicate that, and the throbbing veins, and everything indicates high pressure. It is important to know these differences in these different conditions, because they give us a hint for treatment, and that is the important thing we want to know.

I am going over this somewhat rapidly. This belongs to another department, but I thought you might not have it in this way. You have had some of it. It would be well, however, for us to go over our notes here in connection with physiologic therapeutics. We must have a foundation, or we can not understand the application.

So much for cardiac disorders. You can demonstrate in a great number of cases of organic heart disease a rise of blood pressure in which the blood pressure remains normal in cases where compensation remains good. So long as the compensation remains good that is true. And even in cases of aortic regurgitation that is true, and in cases of aortic stenosis it is sometimes true.

We have considered what to do for high pressure. Have we considered what to do in low pressure disorders? The other day we considered low pressure in general disorders, also high pressure, but I think we did not talk about secondary low pressure. In low pressure it is cold baths, taking care

not to apply the cold bath in such a way as to greatly depress the heart. A prolonged cold bath would depress the heart, hence the low pressure might be increased. A short cold bath would have a tendency to energize the heart to an increased blood pressure. Now you see that if we should produce reaction by the cold bath--if a short cold application will produce reaction--that would open up the arterioles and have a tendency to still further lower the pressure. But the operation of the arterioles in reaction after a cold bath is an active one, and the vessel tone is raised. The orifices of the arterioles are closed, contract somewhat, but at the same time there is a greater swing, a greater movement, so the blood is forced on into the veins and the pressure is raised; the consequence is the heart is better supplied with blood, the ventricles are better filled, and the heart is at the same time stimulated through the excitation of the excitor nerves, so the actual movement of the blood is accelerated, and the patient is benefited.

Cold applied to the skin stimulates through the cold nerves, the thermic nerves, stimulates the heart at the same time, stimulates the peripheral heart, so increases the movement of the blood at both ends. The heart puts blood into the arteries faster, and the arteries put it out faster, and the consequence is a rise of venous pressure. That moves the blood toward the heart faster. Then the ventricles of the heart will be better supplied with blood, and the movement of the blood to the heart more rapidly will fill the ventricles better; and the distension of the ventricles will stimulate the heart to more vigorous contraction, so there is a better pulse volume, a higher pulse pressure, and the blood moves faster in the arteries.

Now the thing which every organ, tissue, and cell of the body needs is more blood. The blood bringing oxygen will bring everything else the tissue needs. It is a circulating market, which supplies all its customers in all parts of the body with the things they long for. It is like a traveling peddler who comes around with everything you want. So better

blood, and more blood is what every organ is crying for. That is clearly shown by another class of cases. Digitalis does not do that. Digitalis will do something to the heart, but it does nothing good to the vessels. Strychnia will not do that. Crile showed that strychnia would actually produce shock. Pässler showed that before Crile did. Pässler and Khomberg in their experiments showed that a dose of strychnia in order to raise blood pressure must be a poisonous dose--one-tenth of a grain, and that this poisonous dose will raise blood pressure momentarily, but it will quickly fall, and this over-stimulation of the vasomotor centers has the same effect as a strong excitation of a sensory nerve. When it is repeated two or three times it has the effect to produce actual shock. Crile first produced shock by putting a dog's paw in the fire and burning it. He simply held the dog's paw in the flame, burned it, and it took half an hour to produce shock. At the end of half an hour that dog would be in a state of shock. But he afterwards found out he could produce shock just as well by a dose of strychnia as by that prolonged burning, and so he did it in that way. In hundreds of experiments upon dogs he produced shock by simply introducing a dose of strychnia. That shows at once that strychnia is the last thing in the world we ought to use for shock, and doctors are recognizing it now.

In shock there is no use for strychnia, because the vasomotor centers are all paralyzed, and a dose of strychnia is a paralyzant. And why should you give a paralyzant when you already have paralysis? Nothing could be more absurd. In fifty years from now I dare say that the backwoods country doctor will not think of using strychnia for shock. It excites the center to the highest degree, and immediately after, the center having been over-excited, is in a state of collapse, and after you have once excited it by that Herculean excitation of strychnia--for strychnia is a perfect Hercules--you can not excite it again.

Suppose you put your finger down here on a stone and let somebody hit it with a hammer as hard as he can. Then let somebody touch that with a feather, stick a pin into it, or hit it with the hammer again. It is not going to hurt you. If you have one good big blow with the hammer on your thumb nail you can get a second one without knowing it. Suppose somebody hits you on the head with a club and knocks you senseless. They can hit you again and you won't feel it. That is just what strychnia does, and after one stroke they feel no more. All the reflexes of the body produce no effect.

We have got to get down to an understanding of this thing. I am determined that this class shall not go off with any false ideas of these ridiculous and wicked remedies. They are wicked because they kill countless numbers of people. Think of the number of people that have been killed by strychnia! Or in surgical shock perhaps from the misuse of instruments or a careless long operation, or from chloroform, or from handling the intestines, from irritation of the sensory nerve so that the patient is in a state of shock. The doctors say in case of shock, Give strychnia, and do they give strychnia in one dose after another, and the patient is going down all the time.

I understand there is a little strychnia in our operating room. I will have to tell you how I think it must have gotten there, because I didn't know it was there. We had a young lady from Chicago a number of years ago who went into the surgical ward. The patient had had a miscarriage, and was brought in afterwards, and there was a little bleeding, a very small amount. And there was a young lady doctor who had come here from Chicago to treat this patient. One day I found her in a great pickle. She sent for me to come in great haste. I found she had given this patient two doses of strychnia. The patient had lost perhaps a couple ounces of blood, and was in a nervous state, which the doctor mistook for a state of shock, so she gave

her a hyperdermic of strychnia, and did several other things that were equally ridiculous. I decided right away that she was not the sort of person for us to have about our ward. She had faith in strychnia. I said "Why did you give her strychnia?" She had also given ergot--a large dose of ergot. I said Why did you give these things? She said, "Because a certain doctor in Chicago said that was the thing to do." I told her "That is not the way we do here. We have got something better to do." The patient was getting worse every minute. She was not in a state of shock to begin with. All in the world she needed was a hot douch and to be told to cheer up. That was all that was necessary in that case. She was in a state of panic in her mind. That is the kind of mistakes that young doctors often make, and that is the reason I am telling you. I suppose likely this doctor installed strychnia there so as to have it ready for any emergency. I shall have to look over that corner in the operating room and see what we have there. We have no need of strychnia in operating room for any case at all. In a case of collapse strychnia might seem to do a little good, because in collapse the vasomotor centers are still capable of responding. A hot fomentation over the heart will do it just as ~~good~~ quicker, and a great deal better than strychnia will. Cold over the heart, cold rubbings, percussion of the skin, pinching the skin, apply the faradic current to the inside of the nostrils and the mucus membrane of the nose--any of these things will accomplish the thing just as well and a great deal quicker.

Then there is something else which acts a great deal better, and I give with both shock and collapse, so you don't have to stop for differential diagnosis, and that is to put on abdominal compression, or to put on Crile's pneumatic suit, which includes the legs, arms and abdomen, and in fact the whole body. I have it up there, and we will experiment with it one of these days. If some of you will volunteer we will see how much we can raise your blood pressure. It is now granted by everybody who

knows anything about the subject that the pneumatic suit abdominal compression is worth more than all the other remedies put together. You can easily do it. Abdominal compression is the most important of all in these cases, for that is where the trouble is, with the splanchnic area. The blood has run into the splanchnic area, and we want to get it out into the general circulation. Just put a bandage right around the abdomen, slip under it a rubber bag with a tube, and blow it up. You do not even need to wait to get an atomizer bulb. You can blow it up with your mouth as hard as the patient can stand it, and there you have it. Suppose you were in an emergency somewhere and didn't have any bag. What could you do? Inflate the colon. Just simply inflate the colon , or a simple compress. But blow up the colon, and you will be astonished to see what effect that will produce.

Constipation is a high pressure disease. Many a patient takes a warm enema for the bowels, and immediately afterward the blood pressure falls, so that the patient is almost in a state of collapse. It is only recently that I was led to use the cold enema instead of the warm. The warm enema causes such a tremendous collapse in very feeble patients. Any of you who have had experience as nurses have met cases of that sort in which the patient collapses after the enema, so that they dread to take it, and that really comes to be a serious matter with very feeble people who already have low pressure. The cold enema, or cold enema at the close of the warm enema will relieve that difficulty, or a hot enema, though it might be a large cold enema repeatedly put into the bowels, or if you blow the bowel up with air, inflate it, which can be done easily done with or without a bulb. So there are other remedies easily at hand besides strychnia for combatting low pressure.

What are we going to do for high pressure? The thing to do is to remove the cause by relaxing the blood vessels. The prolonged neutral bath I think will be one of the very best things we know anything about. Hot sponging of the skin is another very valuable remedy. Friction of the

skin, manipulation of the skin to open up the surface vessels and draw the blood off. A moist abdominal bandage to draw the blood into the skin of the splanchnic area is a good means of lowering the pressure. That also has the effect to dilate the splanchnic vessels, which are sclerotic in all cases of chronic high pressure. In all cases of chronic high pressure you may depend upon it that the splanchnic vessels are disordered. Disease of the systemic vessels is not sufficient to cause high pressure. Remember that. If you find the radial artery hard, that won't produce high pressure. High pressure is a disease of the small vessels that produce high pressure, and not a disease of the small vessels of the skin or of the muscles, but disease of the small vessels of the splanchnic area. So you can not possibly get chronic continuous high pressure. All Bright's disease or kidney disease is a pretty general vascular disorder of the body. Or if it is premature, as it sometimes is, beginning of acute nephritis, then the high pressure is due to a reflex acting upon the heart. The pressure is raised in order to get blood through the kidney, to keep the toxines out of the body, to purify the blood, for the same reason that in brain compression there is always high pressure in order to overcome the cerebral anemia.

I am writing a little paper which I had begun on when I began giving you this series of talks on this subject, and I will put my paper into your hands. The paper is on the practical application of hydrotherapy in these cases. I have not endeavored to cover the whole ground, but just a very small portion of it, in a practical way. You will find the paper printed in Modern Medicine in an early number, with the diagram we had on the board here.

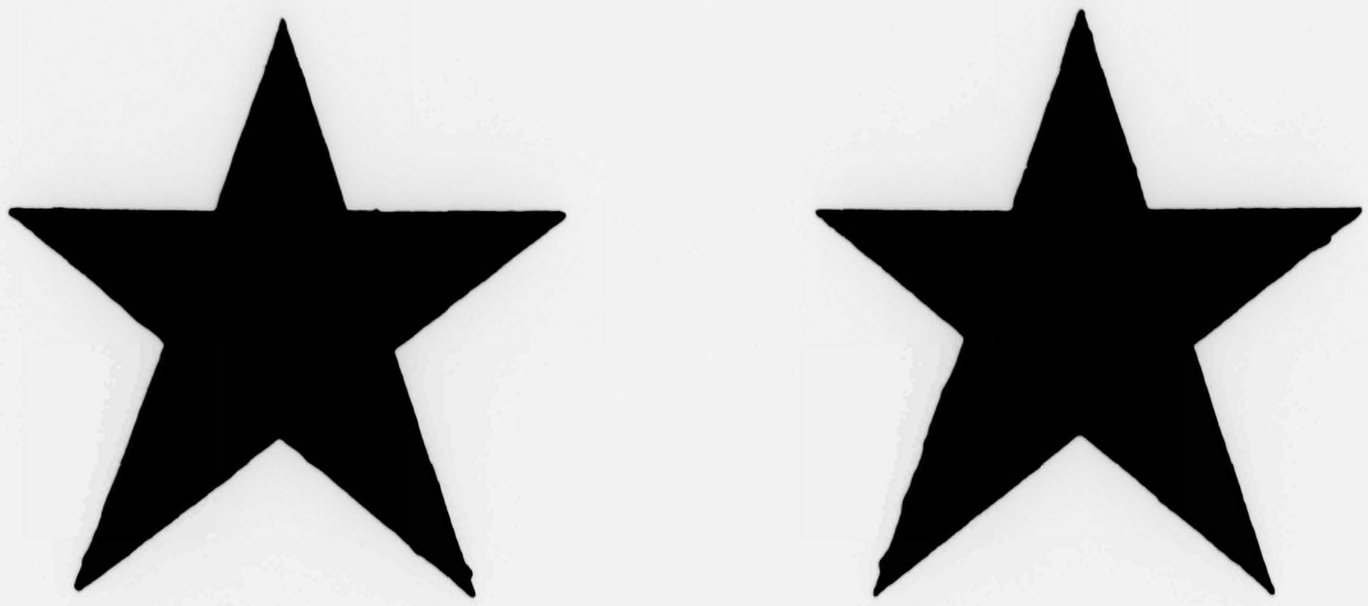
Cases of secondary low pressure are the most important cases of all. Those are the cases you are especially called upon to treat. These are cases in which you can save patients' lives and do more good than you can with all the rest put together. Low pressure cases are not so very important,

because so long as a man is getting on all right, low pressure does not do any harm. The lower the pressure you can live with and do good work, the longer you are going to live. The steamer boiler may be capable of being run at 200 pounds pressure, but if you run that boiler at 40 pounds pressure instead of 200, its life will be longer. This is just the same thing exactly. The heart is a pump. If it does its work at a pressure of 100 millimeters, it will do it longer than it will at a pressure of 200; so if you have low pressure, be glad and thankful, and keep it low. My pressure is only 105, so I have some hopes of living some years yet. If you find your pressure is 120 to 130 at your ages, any of you, you better be looking around to see what you are doing wrong. May be you are eating too much. May be you are studying too hard, so that you have too much psychic influence upon the heart. High mental pressure will make high blood pressure, though I do not think any of you impress me that you are extraordinarily taxed.

A certain doctor in Chicago said the trouble with a great many business men in Chicago was that they did not have brains enough to run their business and their stomachs at the same time. I think if you have taken care of your stomachs, you will have no difficulty in running your business all right.

But what shall we do in these cases of secondary low pressure? They are cases in which low pressure is secondary to high pressure. That means in every single case that the heart has worn itself out, that its reserve energy is all gone, and it is no longer able to sustain the blood at the pressure necessary to overcome the resistance. That means there will be a rapid advance of disease. That means there will be a rapid increase in the disease that has produced the resistance, because of the failure of nutrition. It means there is no longer enough pressure in the blood stream to stretch the vessels open and to keep them from becoming rapidly contracted. So such a patient is coming to his end very fast. What can we do in such cases?

CORRECTION



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An important thing is to dilate the surface vessels, to do everything we can do in cases of high blood pressure. You would not do the things you would do for primary low blood-pressure. In low- blood-pressure you cause contraction of the vessels in order to raise the tension, to force the blood out of the splanchnic area into the general circulation. Would you do that in these secondary low-pressure cases? Would we put compression upon the abdomen to drive the blood out of the abdomen toward the heart? You might kill the patient in a minute that way. Why? The heart is too weak, and forcing a large quantity of blood upon the heart might distend its capillaries and dilate the heart so that acute dilatation of the heart would be the consequence. But the heart's vessels are weak, and forcing a large quantity of blood upon the full heart would easily dilate it. What you want to do is to move the blood away from the heart and do what you can to help the heart. In these cases that is all-important to remember. You must work at both ends. In high blood-pressure you work at one end only. In low blood-pressure you contract the vessels and raise the pressure. The vessels are open; the heart is adequate. In low blood-pressure the heart is strong enough to do the work. In primary low pressure the heart is strong enough to do the work; always strong enough to do the work. The trouble is the vessels are open at the other end, so you must increase the vessel tonus in order to increase the pressure. There is a big leak in the pipe, and you must stop the leak so that the blood can accumulate in the vessels, and that will raise the pressure so you must increase the vessel tone, and we do that by cold baths. If the blood is accumulating in the splanchnic area, as in shock or collapse, we will compress that area, in order to supply blood to the heart in larger quantity. Why is that safe? Because the heart is strong enough to take care of it.

In secondary low pressure we do none of these things. It would be a fatal mistake to do these things. You don't want to contract the blood vessels any more, because they are too much contracted already. You don't

want to carry any more blood to the heart, because the heart is not able to take care of what blood it has. Its capillaries are already dilating;-- you can mark it out on the chest and see they are dilating. It is broken compensation in these cases, so it is of the highest importance that you recognize that fact.

In primary low pressure you can excite the heart moderately, because the heart has such a great amount of reserve power it will respond to it, and help to overcome the low pressure condition which exists a little more quickly.

In secondary low pressure, here are the things to do: First of all relax the peripheral arteries so as to lower resistance, then gently, carefully, stimulate the heart. Why is it right to do that? Because the pressure has become so low that the arteries of the heart themselves are not supplied with the proper amount of blood to nourish its muscle, and the arteries are so degenerating, as well as other parts of the body, and the heart is failing, because of lack of nutrition. So you must raise the pressure a little in order to get control of the heart. The heart has been overworked. The blood vessels of the heart have been undergoing change. The arterioles have been contracting at the further end, so the blood could not be got through into the veins, and the veins of the splanchnic area have been closing up the arterioles so that the blood could not get through into the portal vein. The blood is consequently stagnant, so it gradually leakes through. It does not go back to the heart, but accumulates in the peripheral veins, and the result is the heart is inadequately supplied with blood. It does not get blood enough. The arteries are small, the heart energy is exhausted, and the heart is inadequately supplied with blood, and its nutrition fails.
That makes a vicious circle, continually leading down. Each thing makes the other thing worse. The overworked heart becomes weak. As it becomes weak it supplies itself with blood less adequately, and its nutrition fails still

more, and it becomes weaker and weaker. We must begin at the other end of the circle and work backward you see. Starting with the distal vessels open up the arterioles, lessen the work of the heart; then gentle stimulate the heart so the heart may be able to get more blood, and as the heart gets more blood its work is diminished. If it is not already completely played out, to use the common phrase, completely used up, worked out, then it will respond, and you will see an improvement. You will see the blood-pressure will gradually come back again, rise a little, and as the blood-pressure rises the heart will do better work. The pulse will be stronger, and the heart will gradually come back to a more normal state. But it never can be restored to its normal condition, never.

In these cases of secondary low-tension, what are the particular things we can do? Hot sponging to the surface is a good thing to use. Hot full bath is a thing you would not want to use. A hot full bath might make a still further fall of tension, instead of causing a rise of tension, as it does in normal cases. It will cause first a sudden rise, then a quick fall. The same thing is true of prolonged cold baths. The same thing is also true of exercise in posture. Exercise makes a sudden rise, then a quick fall. Everything which in a normal man produces a sudden rise will in these cases of secondary low pressure cause a very short sudden rise, then quick fall. So you see those measures can not be resorted to, and we must resort to measures of a different character,--those which will relax the blood-vessels without depressing the heart; so hot sponging is one of the best remedies I know of.

Manipulations of the skin to open up the vessels to draw the blood into the skin are good. Very short, carefully administered mitten frictions are very excellent, or a great deal of rubbing with a rather dry mit or very little water. You don't want to extract much heat. You must use very cold water, and a dryly wring mit and vigorous rubbing, taking great care that

the patient does not become chilled. Chilling such a case is almost as dangerous as a bullet wound through the ~~hand~~ body.

The splanchnic area is particularly involved, so that a cold moist abdominal bandage should be worn every night, with mackintosh. The mackintosh should be applied in order to relax these vessels. Hot and cold applications over the abdomen and over the liver too are very excellent in these cases; but you must remember this thing always--rub the skin. Make a short general application, hot or cold, something to relax the general surface, the peripheral surface, before making an application to the heart. You must open up the distal vessels before you stimulate the heart, because the heart is already so weak it can not work against the pressure which exists. Suppose you have secondary low-tension, with a pressure of 100 millimeters, and you make a cold application over the heart: instead of seeing the pressure rise, it will fall. What makes it fall? The heart is already failing, the pressure is going down, because it can not work against that high pressure and the stimulus of the heart, and causes the vessels to contract, dilates the vessels still more. It is the same case you have with physiology. Suppose you are experimenting with a muscle, making a muscle lift a weight, and you keep adding to the weight until you reach the point at which the muscle can just lift the weight. Suppose you increase it a little more, what happens? When the muscle contracts, what happens? It stretches, instead of contracting. Now when the muscle is over-weighted it stretches when it relaxes. That is the very thing that happens to the heart. When you get the heart over-distended in these cases it dilates instead of contracting, then the pressure falls still more, and the patient is made worse instead of better. So how important it is to remember to tone up the peripheral vessels before you make the application to the heart. I wish that I could impress this upon your minds so that you could never forget it, because it is one of the things that perplexed me more than anything else.

Nurses get the idea cold is a good thing for the heart--if anybody has a weak heart, apply cold to the heart, an ice bag to the heart, and clap it on without considering; and I have been scared many times, and I have taken every opportunity when I came in contact with patients to caution doctors and nurses--Don't put that cold on the heart until you have first given the patient a good rubbing to get the skin warm. Give a cold mitten friction, or a very hot mitten friction first, followed by a heating compress to the back, so as to get the blood into the surfaces of the body first, then make the application to the heart; otherwise you will increase the dilatation.

Hydriatic stimulants have to be used with greater discrimination than almost any other hydriatic measures. I have seen doctors and nurses sometimes show great carelessness in applying hot and cold on the heart. I guess I have 500 times forbidden the application of hot and cold to the heart. I think it would be better to abandon that method, and not use it at all, than to use it indiscriminately, and I have often wished I had never suggested it, because it is only in certain special cases it can be used, only when the heart has reserve energy--has an open field to work in, so to speak, that it is proper to use such a powerful measure as hot and cold to the heart. If you have a patient with a very weak heart, and you think you must apply the strongest medicine you have got, so you apply hot and cold. You are very likely to do exactly what strychnia does--to bring that man almost into a state of shock in this case of over-dilatation of the heart itself.

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B L O O D P R E S S U R E

Lecture to Junior Medical Students of the A.M.M.C., Battle Creek, Mich.

February 1, 1906.

--By J.H. Kellogg, M.D.--

Secondary low pressure is told by the history of the case. Last summer a lady came to the Sanitarium, I examined her pulse and found her arteries were just slightly hard, not very much, and a little tehse, and the blood pressure was 170. The blood vessels felt too full and too tense--the radial artery. At the same time I could not distinctly feel the artery between the beats. You must be able to roll the artery under your thumb, and I could not, so I could not say it was systemic or arteriosclerosis, but the blood pressure was high, and she had a moderately regurgitative murmur. The skin had a little peculiar pallor, like what you see in Bright's disease, in a contracted kidney, becoming a little bit wrinkled. This lady has come back, just alive, a day or two ago. I saw her yesterday. Her blood pressure is now 135. She is no better. She is worse. She looks worse. She heard me speaking in a lecture in the parlor about arteriosclerosis, describing a case, and she ran across this woman in the bath room and proceeded to make an examination herself,--felt her arteries, she looked her over, and came to see me last night. She said "When I examined that woman I examined myself. I went to look into the glass, and I am just like her. I am the same sort of case." The woman was in quite a panic. This woman was worse off in some respects than the old lady who was here. She is a much younger woman, only about 45 years old. She has had a blood pressure of 170, but she has this weakened heart, and her blood pressure is going down. What is that? That means secondary blood pressure. So that is the way you know it is secondary.

An interesting thing has recently come to my notice that I think has a bearing on this work. A doctor who was investigating the blood, studying the blood in the Columbian Library of the College of Physicians and Surgeons of New York, supported by the Carnegie fund, or by Vanderbilt--but I think it is Carnegie. This doctor has recently been making some experiments on the viscosity of the blood, and he found that hot baths at a temperature of 105 to 110° will, in the course of ten or fifteen minutes, diminish the viscosity of the blood 10 percent. The viscosity of the blood is about 5 4/10 times that of distilled water. That is determined by the pressure required to drive a certain quantity of blood through a capillary tube of a certain diameter. The amount of pressure required to drive a certain quantity of blood through a very fine capillary tube of a certain diameter, determines the viscosity of the blood. The more vicious the blood is, the greater is the pressure required to drive it through. He found the viscosity of the blood is decreased by a hot bath in ten or fifteen minutes about 10 percent, and the cold bath, on the other hand, from 71 to 73°, for ten or fifteen minutes, will increase the viscosity of the blood to the amount of 12 percent.

You remember iodid of potash diminishes the viscosity of the blood. When a doctor comes to you and tells you a drug will do a certain thing, so much, you ought to know that fact, and to know something else that will do it a great deal better than the drug will do it, and you ought to be able to tell him why. Iodid of potash will diminish the viscosity of the blood 10 percent. A warm bath will do it also. A warm bath has not got to be eliminated through the kidneys, but the iodid of potash has to be. The warm bath does not leave anything behind poisoning or damaging anything; it does not impose any extra work on the kidneys or the liver, or other organs. The warm bath, ten or fifteen minutes, will diminish the viscosity of the blood just as much as a large dose of iodid of potash will.

It is interesting to note that a warm bath will diminish the viscosity of the blood just as much as iodid of potash will, and that is the one drug which is relied upon to do that thing.

When you apply a cold bath then to a person who has low blood pressure, here is another way in which the pressure is raised, isn't it? It raises the pressure by increasing vessel tonus, by contracting the arteries. What has the influence of the cold bath on the viscosity of the blood to do with that? It will have the same effect. If the viscosity of the blood is increased so it requires more pressure to put it through, that makes more resistance to the heart.

The cold bath does three things to increase blood pressure. One thing it does is to energize the heart; another thing, to increase the vessel tonus; another thing, to increase viscosity of the blood; and still another thing, the fourth thing, it increases the resistance of the tissues. So there are four things cold water will do, all of which tend to increase blood-pressure.

On the other hand, when hot water is applied, very hot water will raise blood-pressure; but it falls pretty quick afterward. Why? Because it decreases the viscosity of the blood so the blood slips through the vessels easily. It relaxes the tissues, but it is only the excitant effect upon the heart, and a temporary excitant effect upon the vessels. When you first apply very hot water, what is the effect upon the skin? It produces goose-pimples. It blasts the skin. Does what cold water does. But that effect quickly passes away. So hot water is not a good thing to rely upon for raising blood pressure. A short application of hot followed by cold might work better in some cases possibly. It is a little more powerful stimulus, because the effect which the cold application to the skin has upon the thermic nerves is determined by the difference of temperature between the cold application and the skin. If your skin was already frozen you would not feel ice when it is rubbed on it. Ice would not produce any reaction. If the temperature of the skin was

60° and you put on cold water at 60, it would not produce any effect. So hot applications under certain circumstances may increase the sensory stimulation produced by application of cold to the skin. The splanchnic nerve is powerfully influenced by sensory impressions, and the more powerful the sensory impression you make upon the skin, the more powerful is the effect produced.

But here is a thing you must consider, and this is a very important thing, so don't forget it. I am very anxious you should get it and remember it. You make very hot applications to the patient, give him a hot spray for three minutes, then give him a cold spray for fifteen seconds, what is the general effect of that upon the surface vessels? It is relaxing. Now if you are going to use hot and cold to raise pressure, it must be very short hot and a long cold. But if you are going to use hot and cold to produce a derivative effect, to get the blood into the legs for instance, then it should be a long hot and a short cold. So if you are going to use hot and cold for blood pressure you must reverse the method of application; otherwise you may leave the effect of the hot behind, and dilate the vessels instead of contracting the vessels.

How is it that the viscosity of the blood is raised by the hot bath? The probability is, from the experiment made by Purdon-Opis, the man who made these investigations at Columbian Library, the probability is it is due to the rise of the temperature of the blood; because he first discovered by experiment upon the blood that if he raised the temperature of the blood itself the viscosity was diminished, and if you lowered the temperature it was decreased, so he finds the cold baths and hot baths have this effect; and while he does not say so,but leaves the thing open , still he rather leaves the inference to be drawn that it is due to the change of temperature of the blood. But I confess that seems to me a very doubtful explanation. I hardly believe it. I believe that the effect of cold applications is that of wringing

a sponge. It condenses the blood. While the effect of the hot application is to drain the fluids out of the tissues into the vessels, dilating the vessels, so that the tissues are drained into the blood, and on that account its viscosity is diminished. That seems to me much more reasonable. That is one explanation which has been offered for the difference in the blood count after a hot bath and after a cold bath. The cold application condenses the blood. The blood vessels contain a smaller amount of blood and the blood is more concentrated.

Potash has a chemical effect on the fibrins of the blood. The albumens of the blood are alkali albumens, like the white of egg. The white of egg is alkali albumen. What kind of albumen is casein? Milk is alkalin when it is sweet, and acid when it is sour. Alkali albumens are soluble in water, and the acid albumens are not soluble.

We will talk a little while now about the various disorders in which blood-pressure is a matter of very great importance. In kidney disorders, and nephritis, it is especially important to know the blood-pressure and to keep watch of the pressure. This case that I mentioned to you a few moments ago I believe is renal disease, but she has given no symptoms of it at all. There is very little peripheral or external sclerosis, but I believe there is sclerosis of the splanchnic area, and I believe there is kidney disease, so we are watching the case with a great deal of interest, and I may have something more to report to you about that case. The high pressure is the most important of all symptoms of contracted kidney. It is more important than albumen and diminished urea. The quantity of urea is not notably diminished in a contracted kidney. Urea comes out very easily. The kidneys eliminate urea very easily. The contracted kidney is more liable to fail in the ability to eliminate common salt--chlorid of sodium, than in its ability to eliminate urea; so it is more important to determine the amount of sodium chlorid eliminated by the kidney than to determine the amount of

urea eliminated. Do both, but the chlorid of sodium is of more importance than the other. That is the reason why when edema comes it may be cured by suppressing absolutely chlorid of sodium. We have with us a patient from Toledo for whom there was absolutely no hope at all: his doctor said there was absolutely no hope. The sodium has almost entirely disappeared, and I am compelled to contribute almost all the good results in this case to suppressing chlorid of sodium. He eats everything without salt, and the results are very remarkable indeed.

Dr. Waggoner: Finsen noticed that when he went on a non-salt diet he eliminated the same amount of salt that he did when he ate salt.

J.H. Kellogg: Certainly. Because all he ate was stored up, and that was why he had the edema, because the system had put the salt out in the tissues in order to get rid of it, and the kidneys had lost their power to eliminate chlorid of sodium; so no matter how much he ate, the kidneys were working up to their full capacity all the time. The kidneys had lost their power, and if the kidneys are likely to lose it, whether it is due to chlorid of sodium or any other cause, it is certainly better not to run the risk of getting edema by making the kidneys do the work they ought not to do; and certainly it must be superficial work to make the kidneys eliminate chlorid of sodium that may not be needful. Personally, I have been on the no-salt side for thirty years, and I have no reason to regret it. I don't use any salt, any more than I can help. There is a little salt in bread. I put no salt in my food. It is rather a difficult thing to do in a salty world as we are living in--it is really a difficult thing to do. If you are not accustomed to the use of salt, baker's bread is so offensive to you you can hardly eat it. I can not endure baker's bread on account of the salt in it. If the soup is a little too salt, I simply can't eat it. Our folks get careless and make their foods too salt. I am going to see that they reform on that thing.

Is salt necessary? If so, why? If it is not necessary, why not? We will take these questions up some other time, and I think we will see plenty of good reasons for bringing salt down to a very small amount. How much does Bunge say ought to be eaten? A gram to a gram and a half. The average man eats six or eight grams, sometimes ten. Many people eat ten grams of salt a day, and that is all superfluous.

The most important symptom of contracted kidney is high pressure. It is almost a pathognomonic symptom, and if you can not find any other cause of high pressure, you may be pretty sure it is the kidneys. And you don't want to come to the conclusion that it is not the kidneys until after you have made a great many examinations. Examine many many times before you decide the kidneys are not involved if you have high pressure. If you have a pressure above 170 or 130 millimeters, be almost certain the kidneys are involved, and that the splanchnic area is involved, for you can not have very high pressure without disease of the splanchnic area; do if you don't find arteriosclerosis, find no evidence of it in the radial arteries, don't conclude you have not got arteriosclerosis. It is in the splanchnic area where the trouble is, that is the main thing anyhow. The kidneys are involved with the general arteriosclerosis. If you have got general arteriosclerosis you have it in the kidneys as well as in all other parts. You may have nodular arteriosclerosis, or it may be general. If you have it in the general vessels you are pretty certain to have it in the kidneys also. Sometimes there is a sclerosis in the kidneys generally; sometimes it begins in the kidneys and then extends to the rest of the body. The high pressure produced in the effort to get the blood through the body leads to changes in the vessels.

High pressure itself is a cause of arteriosclerosis. If it begins with the kidney, it will extend to the rest of the body. If it begins in the organs in the rest of the body, it will certainly extend to the kidneys. It works both ways.

If you have a case of arteriosclerosis, and evidence of contracted kidney, and the pressure is rising steadily, you examine the patient day by day and find the pressure going up, you may be worried about that case. You see the disease is advancing rapidly, and that patient has a short time to live probably in spite of all you can do. You must certainly hasten to do those things that lower pressure.

Would nitrate of soda be a good thing to lower pressure?

Would nitrate of glycerine be a good thing? Why are these not good things? Because they are poisons. They weaken the heart. And secondary low pressure is as often produced nowadays, probably more often produced by medication, by continuous medication of nitrate of soda, amylnitrite, and nitrate glycerine, and other pressure lowering drugs; it is more often produced by that means than by any other means. It would naturally come sooner or later from the wearing of heart's energy out, but it is hastened, and probably produced very often by medication. We can do it by other means.

There are certain forms of kidney disease. Amyloid kidney, characterized by failure, by cardiac hypertrophy, and all low-pressure. So you don't find high pressure in a large white waxy kidney. A hemorrhagic kidney is also low pressure, through the secondary anemia produced by loss of blood, especially when the hemorrhages are large. Parenchymatic nephritis, diffused nephritis, may be either high pressure or low pressure. We are not so certain to find high pressure in that form of disease as in contracted kidney, and the pressure is not liable to be so high. I think contracted kidney is the most important chronic kidney disease. Intestinal nephritis must be by far the most frequent, because it is the result of general systemic degeneration. Uremia is one of the common incidents, so-called, of complications of Bright's disease. The larger proportion of patients die of uremic poisoning. In euremic poisoning there is always a rise of pressure, and in

uremic convulsions there ishigh pressure. If a fever patient has uremia and uremic convulsions, the pressure continually rises until the patient dies, sometimes with pressure as high as 350. So if you find a patient has uremia and pressure is going up, you must hasten to do something. The best thing you can possibly do is to sweat the patient, because sweating lowers blood pressure, and at the same time eliminates the poison which produces high pressure.

We will consider circulatory troubles that result from arteriosclerosis and degeneration,--thrombosis in the arteries of the heart or brachial artery, for instance. What would be the effect of that? It would plug up that artery, lower pressure in that end; so there is a difference of pressure between the two radials. There might be a difference in pressure of 50, 60, or 70 millimeters. The pulse might be entirely suppressed in one radial through an aneurysm pressing upon a vessel, as well as from thrombosis. Sometimes a mediastinal tumor might produce that effect. In one case of mediastinal tumor, when the patient stood up the pressure was equal in the two radials, but when the patient lay down on one side there was a difference of 60 and 90 millimeters between the two radials, because the tumor fell on that side and compressed the vessels on that side. In hemiplegia the pressure is always raised a little, whether it is from thrombosis or hemorrhage. If it is thrombosis it will be raised a little. If it is hemorrhage it will be raised very much from cerebral compression, and produce brain anemia and reflex stimulation of the heart to force the blood into that gland. It has been purposed in extreme cases of hemorrhage, where the pressure rises very high, with the sudden rise in temperature, with hemiplegia, to trephine the skull and remove the clot. That has been done, and life has been saved. But the cases in which that should be done are very rare. It is only when there is very marked evidence of cordical injury.

At the beginning what would be the evidence of cordical injury? Paralysis of one side might come from injury to the internal capsule.

It is more likely to be the internal capsule with cordical origin. Irritation of the cortex will set up convulsions, spastic contractions. That is the evidence of cordical injury, isn't it? Now when you have those symptoms--evidences of compression, blood pressure rising very high, it is proper to trephine and remove the clot.

Does a tumor growing on the brain usually produce high pressure? We had a [redacted] man here who died of brain tumor on the way home. The man came here but was almost in a comatose condition. He aroused a little but we could not talk with him in an intelligent way, and we advised his brother to take him home, and he died on the way to Chicago. What was his blood pressure? It was 90. Why does not a tumor produce high blood pressure? Because it comes gradually, and room is made for it. That is the reason it is not high pressure. It is about normal ordinarily. It might be low pressure, if the patient has gotten toward the end of life, what is called terminal hypotension.

Infectious diseases of childhood--measles, hooping-cough, typhoid, scarlet fever, are all low tension diseases. That is why cold baths, cold packs, etc., are so helpful in these cases. The cold pack in raising tension stimulates elimination, drives poison through the kidney with greater force, and so improves elimination, and is a very helpful thing. Intra-current uremia, intra-current Bright's disease, acute nephritis, in these cases rises of pressure. When a child has uremic convulsions, as children sometimes do in scarlet fever, the pressure comes up. In these cases what is needed to lower pressure? Continuous sweating. I have saved many a child's life by putting the child in a hot blanket pack, and renewing it again and again to keep the child sweating. A large hot enema, hot water drinking, keep the sweating going, and by that means, in twenty-four to forty-eight hours many times I have saved a child's life.

CACHEXIA DISEASES

We often find in diabetes arteriosclerosis right along with the sugar. Diabetes is commonly a disease of advanced years. When it occurs in young people it is due to disease of the pancreas generally, and is most commonly a hopeless measure, and the pressure is generally high in diabetes. In tuberculosis, and chronic infectious disorders, the pressure is low. But suppose you have a contracted kidney complicated with tuberculosis, then it may be high, or it may be low. Remember that. It might be normal. If you have got tuberculosis along with a contracted kidney the pressure may be high, or low, or normal, according to which has the greater influence of the two diseases. Pneumonia is a low-pressure disease. Much might be said upon those points. All of the rheumatoid diseases, rheumatoid arthirtis, for instance, are forms of high pressure disease. In acute rheumatism you have infection. In all the fibril infectious disorders there is almost certain to be low pressure. That is at least true of pneumonia, and in chronic infections the pressure is low. In typhoid fever the pressure is certain to be low. These are a few very important things.

BLOOD PRESSURE IN SURGICAL DISEASES

In surgical infections, for instance injury to the skull, we may have extension of acute compression of the brain that will produce high pressure. There may be a depressed skull, or may be a hard clot on the brain. If it is a clot on the brain then we will have compression through that, and that is an indication for operation. It is very important to take the blood pressure when you have got hemorrhage in the head. That will tell you whether you have got hemorrhage of the brain or a depressed skull. I had a case a few years ago, fifteen years ago. I had done an operation on a lady for several things. There was curetting, cervical laceration, laceration of

the peritoneum, and shortening the ligaments. I had done all four operations on this woman. The next day she jumped out of the fourth-story window of the old Hospital. Fortunately it did not kill her. I thought certainly when we picked her up she was dead, but it didn't kill her. I looked into the matter and found how she had come down. There was a long row of boxes for flowers on the balcony, and as she pitched headlong out of the window--the nurse saw her going through the window, siezed her night-dress, but it tore away from her, so she went headforemost straight down to the ground; but fortunately her head struck in that box of dirt, and then accidentally as she struck the ground she fell on a wheelbarrow, smashed the wheelbarrow, dislocated her elbow, and her head was simply pumice. Her head was all swollen up enormously. I felt of it, and it was boggy everywhere, looked as though it was simply a perfect mass of fragments. I thought the skull was in fragments. I watched her a little while and saw she was not dying. The pulse was pretty good. She was not bruised, although she was unconscious, so I said we will see if we can put the pieces together. I cut off a portion of the skull, turned it over, and the skull was absolutely in tact, was not damaged a particle. If I had known the relation of blood pressure to these disorders I should not have made that wound in her skull. It was absolutely useless. If I had taken the blood pressure and found it was about normal, that would have indicated no necessity for operation at all, and I would have had the satisfaction of seeing the patient recover without that ugly wound in her scalp. She made an excellent recovery; in fact it seemed to do her good. It didn't disturb the ligament or peritoneum, or any other operation. She was not the least bit disturbed by her gymnastics, so I have not been so particular since that time about surgical patients taking a walk. I think the patient could get right up right along without running any risk at all, if you could only make the patient believe it. Naturally you would have doubts about it; but seeing what that woman did without disturbing anything at all, convinced me that it was unnecessary to

keep them in bed so long. There was no infection of the wounds, and not the slightest disturbance of the wounds. The uterus was in perfect position, and there was no harm at all done. I think we have made some patients sick by keeping them in bed too long after ~~xxx~~ operations. They get weak, run down, debilitated, and this is a thing on which we need to reform somewhat. Suppose a patient should fall down and get a little cut half an inch long, and you would send them to bed for a month. But instead of that we made a clean wound with a sterilized knife. That wound heals up over night, and there is no danger. The important thing is to keep the patient quiet for a little while. We would not want such patients to exert themselves, but I think they should be allowed to get up to relieve their bladders. It is a great deal less risky to do that than it is to run a catheter into the bladder, which often causes cystitis . We wash the bladder out with hot water now, and that hot bladder douch has eliminated cystitis. We don't have it any more since we apply the cure immediately. In appendicitis there is danger of hernia. If you put in good strong ligatures so they will hold the parts together, the patient will get along all right.

I saw Mayo operate on the case of a womanwho had gastric cancer. He opened the abdomen, could do nothing else, and closed it up. He said to her to go home day after tomorrow. His instruction was that she should go home "day after tomorrow." She went home all right. He said if he should send that patient to bed her feet would begin to swell and she would die, but if he got her right up on her feet and started her off home she would be all right. He didn't want to keep her, because he was sure she would die. Mayo's statistics are made up in a somewhat peculiar way. He calls every case a failure when the patient dies in the hospital after operation. If they get out of the hospital before they die, then the operation is not to blame for it. That is the way his statistics are made up.

SURGICAL SHOCK

The things which produce shock in the first place after opening the abdomen, the skin incision, raises pressure. The incision of the peritoneum raises pressure still more; but after the abdomen is opened the intra-abdominal pressure is gone and the pressure falls. The mesenteric vessels fill up. Next time when we have an abdominal operation, when we make the incisions, you notice how the veins are distended with blood. They seem to be distended as though they would burst. They are like whip cords--feel just like raw-hyde whip, they are so distended with blood. This is because the intra-abdominal pressure has been suddenly removed and a large amount of blood runs into the abdomen as soon as you open. So when you are about to open the abdomen, if the assistant is giving chloroform, you should say to him Stop that chloroform while I am opening the abdomen. Why? For a little while the chloroform depresses the pressure, and when you open the abdomen the pressure is going to fall. It first rises when you are cutting the periotneum, then it will fall, and if it is going to fall you don't know how far it is going to fall, and if you have chloroform going and open the abdomen at the same time, you are going to lower the pressure, and you don't know how far it will go down. I saw one patient die as quick as a snap of the finger under those circumstances. So you must be careful about that.

Another thing that lowers blood pressure is pulling the intestines. Every time you pull the intestines the vasomotor centers are stimulated and there is a little rise of blood pressure, but after that they fall. They are so strongly stimulated by pulling the intestines, sponging, manipulating the internal organ, in fact every time you do either there is an exhausting impression made upon the vasomotor centers, and the effect of a good deal of manipulation is to completely exhaust the centers. Then the normal stimuli which will respond from the vessels by which the circulation is regulated,

by which the splanchnic nerve is made to operate in controlling the tone of the splanchnic vessels, these normal stimuli are no longer felt; the splanchnic nerve lets go, and the vessels dilate, fill with blood, and the patient then has shock. Massage raises the pressure, because you don't do it hard enough to produce shock. Of course it is possible to give a person massage to the abdomen in such a way as to bring him into a state of shock.

There are other things which lower blood pressure--contraction upon the wound. When the sensory nerves are involved, contraction upon those sensory nerves, especially the blood dissection, lowers pressure. Rough sponging of the tissues makes its impression upon the sensory nerves. Imagine you have a raw surface upon your hand, an open wound, and the surgeon was sponging it, treating it in the way such surfaces are treated under the anesthetic, what would be the effect? It would be very shocking indeed. That effect is felt by the sensory nervous system just the same as though the patient were not under the anesthetic. The psychic effect is not so great, but the vasomotor centers feel it just the same; consequently we must handle wounds with just as much care and delicacy in operation as we possibly can, just as much as we would if the patient were fully sensitive and awake. In abdominal operations particularly we must use the greatest possible care in manipulating things just as little as possible. I had one patient who died, and I believe she died because I handled her intestines too much. Dr. Martin, of Berlin, some years ago stated that in doing pelvic operations he made a large incision, drew all the intestines out, laid them up in warm towels on the abdomen, and that gave plenty of room; ~~Bufarexaxaxrytxingxxxxxixxxida~~ then everything was in sight. After Dr. Martin, the great gynecological surgeon of Berlin, had been doing this for years, in one case I said I would try it. It was a very bad case! So I did it also, with great care to keep everything covered up. That patient died, and I believe she died of shock. I think that was the reason she died. But I did not do that any more. When we find that we have got on

a wrong track,--we may be led astray sometimes by our confidence inxxx great names and in men who have great prestige; but I never did that again. I think it was manipulation in drawing it out. It is a great deal better to put the patient in the Trendelenburg position. That is a comparatively modern thing. It is only a few years that we have been doing that--putting the patient in the Trendelenburg position, then taking everything up carefully with napkins. We are thus enabled to avoid the difficulty which comes from the experience which I have just told you about.

What shall we do for chloroform shock? In the first place, don't use chloroform. Use it only when you have to use it. Ether is irritating to the lungs of people who have had bronchitis. Old people who have emphysema , who have had pneumonia, or have had acute bronchial troubles, we may sometimes use it. Children have good strong hearts, and are not likely to die from chloroform poisoning. But you must use a very small dose. Children struggle so against ether that chloroform is perhaps the lesser of the two evils. A cold compress applied over the lower chest will have the effect to help the heart through. It draws the blood out, so takes the blood from the portal circulation. Every time you put cold on the chest it makes the patient take a deep inspiration. Study that carefully when you put the compress on. That was the first thing that led me to think of doing that. That is why I use the compress instead of the ice bag upon the heart to get the effect upon the chest, asperating the blood of the splanchnic area and so help the circulation, helping the heart; and the cold also helps the heart itself: so we do that continually with chloroform. I am not so sure it is the thing in ether, but still I think it is of value. Why? Because it helps support the bronchial vessels, and I think obviates some risk of pulmonary congestion, acute edema which comes on sometimes with either. I had a patient die once from ether; the only one that ever did die from ether. We got started with the operation, and found that this patient had a

great deal of tough mucus in the throat, and hurried through the operation, got through as quick as we could, but in spite of all we could do this patient died, and on examination the lungs were completely filled with tough fiberous mucus, that filled out every air cell and every tube everywhere, so it could not be gotten at. The patient died two or three hours after the operation. It was very acute congestion, and the lung filled up with fibrin which was poured out into the chest. The cold compress will help to obviate that. So far as I know, this is the only clinic in which that is used. I think we are the first to use it. The time will come when it will be part of the technique of all surgical operations, to apply the cold compress, because it is such a simple remedy, so easy to use, and has such great power and is so very effective.

Another thing. In case you have to use chloroform and are not operating upon the abdomen, apply an abdominal compress. That is the thing that will help, because it is the abdomen where the blood accumulates. It is in the splanchnic area through paralysis of the vasomotor centers of the splanchnic area. The blood lags here, so that we should put an abdominal compress, a bag and a bandage, over the abdomen when we are operating upon some other part of the body and using chloroform, which helps very much against the danger of shock during the operation, or collapse after the operation.

There is much more to be said about high pressure in surgery, but just a word about high pressure in obstetrics. In pregnancy the pressure is raised always. As pregnancy advances pressure rises, simply through the increase of ultra-abdominal tension. Increase in the quantity and size of the abdominal contents raises blood pressure by compression of the vessels of the splanchnic area. During the parturition, before the operation begins, high pressure rises with each uterin contraction, and during labor the pressure rises higher. After the labor is completed the pressure falls at

once. After the evacuation of the abdominal contents, fluid, the removal of child, pressure falls at once. The intra-abdominal pressure is almost entirely gone.

There are some abnormal physiologic conditions that are very important to be borne in mind. If you find pressure suddenly rising, that indicates danger of acclamshia (?). That indicates the patient is likely to have puerperal convulsions. If you find very prolonged labor, and the pressure suddenly goes up, that means impending convulsions. If labor, if pressure does not drop at once to normal, or below normal, that means puerperal convulsions coming sure, almost certain. That is the only thing that could hold the pressure up. So when you find these symptoms you should begin to do something right away, before convulsions come.

What is the best thing to do? Sweating baths, water drinking. It must be a sweating bath, not simply a warm bath. We might raise the pressure by promoting the absorption of water, but it must be a very hot bath. A vapor bath, or a hot air bath might be suggested, but it must be a sweating bath. Purdon-Opis found out that a hot bath diminishes the viscosity of the blood, and a cold bath increases the viscosity of the blood; he found the hot air bath increases the viscosity, as did the cold air bath. It absorbed so much water from the blood it naturally would increase the viscosity of the blood. He did not seem to recognize that, but that is my explanation. Now I think we have most points of this subject pretty well in mind.

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BLOOD PRESSURE

A Lecture at the Battle Creek Sanitarium Parlor

Thursday, Jan. 25,1906.

(8 o'clock P.M.)

By J.H.Kellogg,M.D.

I promised to talk to you tonight about blood pressure. Blood pressure is a very interesting subject, and there are a few things about it which I think may interest you. When you first come to the Sanitarium, the first thing that is done to you by the doctor is to have your arm siezed and a bandage put around it; have your arm very uncomfortably squeezed. The doctor makes a report from this, and sends it in, and perhaps he tells you that your blood pressure is 100, or 150, or 200, or 250, or something of that sort, and you wonder what it all means anyway.

Now the body is an engine, or a machine, rather, and a wonderfully complicated machine. It is rather a series of combinations of machines of various sorts. Here is the stomach, which might be called the chemical laboratory of the body. That is where everything goes in. Things that are red, and green, and black, and white, and all sorts of colors go into the stomach, and they are all converted in the stomach into one substance--red blood. It is a wonderful alchymy, isn't it, how the stomach can make red blood out of spinach, for example, out of potatoes for example. Where does the color come from? How can the stomach make red blood out of all these various ingredients that we take as food? That is something which nobody can explain. It is the same problem which you have in your flower garden, where you see white daisies, yellow marigolds, red roses, and all sorts of flowers of various colors all growing up out of the same soil, with the same kind

of water, the same sort of earth, and the same air; and still you have all these different colors in all these different flowers. So the stomach takes all the different colored foods and makes them into red blood.

Then there is the heart. It is a pump. After the blood is made it must be circulated; it must be distributed around to all the different organs which need it. The heart is really like a great reacting pump, which pumps the water up into the reservoir, and from the reservoir it runs out into the pipes, or in the troughs, or in the little ditches: it runs around to all the different plants. Potatoes, for instance, need a whole lot of water. The green meadow needs to be flooded now and then. And then there are the pines which do not need so much water. So all the different plants require each its necessary supply of water.

But the blood carries not only water, but also carries food material. It is like the river, you might say like the yellow river of the Nile, which brings down soil substance as well as water. Now the heart is a great reacting pump that supplies water and food material to all the different little plattlets that are growing in the body.

Now here is the liver. That is another heart. The liver is a filtering or rendering establishment. You know down in Chicago they have a place where they render things. There is a cart which goes around to the different wards and picks up the dead animals they find,--a dead cat, or a dead hog that died of apoplexy, or a horse that dropped dead on the street from overwork, and perhaps there is a cow, or a chicken, or something else. All these different animals are thrown into the cart and carried off to the rendering establishment. At the rendering establishment the hair is converted into plastering material, the hide into leather, and the bones and the flesh are ground up into fertilizing material; and the grease is sent over to the Oleomargarine factory, to make into butter and refined lard, and various other things. And I heard of one of them that actually converted

the livers into coffee.

The liver is a rendering establishment for the body. It converts all these various odds and ends,--little things which are dying in the body, blood cells and other things that are dying in the body--all these things come around to the liver. If you smash your finger, bruise it, it gets black and blue, and some of the blood runs out into the tissues: that blood is all gathered up in a curious way. The macrophags, or large white corpuscles found in the blood, come along, find these bits of red blood, and swallow them, just simply fold themselves right around them. It is a very curious thing how all these white blood cells, for instance, will swallow a red cell. They just put out a little lip on either side, and it keeps putting out its lips further and further and further, and by and by it gets the lips clear around and shuts the red cells all in, and in that way completely surrounds it. So these white cells pick up these little fragments of red cells, carry them to the blood, and the blood carries them to the liver, and the liver renders them and converts them into other things. The alkali or potash is taken out in the form of bile. The coloring matter goes down to the hair and eyes, and is useful for other purposes. So these various organs all have their various duties. The liver filters the poisons out of the body, and the kidneys filter poisons out of the body. Really, the kidneys do the same thing, to a certain extent, as the liver does. There is a curious arrangement of the kidney, by which the blood serum runs out down into the kidney, where the watery portion is absorbed and the poisons are left behind, and these poisons go down into the bladder and are discharged from the body; so the arrangement is very similar to that of the liver.

Then there is the brain, the thinking machine, to which one-fifth of all the blood in the body goes. The great arteries, two in front and two behind, are constantly forcing up blood into the brain, so that the thinking machine shall be kept in active operation. Now in order that the blood should

be distributed to these various parts, that each part should be kept in order, a very interesting curious arrangement is provided. In the first place there is a pump. That is the pump that pumps this blood. Then there is a reservoir into which the blood is pumped. We call this reservoir the arteries; the great arterial system--a series of pipes that runs throughout the entire body constitutes the arteries. Then there is a series of reservoirs distributed into different parts of the body, that are called veins. These are in the skin, for example, which holds about half as much as this arterial system, and the muscles, which hold about two-thirds as much, and the large vessels of the abdomen, that are capable of holding all the blood in the body. All the blood that is sent into this great reservoir, called the arteries, can be held in this reservoir called the portal vein. Half of this can be held in the muscles, and two-thirds of it in the skin. Now the blood goesmm out of this reservoir into this other reservoir, which is called the arteries and capillaries. Here is where provision is made for keeping the pressure up. The heart pumps blood into this reservoir. These openings are all under control. Little muscles control these openings, and these muscles are under the control of the nerves, just as much as the muscles of the mouth are under the control of the nerves, or the muscles of the eyes are under the control of the nerves. When it is necessary for the pressure to be high, then all these little openings will close up--shut up, in order that the pressure may be raised.

Now what will cause pressure to rise? Suppose, for instance, when you lie down to sleep at night the heart begins to beat slowly, so that when you lie down it beats seventy times a minute, or sixty times perhaps, or sixty-five,--beats slower at any rate, so there is not so much blood pumped into the reservoir: you see the pressure will not be so high. It leaks slowly through down into the veins, then in the veins it is collected up and carried back to the heart. Here is where it comes back to another heart,

the right heart, and through the right heart is carried around here to be purified. Here is where it passes through these two other reservoirs. From there it goes around to the left heart to be pumped back again. That is the way it is distributed. And here is another filter, and that we call the liver, where the blood is filtered.

Then this pump is put inside of another cavity, called the chest. The pump is inside of this chest cavity here you see. This is a diagram representing the circulation. Now we will say, for instance, it is night, and you want to go to sleep. You don't want to have high pressure, so the pump stops pumping so hard, and the pressure falls, and when the pressure falls a little there is not so much blood distributed.

Now we will suppose that this is your brain, and that it is located at this point. The blood that goes through the brain--if the pressure is not too great the brain will not get so much blood so the pressure will fall, and the brain machinery will go slow; by and by it will cease altogether, stop altogether; that is, the principal part of the brain, and you will fall asleep. But while you are asleep the pressure gradually rises, keeps rising more and more and more, until by and by, along toward morning, the pressure gets so high that the machinery starts again. It is just the same as though at night, when you wanted your mill to stop, the fireman pulls out the fire from under the boilers and lets the steam go down; but he puts in some coal and starts a slow fire, and gradually the steam rises again, and by and by the steam gets up to the point where the engine begins to go, and the wheels begin to turn, and the whole mill starts again. That is why you wake up. There is a gradual rise of blood pressure, enough so that by and by, along toward morning, the mills are set going again, and you can not stay asleep any longer. Did you ever try to go to sleep when you are not sleepy? You can't go to sleep when you are not sleepy. You would have to take some medicine. The only way you can get a person to go to sleep

when he is not sleepy is to knock him on the head with a club or a dose of bromide of potash, which is the same thing. A dose of medicine is simply a blow on the head. It is filling your brain with poison. Hitting it on the inside with a poison drug, or hitting it on the outside with a club, are just the same. They are both blows. Whichever way it comes, it is a blow just the same, and the brain is poisoned, and then you can go to sleep, or the blow may knock you insensible, and then you are asleep anyway; but you wake up after a while.

The same is true of every organ of the body. The higher the pressure of the blood, the more blood is forced into that organ, and the more active is the function of the organ. Here are the salivary glands. Ordinarily there is not so very much saliva produced, but if you undertake to make a meal out of granose flakes, for example, or corn flakes, or dry zwieback, you put these things into your mouth and begin to chew, and by and by the saliva will flow in great abundance. Sometimes you notice when chewing that there seems to be a little spurt of water in your mouth, as though something was spurting into your mouth--a little jet of something forced into your mouth. What is that? That means the pressure had been rising, and had risen so high that your salivary glands was producing saliva in such quantities that it was actually being forced out in jets, just as the blood would spurt out if you should cut an artery. Claude Bernard, the great French physiologist, discovered that first, and he found it actually occurred sometimes. Pressure has risen during the movements of the jaws to such an extent that the pressure in the salivary glands has been raised so that there is an increased amount of saliva produced.

The same thing is true of the stomach. After dinner you need more blood to digest the food you have eaten. Everything that is done in the body is done by the blood. The blood is the traveling magician which goes around and does miracles everywhere. Miracles of creation, miracles of healing

are accomplished by the blood. Wherever there is a part out of order, the blood goes there and repairs it. Wherever there is any work to be done, it is the blood that does it. The blood is, as I said, the great magician, the miracle-worker, the power in the body which does the work. The Bible says "The life is in the blood." That is Scripture:--"The life is in the blood;" and the blood is the life of the body. And we know that as an actual physiologic fact. So there is a constant regulation taking place of pressure in each individual part.

If you want to do some hard thinking, the first thing you know the blood is going up into your head. After you have been doing some hard thinking you have noticed that the blood would come rushing into your face. Suppose somebody asked you a question that was very hard for you to answer. Did you ever have that experience? Perhaps some of you have been school teachers, and at some time a school boy has come to you and you begin to examine him and ask him a question, and the boy stood there without answering it; pretty soon his cheeks began to get red, and his whole face got red. Why was that? That boy is thinking so hard. What difference does that make? Why, the effort to think hard had set his heart to going. His heart was trying to help out his brain, you see; and the fact that he needs to think hard has set his heart to work to get more blood into his brain, so he can think hard. That is what it means. You have sometimes seen a speaker come up on the platform to speak. At first you think he is not going to say very much. Perhaps he is a political speaker. You may have had the experience yourself sometime. When he began to talk you did not know whether he was going to say very much or not; but by and by he is warmed up to his subject. What does that mean? That simply means that the heart gets to going, and begins to pump and sends more blood into the brain, and with the increased feeding of the brain, the increased stimulus of the brain that comes from the activity of the heart, the speaker's powers increase, and the activity of the brain is increased. That all comes from blood pressure. It is simply an

improved blood pressure.

The blood pressure does not all depend upon the heart. Now I am going to tell you one of the most wonderful things that I know of in physiology. That is that the mental activity, the brain activity, our very thinking, in fact, depends more upon the stomach than it does upon the brain. The Chinese have the idea that the stomach is the seat of the soul, you know. They really have some foundation for that belief. The Ancients believed that a man's liver had something to do with his character; so when a man had the blues they said he had hypochondriae. What is hypochondriae? It means the blues down under the ribs. Chondriae relates to the ribs, and hypochondriae is the place under the ribs. So when a man had the blues, he was down under the ribs, you see. A man who is depressed is simply down under the ribs. There was something the matter with his liver. He had black bile, too much bile was circulating in the blood, so he was said to be"down under the ribs." We say "down in the mouth," because the corners of a man's mouth come down. But it is a great deal more sensible to say "down under the ribs," than "down in the mouth." At least one is just as reasonable as the other. But there is some foundation for that idea. And these little arteries I was telling you about have muscles in the wall, and when it is necessary for a man to have some blood in his stomach--for instance, over here in this portal circulation; that is where the stomach is: this portion represents the stomach, this represents the skin, and this represents the muscles. If a man needs blood in the stomach, he does not have so much blood in the other parts, so these little gateways shut up, so he can get blood into his stomach after dinner. The little gateways that let the blood into the skin are shut up. Those which let the blood into the brain are shut up in part, and that sends the blood to the stomach.

That is the reason why a man feels sleepy after he eats a big dinner. Sometimes, if he has got slow digestion, he feels sleepy even after he has eaten a little dinner. He feels as though he had eaten a big dinner.

That is because the gateways into the stomach open up and draw the blood in there, and he has not got blood enough for his brain and his stomach too. The doctors in Chicago say that the business men in Chicago do not have brains enough to run their business and their stomachs too; , and that is quite reasonable. A tired out brain might be able to manage the stomach, but it could not manage the business and the stomach at the same time. I met a judge out in Iowa some time ago who was taking meals at our vegetarian restaurant in Des Moines. The judge said "I have found out that I can not do any business after dinner unless I come up here to take my dinners. I used to go to the hotel and get my dinner, and I would sit down and eat a pork chop, or roast beef, or something of that sort, and then I would go back to the bench and sit down, and could not do a thing for at least two hours after dinner. But now, eating this kind of a dinner, I can work just as hard after dinner as before." That is just the difference in eating rightly and wrongly, you see. In one place he swallowed pebbles, as the hawks do in Tartary.

You notice sometimes after dinner your hands get cold, and your feet get cold. Why is that? It is because so much blood has run into the portal circulation that you have not got blood enough for your hands and feet, and for your stomach too. You notice perhaps sometimes that you feel a little chilly after dinner. That is the same thing. You feel a little chilly because you have not blood enough to keep your skin warm and at the same time supply the mill that is grinding your food up--the digestive mill. It may be you have been in the habit of eating too big dinners, and making greater demands upon the blood supply than is reasonable, so the blood vessels of the portal circulation have become too greatly dilated. At any rate these oscillations are taking place in the body all the while. If you need a great deal of blood in one part, more blood will leave another part so that that part may be supplied. If you need a lot of blood in your head

it may be you can supply it by getting the blood out of some other part. Your feet will get cold, perhaps, when you are thinking real hard, or your hands, because so much blood goes into your brain, and there is not enough for your hands and your brain too.

I was reading in a work on Hygiene some time ago, and I saw a picture of a young fellow sitting in a chair reading a book, and he slipped down forward on the chair, and his heels were up high on the wall. This was an English book I was reading, an English work on hygiene, a very authoratative work, and under this picture there was printed the explanation--"This is the American student's position, very much practiced by the American College student, who have discovered that by putting their heels up high they have more blood to keep their brains going." That was the idea, a better blood supply for the brain by putting their heels high. In other words, the American student didn't have enough blood to keep his brain and his heels going both, so he sacrificed his heels for the sake of his brain. That is probably because the college boy does not have the right sort of things to eat. He is trying to run brain and heels both on boarding house hash and white bread, fine flour bread, baking soda biscuit, and that sort of thing, and the thing does not work well.

Now here is a wonderful thing I am going to tell you about. This set of veins here, the veins of the liver and the stomach, and all these large veins in the abdomen, these veins differ from the other veins in the body-~~XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX~~ The arteries have muscles in their walls, so they can be controlled, but the veins have no muscles in their walls. But now these large veins have muscles in their walls, and there is a nerve center that has the control of these muscles, so when you need a little blood in the head, and it is very important that you should have it, you can get it. You simply telegraph to your stomach--"Here, hold on a little while down there: stop this digestion a few minutes, and let us have a little

blood to think with!" and the thing will come. The digestion will stop, but it is only under very extraordinary circumstances. I remember a lady who was eating her dinner, getting on very comfortably one day, in the dining room, many many years ago, when we used to distribute mail at the dinner table. (We did not know any better then, but we do now.) This lady was eating her dinner, getting along very nicely, but she opened a letter that had been handed to her in the middle of the meal, and learned from the letter that her baby was sick. She got up from the table immediately, left the table, lost her appetite at once, stepped out of the dining room and as soon as she got to her room she lost her dinner too. She had an acute attack of indigestion, which came on instantly. The digestion ceased at once; her stomach revolted against the food she had taken. Why? Because she had got some bad news from home. There was nothing in the world the matter with her stomach. The blood vessels suddenly contracted in her stomach, and the blood went to her head. The unpleasant news aroused her brain to such activity in thinking what she should do for that baby, and was so worried about it that the digestion simply stopped immediately.

Now it may work the other way as well. Here is a man who is very very drowsy, and sleepy, and stupid. You shout at him The house is afire! or something of that kind, and he wakes up right away. The blood suddenly goes to his brain, and he is no longer stupid, or sleepy, or drowsy, because this portal circulation has contracted the blood vessels down here; the portal circulation becomes contracted, so the blood is forced up to the brain where it is wanted.

Now these portal muscles of the portal circulation here are very sensitive, and they can be made to contract very easily. This large nerve that controls the portal veins, called the splanchnic nerve, is the most sensitive vasomotor nerve in the body. All those nerves which control blood vessels are called vasomotor nerves, and the most important and most

sensitive of all vasomotor nerves is this splanchnic nerve. Now we can excite the splanchnic nerve in a variety of ways. For instance, just simply pinch the skin over the stomach and the splanchnic nerve will be excited, because the muscles contract, and so relieve the congestion of the stomach somewhat. Percussion will do it. That is why you have massage to the abdomen--why massage relieves you. You feel a heaviness in the stomach. You put a mustard plaster over it, and it relieves the pain; because the mustard plaster relieves the sensory nerve, the sensory nerve causes contraction of the congested vessels through the splanchnic nerve, and the pain is relieved. Apply a hot fomentation over the stomach of a baby that has colic pains, for instance. That pain is due to low pressure. There is not pressure enough there. There is congestion. Apply a hot flannel, or a hot bag, something of that kind, and the pain is relieved almost at once. Why? Because the muscles of the portal vein are made to contract. The splanchnic nerve is stimulated, the portal vessels contract, and the blood is forced out, so the pain is relieved.

Now why does this happen? It is a very common phenomena. I saw an interesting sight three years ago this winter. I happened to be in San Diego for a few days. I was taking a few days' vacation there, writing a book. I was traveling on the cars, had my stenographer with me, was dictating on the cars, visiting various places. We were thinking of starting a sanitarium at San Diego, and I visited the State for that purpose, prospecting the country. We now have a very nice institution down near the old town of San Diego--a short distance from San Diego. There is a little place there called Paradise Valley, a mile and a half East, I think, of National City, which is just below San Diego. If you go there you will find a beautiful little sanitarium there. I was making a pioneer visit down there, an exploration visit with reference to the establishment of this place. I went to see this very place that is now fitted up for a sanitarium,

and I was stopping at the hotel Coronado, over on the island. And I went out one morning at 7 o'clock to take a swim in the surf. The temperature was only 46, and I thought it would be a very nice time to get a morning dip. As I was going out I passed by the animal house there where they have some monkeys and other things inside, and I always stop to see monkeys. I have learned so many interesting things from monkeys that I always watch them a few minutes if I get a good chance. I had a monkey live with me for a while once, and I studied him some little time. I learned about mastication from monkeys. I will tell you about that now, for it is real interesting.

I gave my monkey some cherries one day, and he put them into his mouth and swallowed them as fast as I could give them to him. I said, "He is certainly swallowing those cherries whole: He will certainly have a bad attack of indigestion." And I said, "For pity sake, how can he ever digest those cherries! He is swallowing them whole!" A little while afterwards I was looking at the monkey and I noticed some great lumps in the side of his face. I said, "Dear me, my poor monkey is getting tuberculosis. He has got enlarged glands;" and I began to examine his large glands and I ~~found~~ discovered they were cherries. He had simply great pockets in his cheeks, and he had stored these cherries all up, and now he was bringing them forward one by one. When he wanted one he would bring it forward with his cheek, take it between his teeth, then he would put out the cherry pit, and pretty soon the whole skin would follow. He took it all off with the greatest care, masticated them very thoroughly, and simply stored them up to chew, just as a cow ruminates after storing away her dinner in her stomach.

I stopped to watch the monkeys for a little while,--a mother monkey and two young monkeys. Somebody had been throwing in some green guavas into the cage. It was evident that one of the monkeys had been eating green guavas. The mother monkey knew better, and she had gathered up all the guavas and was sitting close by them. One little monkey was skipping

around the cage, and he would run up and try to steal one of those green guavas, and he got his ears boxed every time he did it. The other monkey had a very wry face and was making a whining noise, and he had climbed up the side of the cage and was hanging over the hot water pipe, and he was taking a fomentation over his stomach. That monkey knew what was good for him. He knew that hydrotherapy is a natural method. That is why we call it the "natural method." Animals use it, use cold water if they get a chance, and if we could supply the animals with hot water bags they would soon find out that they were good for headaches and stomach aches, and things of that sort, and would make use of them.

Now when we apply a fomentation of any sort to the stomach it causes the contraction of these vessels, and so affords relief. What a beautiful thing that is! But you do not always have a fomentation, perhaps. There is a close connection between the skin and the internal parts. Any sort of irritation of the skin will cause contraction of this nerve, of this vasomotor center; any sort of pain anywhere will cause contraction of that splanchnic nerve. That is the reason why the pain strikes to your stomach, you know; that is the reason why pain strikes to your stomach, because of the connection of the nerves of the body with this great splanchnic nerve which controls the circulation of the stomach and bowels.

Now I have not gotten ground yet to explain to you that wonderful thing--the connection of the stomach and brain. Whether a man can think well or not depends on how much blood he has got in his stomach. Because you have only a certain amount of blood, ten or twelve pints of blood, in your body, and if you have too much blood in your stomach you have not enough blood for the brain, don't you see. That is the reason why, when you eat too big a dinner, you are stupid; because your stomach has more blood than belongs to it, and there is not enough left over for the brain. So this splanchnic nerve is the nerve that controls the circulation of the brain.

When the splanchnic nerve, this nerve of the stomach, is stimulated, it causes contraction of the vessels of the stomach, then there is blood to supply the brain; and you see how important that is, because this portal circulation, these large vessels of the stomach and the bowels are capable of holding not a fourth of the blood in the body, not half the blood in the body, but all of the blood in the body; and if this nerve, this splanchnic nerve is completely paralyzed, and these vasomotor centers generally are completely paralyzed, the man then bleeds to death, because all the blood runs out of the arteries into the veins. The amount of blood ordinarily in the vessels is less than half what they will hold. They will hold more than twice as much blood as they ordinarily contain.

A man experimenting took a dog, put a little tube into one of his veins, pumped salt water into his veins until he had pumped in more salt water than the dog had blood in the first place, and yet the blood pressure did not rise to a very great extent. The pressure remained about the same as before, and the dog did not suffer any particular harm from it. It is possible to pump into the blood two and even three quarts of water into the arteries before the blood pressure is raised to any great extent. So you see there is plenty of room for more in the arteries, consequently if there is a contraction in the larger vessels here, they open up and let the blood run into these organs. That person is very likely to have too little blood left for his brain, and he is likely to faint away.

I saw a man in the gymnasium once exercising his muscles very violently by giant swings, great somersaults, and all sorts of clever performances. He had been exercising his muscles very violently, and in doing so he had opened up these large vessels to such an extent that when he finally came down on the ground he was as pale as death, and fell right over on the floor unconscious. This was because such an enormous amount of blood got into his muscles there was not enough to keep his brain going.

You will find that the majority of men who have great muscular development are not the great thinkers, as a rule. The man who is the great thinker ought to have good muscles two, but he can not be a great athlete and a great thinker at the same time. He can not be, because so much of his blood will go into his muscles he will not have nough to keep his brain at the highest degree of activity. Now suppose, then, a man has got too much blood in his brain. How can he get it out ? The easiest thing in the world to do it, to get it out, is to get it into the skin. A man who has got congestion of the brain has too much blood in his brain, and we can get the blood out of his brain by getting it down into some other parts of the body. Gravity will do it. If a man lying in bed has too much blood in his brain, what do we do? We simply raise his head, prop him up, and the blood will run out into his stomach and so relieve his head. But now suppose he has not got enough blood in his head. We had a man some time ago whose blood had depreciated to such a degree that he had only one-fourth the number of blood cells he ought to have. This man was so feeble that when we simply raised his head, he fainted away. We took that man, put up the foot of his bed, had him lie with his heels high and his head down, so the blood would run out of his legs down into his head, and he got well.

Suppose, on the other hand, you have got so little blood in the head that you suddenly feel faint. Suppose a man faints away, what is the matter? His blood is running away down here into his portal circulation. Here is a man in a state of shock or a state of collapse, a man who has been through a railroad accident, perhaps, and has got a shock or collapse. His pulse is very feeble. He may fall unconscious, perhaps, may faint away. What is the thing to be done? In the first place, what is the trouble? When a man has fainted away, the blood has run out of his head. That is what the trouble is. The nerve which controls the blood vessels has been paralyzed and allowed the blood to run down here into the portal circulation

in excessive quantity, and there is not enough left to keep the brain going. Now I want to tell you what to do in such a case as that. It is such a simple thing, everybody ought to understand it. Suppose I should suddenly begin to feel faint. My face should get pale and things begin to swim before my eyes. What is the thing to do? Somebody says, Lie down on the floor. That is good, but there is a better thing to do. This is the thing to do. Put your hands right over your stomach and bend over forward so as to bring your head as far down as possible. What will that do? It will compress the abdomen and drive the blood up into your head at once. Just simply bend over and bring your head as low down as you possibly can. It is better to be sitting down when you do that, because there is less danger of you pitching forward on the floor. Recovery is much quicker if you do that than if you lie down on the floor. If you get your head low, and compress your stomach at the same time, that blood will be compelled to run up into your head at once, and recovery occurs immediately.

Now we have tried this a great many times. Sometimes people have weak hearts. I remember a man sometime ago who had such a weak heart that whenever he rose upon his feet he became giddy. His heart was not able to do the work. His heart could take care of him when he sat down, but not when he stood up, that is, not when he stood up suddenly. It was some little time before the heart could rally so as to pump the blood up into his head. Whenever he rose up suddenly he would pitch right over on the floor, or simply go right over, just like a stick. Now I explained to this gentleman this very simple thing. I said,"Just before you rise, make a great bow, a great obeisance, and get up after that." So he did, and he had no trouble at all. He was immensely delighted to find that out--to find that he could get up without pitching headlong. It was a very practical thing for him, so he adopted that plan until he got well. Of course he did not have to continue it forever. As his heart got stronger he got over that. Before getting up

he would simply bend over, then get up, and he was all right. He had a large supply of blood in his head.

Here is a person who has fainted away from surgical operation, or a little wound. The common practice is to give that person alcohol--if anybody has fainted away, give him alcohol or brandy, of course! My friend, that is the worst thing in the world to do. Box the patient's ears, pull his nose, do anything, but don't give him brandy. The only benefit that could possibly come from that brandy it the little smart it produces when it goes into the mouth, or goes down the throat, or if injected under the skin it makes a little smart, and that smart is the thing that excites this splanchnic nerve, makes the contraction of the portal veins, and so sends the blood into the head. It is the smart, the pain that is produced that does it. Percussion will do that a great deal better than brandy--percussion to the heart, slapping the face. Cold water will do it better still. Why? Cold water stimulates the thermic nerves. It is a stimulus, an excitant. Hot water will do the same thing. Hot water, cold water, percussing the skin, pinching the skin, slapping the patient's face; anything that produces pain or a sensation, a stimulus of the sensory nerve, will revive the patient, and will do it better than brandy will do it. And there is something else that will do it a great deal better yet, and that is simply the compression of the abdomen. Do both things; stimulate the patient in any way you can. Dip the hand in cold water and put it on the face or chest, or cold to the heart, but at the same time put the compression right upon the abdomen. What does that do? It does just what it would do to a bag full of water. If you have a bag full of water, with an opening in it, and you put your weight upon the bag, the water will all be forced out. That is the situation. The blood has run into the abdomen here. That is why the patient has fainted away, because the blood has run down into this place and he has not got it in his head. Simply make compression at that point; put a weight over the abdomen. I removed a great big cancerous tumor in

operation once. It was a peculiar situation, where many great nerves were involved, and they were shocked or collapsed in consequence of irritation of the nerves, so at the end of the operation the patient looked as though she were dead, although she had not lost any blood to amount to anything. Her face was an ashen gray. There was scarcely a trace of the pulse, and apparently no respiration. The blood pressure which was taken at the time was zero. There was no blood pressure at all, apparently. But I immediately seized a bag--it occurred to me just that moment--I seized a rubber bag slipped it under the bandage that had already been applied, and blew it up as quickly as possible, and the blood pressure rose instantly to 75. I said Is it possible? So I let the air out, and the blood pressure fell down to zero again. Blew it up again, and this time the pressure rose to 115. The patient was all right, and kept on being all right. The patient's life was saved just by that little thing. We can give that with any kind of a bag, and you don't even have to have a bag. You can simply make the compression with the hands. So there is a simple thing that acts instantly.

When alcohol is given that makes a stimulus for a moment. The patient feels a little better, and if it is simply a common fainting spell the patient may be all right awyway; but if it is a surgical shock, a serious shock or collapse of any kind, then there is harm done by the alcohol, because as soon as that alcohol has been absorbed that will cause these vessels to dilate still more than before. It will weaken the heart, it will diminish blood pressure. It will dilate these arteries, and that will let the blood run here into these reservoirs. That is why the drunkard's face is flushed. So the patient may be made worse instead of better.

If there is anything which has been positively settled by scientific inquiry within the last few years, it is that alcohol is not a stimulant, and is a narcotic. It does not energize, but it depresses, and lessens power, lessens strength every single time and under all conditions. It is only

the excitement that comes from irritation by the contact of alcohol with the nerves of the stomach during the first few seconds, and after that it is depression, narcotism.

Now these questions: What is the normal blood pressure? What is high blood pressure? What is the harm of high blood pressure? What is low blood pressure? How can you get rid of high blood pressure if you have it? What can you do for low blood pressure? I will take up these things next time.

JHK v--m 2/15'06

~~(Hydrotherapy)~~

HYDRIATIC MEASURES FOR REGULATING BLOOD-PRESSURE.

The evident inadequacy of drugs for the correction of abnormal conditions arising from the failure of the blood-pressure regulating mechanism of the body, which has been made so clearly evident by the experiments of Rhomberg, Fässler, Crile, and other investigators, has brought prominently before the profession the importance of the physiologic method in dealing with questions pertaining to the blood circulation, and particularly as a means of correcting defects of the pressure regulating function. It is not the purpose of this ~~chapter~~ article to deal with the whole question of physiologic therapeutics in relation to blood-pressure, but rather to point out those hydriatic measures which are of greatest value in the practical treatment of cases of abnormally high pressure or low pressure.

First a word with reference to the physiology of blood-pressure and pressure regulation. The circulating mechanism consists of a pump, the heart; ~~a series of~~ and reservoirs--the arterial system, the high pressure reservoir, and the ~~veins~~ venous system, the low pressure reservoir. These two reservoirs are connected by small tubes, ~~They are~~ the arterioles and capillaries. The pressure in the arterial reservoir is due to the fact that the heart is able to pump blood into the reservoir more rapidly than it escapes through the small openings which connect the arterial with the venous reservoirs. The size of the outlet openings is controlled by nerves and nerve centers acting upon the muscular walls of the small arteries, whereby the tubes are made to dilate or contract as the needs of the body may require. When the arterioles and capillaries contract, the blood escapes less rapidly, and the pressure rises so long as the heart has energy enough to enable it to respond to the demands made upon it. The limit of pressure rise is reached only when the pressure is such as to force out through the smaller openings the amount of blood needed to supply each one of the great organs or series of organs in the body. General blood-

pressure may be increased for the purpose of meeting the needs of a single organ, as in cases of brain anemia, due to compression of a tumor, or any other mechanical cause. High blood-pressure usually exists also in chronic interstitial nephritis, as a compensation for the crippled condition of the kidneys, as well as in general arteriosclerosis. ~~Many other illustrations might be cited.~~

The venous reservoir may be regarded as divided into three great reservoirs: the veins of the skin, which are capable of holding two-thirds of all the blood in the body; the veins of the muscles, which are capable of holding half the blood in the body; and the portal system, which is capable of holding all the blood in the body. The portal system differs from the other venous systems of the body in the fact that the walls of its vessels are supplied with muscles which are under the control of the great splanchnic nerve. The portal system also differs from other venous systems in the fact that it is connected with a second venous reservoir, the hepatic veins, through the capillaries of the liver, a series of minute channels, so that the blood which passes through the portal circulation traverses two sets of capillaries. It is perhaps for this reason that the portal veins are supplied with muscles, so that the blood current may be accelerated.

The relation of the portal and hepatic reservoirs to the chest cavity is also a marvelously wise arrangement, since each inspiratory movement acts forcibly as a means of withdrawing the blood from the hepatic and portal reservoirs toward the heart.

The several secondary venous reservoirs, the skin, the muscles, and the portal circulation, are directly and indirectly connected, and through the action of the vasomotor centers the blood may be accumulated in one or the other of these reservoirs, as may be necessary to meet the needs of the body in conditions of health or disease. The large capacity of these several reservoirs renders it evident that an accumulation of blood in either one

must have a very marked effect upon the pressure of the arterial reservoir. That is, the filling of the skin reservoir, which is capable of holding two-thirds of all the blood in the body, must have a notable effect in lowering arterial pressure. The filling of the portal reservoir must have a still greater effect upon the general blood pressure. An accumulation of blood in all the venous reservoirs, such as occurs in shock or collapse, may bring about such a fall of arterial pressure as to cause death. This is what occurs after division of the cervical cord. The experiments of Crile have shown most conclusively that in shock and collapse there is excessive accumulation of blood in the portal venous reservoir.

The chief factors concerned in blood pressure, as observed in health, are--

1st, Cardiac energy, by which blood is being continually forced into the arterial reservoir.

2nd, The vessel tonus, by which the outlets of the reservoir are narrowed.

3rd, The peripheral heart, — the rythmical activity of the arterioles and capillaries.

4th, Blood volume, whereby the ventricles are distended and stimulated to contraction.

5th, The elasticity of the arterial walls and of the tissues.

These several ~~elements in blood pressure, productive and regulation~~, factors in the causation and regulation of blood pressure. may be influenced by hydriatic and other physiologic measures more positively and certainly than by any other means. Physiologic measures have a great advantage over all others in that their efficiency increases with use, whereas in the case of drugs a tolerance is rapidly established, so that a drug, the first doses of which produce very powerful effects, soon fails to produce any effect at all, or may even produce opposite effects. A physiologic measure produces the same effect the thousandth time it is applied as the

first time, unless of course there has in the meantime been such an advance in the disease that the vital mechanism has in the meantime become so crippled that its power of response is lost. Of all physiologic measures which may be brought to bear in cases requiring the regulation of blood pressure, hydriatic are on the whole the most practical, both because of their effectiveness, and because they are so commonly and universally available. The physiologic effects of hydriatic applications in relation to blood pressure may be thus briefly stated:--

(1) HYDRIATIC MEASURES FOR EXCITING CARDIAC ACTIVITY

As a matter of fact, cases are comparatively rare in which cardiac stimulation is required. The heart is usually doing its full duty, and more. The trouble is usual that the heart is working under unfavorable conditions. For example, when the outlets of the cardiac reservoir, the arterioles, are widely dilated through failure of the vasoconstrictors or over-action of vasodilators, if such a condition exists, the heart may be expending twice the ordinary amount of energy, while the blood pressure still remains at an abnormally low point. This is the state of things which exists in shock or collapse. The arterioles leading into the portal reservoir are so widely open that an excessive amount of blood accumulates in the abdominal veins, and pressure in the systemic circulation must necessarily fall. The large amount of blood withdrawn from the circulation leaves the heart without adequate supply. The ventricles are not well filled, and so the heart action becomes inadequate. In other words, there is a large leak in the water main, while at the same time the supply to the pump is diminished and under such conditions the pressure must fall. Under such circumstances it is very little use to increase the speed or power of the pump. The leak must be stopped, and the supply to the pump must be increased. Moderate stimulation of the heart, even under these conditions, may, however, be beneficial, as an aid to most speedy relief.

A most convenient and effective means of cardiac stimulation is the cold precordial compress or the ice-bag over the heart. It may be employed, with proper precautions, in all cases of cardiac weakness. Cold rubbing to the chest, general cold mitten friction, the cold rubbing sitz bath (75° to 65° degrees two to five minutes), a rubbing shallow bath (87° to 75° one to three minutes), the cold spray (70° to 55° fifteen to sixty seconds), alternate hot and cold sponging or rubbing of the spine, these are all excellent means of stimulating a flagging heart. The ice-bag may be employed fifteen to thirty minutes two or three times a day. Warm applications are depressing to the heart, also prolonged hot applications. Short hot applications stimulate the heart.

(2) METHODS BY WHICH THE VESSEL TONE MAY BE INCREASED

In general, cold baths raise the vessel tonus, while warm baths lower it. Neutral baths have little influence upon blood pressure. When prolonged, neutral baths slightly raise the blood pressure by increasing the volume of blood through the absorption of water, and possibly by the elimination of pressure lowering toxins. Cold mitten friction is one of the very best means of increasing the tone of the vessels. ~~The experiments of Müller~~

Müller found that baths below 92° slowed the pulse and raised blood-pressure. The lower the temperature of the water, the greater the rise in pressure. Neutral and warm baths, that is those having a temperature of 92° to 104° F. produced first a slight rise of pressure, then a fall, followed later by another rise. Baths at a temperature of 104° F. and upward increased the pulse rate and raised pressure. Vapor baths and hot air baths at a temperature of 122° F. and upward occasioned a rise in pressure and pulse rate. Water baths at a temperature below that of the body (98.6° F.) slowed the pulse. Baths at a higher temperature increased the pulse.

Carl Bruck made in 1902 an important study of the effect of cold baths upon blood-pressure. His observations showed that ~~emersion~~ immersion baths at a temperature of 46° F. caused a rise in blood pressure within 30 seconds. A bath at 60° caused a rise of pressure within one minute. A bath at 68° to 73° of less than two minutes' duration was quickly followed by a fall in pressure.

The writer observed ~~that~~ a fall of 20 millimeters as the result of an electric light bath administered by means of the horizontal cabinet. A rise of ten millimeters was observed in a healthy subject as a result of swallowing rather rapidly two pints of cold lemonade.

(3) MEASURES WHICH INCREASE THE ACTIVITY OF THE PERIPHERAL HEART.

The rythmic activity of the small vessels whereby the blood is moved forward into the veins is an important function to which the term "peripheral heart" may be very properly applied. Its activity may be stimulated by short cold applications, especially when accompanied by rubbing. Prolonged cold applications cause a spastic contraction of the vessels, and this produces venous stasis, which is shown by the mottled blue appearance occasioned by prolonged exposure to cold. Short cold applications, on the other hand, both raise the tone of the peripheral vessels and increase their activity. Short and very hot applications produce a similar effect. Prolonged hot applications paralyze the peripheral vessels, producing stasis indicated by a dusky tinge of the skin.

(4) MEASURES BY WHICH BLOOD VOLUME MAY BE INCREASED.

The experiments of Crile and others have shown that in cases of acute low pressure there is usually an accumulation of blood in the portal circulation, while In cases of chronic high pressure there is usually a diseased condition of the vessels of the splanchnic area, a condition which may exist when evidence of general arteriosclerosis can not be discovered in the radial or other external vessels. Hydriatic measures may render great service in both these classes of cases. All vasomotor nerves respond readily to sensory impressions. The splanchnic nerve has been shown by Tigerstedt to be more sensitive to reflex influence from sensorial impressions than any other vasomotor nerve in the body.

The following are effective means whereby the splanchnic nerve may be stimulated, thus causing contraction of the portal vessels, and increasing the supply of blood to the heart: The cold abdominal compress, to be withdrawn for five minutes every half hour to allow warming of the skin. Ice rubbing of the abdominal and dorsal regions for two minutes, preceded by

very hot applications for half a minute, repeating the alternations for ten or fifteen minutes. ¶ The cold sitz bath (75° to 65°) accompanied by vigorous rubbing of the submerged parts, duration eight to twelve minutes. This is a powerful means of increasing the tone of the mesenteric and portal vessels. It should be remembered, however, that a short cold sitz bath, one to four minutes, is quickly followed by reaction, thus increasing the amount of blood in the portal circulation instead of diminishing it; hence the ~~The~~ duration of the bath must be not less than eight minutes. It may be continued to fifteen or twenty minutes in special cases. ¶ The cold shallow bath, or cold rubbing sitz, ~~gastric crisis~~, three to five minutes, with vigorous rubbing. ¶ The wet girdle, without mackintosh, consisting of a towel wrung out of cold water, placed about the trunk and covered with two or three thicknesses of flannel. The wet bandage should be renewed before it is entirely dried. This is an admirable method of acting continuously upon the vessels of the splanchnic area in such a way as to ~~perfectly~~ increase the tone. The evaporation of the water contained in the moist bandage produces a moderate degree of cooling, the influence of which upon the visceral vessels is most excellent. ¶ Abdominal massage is another excellent means of forcing the blood out of the portal vessels into the general circulation. ¶ Another means which the writer has found effective is to slip under a tight bandage placed about the body an empty rubber bag, then inflating the bag with air, which may be pumped in by means of a rubber bulb, or the bag may be distended by placing the end of the tube in the mouth and inflating it with air from the lungs. Another excellent method is to fill such a bag with cold water. This secures the favorable effect of three factors,—the weight of the water, the distention of the bag, and the low temperature of the water,—thus producing both a thermic, a sensory, and a mechanical effect. This application contracts and compresses at one and the same time the mesenteric and portal vessels. ¶ Deep breathing, especially raising the chest, with strong contraction of the abdominal muscles, is a most effective means of emptying the abdominal vessels and forcing the

blood which so easily stagnates in the splanchnic area, toward the right side of the heart, and thus bringing it back into the general blood current. Abdominal supporters of various sorts doubtless owe their efficiency chiefly to the compression of the vessels rather than to the support of prolapsed and pendant viscera. The Priessnitz bandage is doubtless also beneficial in the same way.

WARM HOT BATHS RELAX THE VESSELS ALONG WITH OTHER TISSUES, ESPECIALLY THOSE OF THE SKIN, WHILE COLD BATHS CONTRACT THE VESSELS AND THE TISSUES.

Landerer has called special attention to the importance of tissue elasticity as a factor in blood pressure. This is a matter of special importance in relation to the skin, the vessels of which contain less muscular tissue than do those of other parts. Cold applications to the skin render it firm and dense, and greatly increase its elasticity, thus tending to raise the blood pressure. This is true of all applications to the skin, especially those of two minutes or longer duration. Any cold application which leaves the skin firm and smooth will produce this effect.

The experienced physician will have no difficulty in applying the preceding facts to all cases of high or low blood pressure which come under his supervision. A few additional suggestions respecting the application of hydrotherapy to individual cases or classes of acute and chronic disease may be of service.

CLASSIFICATION OF CASES IN RELATION TO HIGH PRESSURE AND LOW PRESSURE.

Cases requiring therapeutic regulation of pressure may be included in the following three classes:—

(1) Low pressure cases.—In acute cases both the heart and the blood vessels may be involved. That is, the heart may be weak and the vaso-constrictors paralyzed. This condition is found in the majority of acute infectious disorders, and is a result of the toxic influence of bacterial

poison upon the heart and vessels. This is a reason for the great efficiency of the Brand Bath in typhoid and other acute infectious febrile disorders. The value of the Brand Bath is due far less to its influence upon temperature than to its beneficial effect upon the heart and vessels. The strong sensory stimulation produced by the contact of cold water with the skin energizes the heart, stimulates the splanchnic nerve, and so controls the vessels of the splanchnic area, thus supplying an increased amount of blood to the heart, whereby it is able to fill the arterial reservoir, while at the same time raising the tone of the peripheral vessels, and increasing the activity of the peripheral heart. The cold bath of Brand, when properly administered, is one of the most efficient of all means of aiding the body in its battle against the invading organisms of infectious febrile diseases, hence its adaptability to all disorders of this class, which are without exception characterized by low blood pressure.

The cold wet sheet pack, the cold rubbing sheet, vigorous cold sponging, ~~and~~ vigorous cold rubbings, and all ~~this~~ other hydriatic procedures ~~measures~~ ~~recommended~~ useful as anti-febrile measures, are effective from their favorable influence upon blood-pressure.

One point should be borne in mind especially in the treatment of typhoid fever, namely, in cases of hemorrhage there is likely to be a sudden drop in pressure, although the pressure may already be low. If perforation and infection occurs, however, there will be a ~~sudden~~ rise in pressure. The systematic observance of blood-pressure, as well as of temperature, is a matter of great importance in all febrile and surgical cases. It is, in fact, only by this means that the condition of the patient can be thoroughly understood and appreciated, and the proper indications determined.

HYDRIATIC MEASURES ADAPTED TO CACHECTIC DISORDERS.

In nearly all cases of chronic cachexia, in advanced malignant disease, especially cancer of the stomach, and chronic pulmonary tuberculosis, in fact, in nearly all chronic wasting disorders, low pressure is present, the result of cardiac weakness through malnutrition and imperfect control of the splanchnic vessels. The writer has often obtained the most surprising and beneficial effects in these cases by the application of cold rubbings from one to three times daily, gentle massage, the application of the sinusoidal current, especially in the form of a general sinusoidal bath, and applications to the splanchnic area. For this purpose the electrode should be applied to the lower dorsal region of the abdomen. The current should be of strength such as ~~applied strong enough~~ to cause vigorous and slightly painful contraction of the abdominal muscles.

HYDRIATIC APPLICATIONS IN CASES OF CHRONIC CARDIOVASCULAR DISEASE--ARTERIOSCLEROSIS.

The heart and vessels must be considered as one organ, the vessels being simply ramifying branches of the heart extending throughout the body. Those influences which affect the heart affect also the vessels. From the standpoint of chronic cardiovascular disease, cases may be divided into three classes: low pressure, high pressure, and secondary low pressure. In low pressure cases the fault is primarily with the heart. The difficulty may be either stenosis or insufficiency of the valves, inflammation or degeneration of the cardiac muscle, or a crippled condition due to pericardial inflammation. The pump is weakened, so that the adequate pressure can not be maintained in the arterial reservoir. In high pressure cases the trouble is disorder of the arteries, generally with the small arteries. The case may be one of general arteriosclerosis, easily recognized by examination of the radial pulse, which can be easily felt rolling under the finger. Recent studies of this subject have shown, however (Von Basch and Huchard) that high pressure exists

in many cases in which arteriosclerosis can not be discovered by examination of the superficial vessels, due to degenerative changes in the vessels of the splanchnic area,-- a condition which is becoming more and more common as a result of the sedentary and luxurious habits so increasingly prevalent at the present time. Postmortem examinations have also shown that (Rosenfeld and Hirsch) degenerative changes of the portal circulation are often present in cases of renal disease when no changes can be discovered in vessels which are accessible to the touch. In all these cases high pressure is due to a decrease of size of the outlets from the arterial reservoir.

The fact that the pressure is high is evidence that the heart does not require stimulating by drugs or other means. The disorder is of a permanent character, and hence the heart must always have an excess of work to do, ~~and consequently~~ nothing could be more unwise than the frequent or habitual use of drugs, which lower tension by lessening the force of the heart. Thousands of lives have been shortened by the use of such drugs, since they necessarily hasten the time at which the heart energy will permanently fail.

High pressure is not in itself a detriment. It is, in fact, protective. ~~The pressure must be raised in order that the necessary supply of blood should be provided to the famishing tissues.~~ The narrowing and withering of the arterial twigs as the result of the degenerative process threatens the tissues with starvation. The heart is working with sufficient energy to maintain the pressure at such a point that an adequate supply of blood can be forced through the narrow channels to maintain the integrity of the tissues and their functions. The thing to be done then is not to lessen the energy or activity of the heart, but to lessen the resistance against which it works. In other words, to stop the degenerative process, and to dilate the contracted vessels. The best means for ~~accomplishing this~~ relaxing the contracted vessels are the following: —

(1) Baths of all sorts at a temperature of 92° to 98°. Baths at the lower temperature should be accompanied by rubbing so as to maintain the surface circulation. Baths at the higher temperature should not be greatly prolonged. A duration of fifteen to thirty minutes is about the proper time. At a temperature of 92° the bath may be considerably prolonged with advantage.

say ~~fifteen to~~ to forty thirty minutes, or even an hour or two. The shallow bath, and the rubbing sitz bath at 78 to 85° is a very excellent measure. Duration should be one to three minutes for the shallow bath, or two to four minutes for the sitz bath. The neutral fan douche (92° to 96°), the neutral spray, rain douche, and the needle bath (88° to 96°), applied for one to three minutes, are measures of value as a means of dilating the peripheral vessels.

(2) Hot immersion baths, and general hot baths of all ~~sorts~~ kinds should be avoided as dangerous, the first effect of such baths being to raise the pressure, which may produce great injury through the rupture of some weakened vessel in the brain or elsewhere. Partial hot baths, however, may be employed with advantage, particularly hot sponging, hot mitten friction, the short hot foot bath combined with a fomentation to the abdomen or to the spine.

(3) ~~The~~ Cold immersion baths, the general cold shower, or the general cold douche, are measures which should be carefully avoided. The short cold towel rub, and mitten friction with water at 65° to 75°, may be utilized, if care is taken to avoid chilling the patient. It is well to apply a hot bag to the spine or feet during this application, to insure against chilling. All the above hydriatic applications may be repeated two or three times a day with advantage.

(4) The wet girdle, and heating packs to the legs worn at night, are measures of great value in cases of high blood pressure due to arterio-sclerosis. The wet sheet pack, preceded by vigorous friction of the skin, and followed by cold mitten friction, is also a measure of very considerable value.

(5) The partial electric light bath applied in succession to various parts of the body, and continued until the skin is thoroughly reddened, is one of the most effective of all means for dilating the surface vessels. The cabinet electric light bath, however, ~~should be avoided~~ may be employed in cases in * and clearing the tissues of waste products.

which the pressure is not high and the vascular changes are still in ~~their~~ an incipient state. The arc light bath may be employed in the same way to excellent advantage. The sun bath , used with precaution and repeated daily until the skin is thoroughly tanned, is one of the most effective means of combating degenerative changes in the cutaneous vessels.

(6) The sinusoidal electric bath, at a temperature of 94 to 88°, also baths at the same temperature combined with faradic and galvanic electric currents are very servicable in this class of cases.

HYDRIATIC MEASURES ADAPTED TO CASES OF SECONDARY LOW TENSION.

Every case of high tension due to degenerative changes either in the systemic vessels or in the vessels of the splanchnic area, sooner or later gives place to low pressure, due to exhaustion of cardiac energy. The enormous increase of cardiac work required to maintain the pressure in the arterial reservoir when the outlets are greatly lessened in number and capacity, sooner or later wears out the strongest heart. If the patient does not die of apoplexy or of some intercurrent malady, death should come in time from cardiac failure. The treatment of this class of cases must be entirely different from that which is appropriate in cases of primary low pressure, for although the pressure falls, the condition of the vessels remains the same. Primary low pressure leads to rise of pressure by contracting the arterioles, thus diminishing the outflow from the arterial reservoir. In secondary low pressure the ~~fail~~ fault is at the other end of the circulatory system; namely, failure of cardiac energy.

There are two things necessary, ~~then~~, in these cases. First, to dilate the small vessels so as to diminish the work to be accomplished by the enfeebled heart, and second, to energize the heart so far as this can be safely done. The measures required are, then, a combination ~~accomodation~~ of those indicated in high pressure due to arteriosclerosis, and those which tend to increase cardiac energy. For the last named purpose one of the most useful measures

is the cold precordial compress or ice bag placed over the heart. But in the employment of this measure care should always be taken to precede the application by an application ~~of some sort~~ whereby the peripheral vessels may be relaxed, and thus the work of the heart diminished. The reason for this is obvious. If the heart is exhausted because of long continued effort to overcome an abnormal degree of resistance, the employment of ~~a~~ any cardiac stimulant ~~of any sort~~ must serve only to still further exhaust it. ~~This~~ It is like whipping a horse which is pulling a heavy load. The activity of the overworked beast may be increased temporarily, but only at the expense of hastening the moment when the animal will fall completely exhausted. On the other hand, if the load is lightened before the whip is applied, the lessening of the work to be performed, combined with the stimulus of the whip, may carry horse, driver, and load safely over the hill top. ~~And~~ The best means for relaxing the surface vessels in these cases are hot mitten friction or sponging; hot fomentations to the spine; dry hand rubbing; short cold mitten friction; the hot foot bath accompanied by hot mitten friction or hand rubbing; gentle exercise; light massage; a very short electric-light bath at a moderate temperature, one to three minutes, with an ice bag over the heart after the first half minute.

It is in this particular class of cases that the Nauheim baths are of great service. The temperature of the baths should generally be 88° to 92°. ~~The~~ A moderate stimulation of the thermic nerves energizes the heart. The reaction which follows the cold application, especially when the bath is accompanied by rubbing, as it always should be, relaxes the surface vessels, and so lessens the work of the heart. The systematic use of this bath may greatly prolong the life of a person suffering from secondary low pressure, although of course actual cure is out of the question.

Caution.—

The greatest care should be used in these cases to avoid general cold baths, general hot baths, and abdominal compression. The patient's life may be easily snuffed out by an injudicious hydriatic application. A general chilling of the surface is as dangerous in such a case as a bullet wound through the body.

In cases in which the high pressure is due to changes in the vessels of the splanchnic area, either with or without accompanying cardiac or renal disease, measures may be employed which will serve to dilate the portal vessels, thus lessening the resistance in the vascular system. The measures most useful for this purpose are the following: The protected wet girdle worn at night (care must be taken to wring the wet towel dry, to cover well with mackintosh, and to protect sufficiently to secure quick heating); the neutral sitz bath (92° to 98°, duration fifteen to twenty minutes) twice daily; the Scotch douche to the back and abdomen and over the hepatic region. When the abdominal muscles are contracted, the application of the wet girdle may be preceded by a fomentation to the abdominal region for three to five minutes, and the neutral sitz bath may be preceded by a hot sitz, temperature 102°, for one or two minutes. Care should be taken to keep the colon empty, employing if necessary the daily enema or coloclyster at a temperature of 90° to 100°. The effect of these applications will be to dilate the vessels of the splanchnic area. In extreme cases the legs may be utilized as a means of diverting blood from the general circulation by employing a heating compress at night. In these cases great care should always be taken to avoid chilling the surface. The patient should be dressed warmly, so as to keep as much blood in the skin as possible, and a flannel bandage should be worn about the abdomen to promote the accumulation of blood in this region.

The employment of hydriatic measures as a means of combating dangers which occur through disturbance of blood pressure during surgical operations, especially collapse and shock, can not be over-estimated.

The systematic use of the sphygmomanometer before, during, and after surgical operations should be made the rule in every surgical hospital. It has been the custom of the writer for many years to measure the blood pressure of every patient coming under his care, and more recently the plan of taking blood-pressure before the operation, at frequent intervals during the operation, and at stated intervals during the first few days following the operation, especially in grave cases, and in all abdominal cases, has been adopted as a routine practice. Great benefit has been derived from the systematic use of the cold chest compress as a means of maintaining the cardiac activity during operation, especially when chloroform is employed. After all operations it has for years been the custom of the writer to apply general cold mitten friction and the cold precordial compress as a means of aiding the patient to recover as quickly as possible from the effects of the anesthetic. In cases in which the anesthesia has been prolonged, a hot enema is administered as a means of raising the blood pressure and aiding the kidneys in the elimination of pressure lowering poisons.

The value of the practice of taking blood pressure in connection with every surgical operation was well shown in a case in which, after removal of a large sarcoma from the groin which involved many branches of the crural nerve, the patient's blood pressure was found so low that it could not be registered by the tonometer. Strong compression of the abdomen by placing a rubber bag under a bandage and inflating it, brought the pressure at once to 75 m.m. When the air was allowed to escape, the pressure again fell to zero. A second inflation of the bag brought the pressure up to 115 m.m., where it was held by continuing the abdominal compression during several hours, until the symptoms of shock had disappeared. In this case cold mitten friction, the ice-bag over the heart, and other means for stimulating the cardiac and vasomotor centers, were assiduously employed, as in all similar cases. As a rule,

in such cases, the ice bag is employed continuously for several hours, being removed for five minutes every half hour, and cold mitten frictions, employing water at a temperature of 60° to 34°, are repeated every hour, and in extreme cases every twenty or thirty minutes.

The subject of blood-pressure is a comparatively new one in physiologic therapeutics, for the reason that it is only recently that accurate means for measuring blood-pressure have been available. Comparatively little is yet known scientifically concerning the physiologic therapeutics of blood-pressure. The writer, together with many other observers, is engaged in a careful experimental study of this subject. Positive and accurate facts are now easily obtainable by the assistance of Erlangers admirable instrument, which eclipses all others in the accuracy of its measurements.

Feb. 1, 1906.

BLOOD-PRESSURE IN INTERNAL DISORDERS.

NEPHRITIS:

High pressure most important symptom of ~~contracted kidney~~.

Amyloid cardiac hypertrophy generally follows, and blood-pressure is low

Blood-pressure low also in ~~hemorrhagic form~~ of nephritis.

In ~~diffused, parenchymatous nephritis~~ pressure may be high or low.

In ~~contracted kidney~~ with ~~tuberculosis~~ pressure may be low.

UREMIA:

Blood-pressure always high, and rises with convulsions.

Rising pressure indicates that the patient is getting worse.

A rising pressure in ~~acute nephritis~~ indicates danger of uremia.

Thrombosis, aneurism, and compression may produce difference in pressure between the two radials.

In one case of mediastinal tumor, there was no difference in pressure ~~when~~ between the two radials when patient was sitting up, but when he lay down on one side the difference was 60 to 90.

HEMAPLEGIA:

When due to profuse hemorrhage, pressure is very high from compression which causes anemia in the brain.

In ~~thrombosis~~ pressure is normally or slightly hyper; usually slightly hyper.

Acute, infectious disorders of childhood almost always attended by low pressure.

When acute nephritis occurs as a complication, pressure usually rises.

In TUBERCULOSIS pressure is usually low.

In cases in which hemorrhage occurs, there usually is high pressure before the hemorrhage.

In DIABETES, high pressure.

In ANEMIA, low pressure.

In CACHEXIA, especially GASTRIC CANCER, advanced TUBERCULOSIS, and other wasting, exhausting diseases,--low pressure.

In GOUT, high pressure.

In ERYTHEMA, BRONCHITIS, ECZEMA, high pressure.

In PLEURAL, and ABDOMINAL DROPSY, high pressure.

In LOCOMOTOR ATAXIA, pressure low with lightning pains.

High pressure during GASTRIC and ABDOMINAL CRISES.

In GENERAL PARESIS, low pressure.

In MELANCHOLIA, high pressure.

In CHRONIC MELANCHOLIA, low pressure.

In MANIA, low pressure.

In EPILEPSY, high pressure during spasm.

In FACIAL NEURALGIA, TIC DOULOUREUX, high pressure during spasm; may be very high.

In INSOMNIA, may be high pressure or low pressure; usually high pressure.

Pressure falls during sleep; gradually begins to rise some hours later; rises until patient wakes.

INSOMNIA with low pressure is due to nerve irritants in the blood.

BLOOD-PRESSURE IN SURGERY.

ANESTHETIC:

Ether causes rise of tension, especially at first.

Chloroform causes low tension.

Gas produces high tension due to partial asphyxia.

If pressure falls from shock while giving ether, better continue ether if necessary than to stop and begin again.

To combat low pressure of CHLOROFORM, ice over chest and heart. Stimulates respiration, so brings blood out of the abdominal area.

When operating elsewhere than on the abdomen, apply abdominal compression with the compression bag.

In abdominal operation, pressure rises with skin incision, and still more with incision of the peritoneum.

Pressure falls with opening of the abdomen.

Manipulation of the intestines causes fall of pressure from shock. Sponging in particular has this effect.

GENITO-URINARY ORGANS:

Manipulations involving external or internal organs in women cause high pressure; in men, low pressure.

Contraction on spermatic cord causes fall of pressure.

In head injuries, high pressure indicates compression from depressed bone or clot.

High, rising pressure, are indications for operation. The same is true with apoplexy with large hemorrhage and very urgent symptoms. Operation is indicated.

OBSTETRICAL CASES:

Pressure raised during pregnancy, probably from increase of intra-abdominal pressure.

Pressure rises during labor.

Rise of pressure with each uterine contraction; even painless contractions.

Very high pressure, or rapidly rising pressure, indicates danger of eclampsia. This is an important reason for taking blood pressure at later stages of pregnancy.

After child-birth, pressure falls. If pressure does not fall, look out for convulsions.

The best thing for combating is vomiting. This lowers pressure and eliminates poison.

SURGICAL SHOCK:

Produced by--

Chloroform,

Long operation,

Operations involving sensory nerves,

Manipulations of intestines,

Pulling of tissues,

Blunt dissection, and

Rough sponging.

Dr. Burton-Opie has recently made experiments in the Columbian Laboratory, of the College of Physicians and Surgeons, of New York, on the effects of hot and cold baths on the viscosity of the blood.

He found that cold baths (75° to 75°) increase the viscosity of the blood 15%.

Hot baths (100° to 110°) diminish the viscosity 10%.

This has an evident effect upon blood-pressure.

Cold baths increase vessel tonus and viscosity both.

Iodid of potash diminishes viscosity 10%.

February 1, 1906.

BUSINESS OUTLOOK

and

THE NEW DEAL

by

ROGER W. BABSON

Synopsis of Address
Before the
COMMITTEE OF ONE HUNDRED
Miami Beach, Florida
February 13th, 1934

My studies indicate that the recession in business which has been in progress since 1929 had run its course by the spring of 1933, although without question the people of the United States had lost *confidence in Herbert Hoover.* Therefore, a change of "Doctors" materially helped the patient's recovery. Statistics on employment, payrolls, retail sales, railroad earnings, electric power consumption, and check transactions prove conclusively that we are now on the upgrade. Of course if the patient is given artificial stimulants, relapses are inevitable, but, based on the Law of Action and Reaction, a period of prosperity is soon naturally due to follow. Commodity prices should continue to strengthen. There should be a recovery in the building of homes of which there is now a shortage of 900,000. When a new home is built, twenty-six industries are definitely helped and real estate as a whole is benefitted.

The larger industrial companies——especially those with relatively small labor costs and large raw material reserves——should prosper. As industries prosper, the railroads, banks and utilities also prosper. Of course any Administration is handicapped by attempting to put over a program of social reform and, at the same time, induce those with money to risk it in new enterprises. This is especially true with the added uncertainty of how much the dollar will be worth when the prospective loans mature. Therefore, contemplated plans of the Administration must avoid killing the initiative of the small group who——under our present economic system——must be depended upon for getting men and women back to work at their old positions and for providing new positions for those who are idle due to technological changes. It is unwise to sink a ship even to drown the rats!

Surely the President's goal of having a more equal distribution of the Nation's income is right

and everyone should cooperate in helping him bring this about. Statistics clearly indicate that with modern machinery installed, in the Nation's present existing factories, and with proper distribution and planning, every family could have in food, clothing and shelter the equivalent of an income of $10,000 per year. Furthermore, this could probably be accomplished with proper discipline by giving people the first twenty years for education, health development and character training. They would be compelled to work only until they become fifty years of age and then only eight months a year, leaving them free to spend the remaining four in Florida! After fifty years of age we could all devote our time to the sciences, arts and such hobbies as we may have, with the privilege of free speech which under such a system probably could not be freely given to the youth. The privilege of voting should be granted to both men and women irrespective of property; but the voting age should be materially raised perhaps to fifty years of age.

Whether or not the above ideal conditions will ever come about for many generations is, of course, debatable. I mention them here merely as a suggestion of what statistics indicate as possible under a system of planned economy as suggested by some of the more radical advisers of the Administration. Without doubt they are theoretically right in their assumptions, although they face very serious practical difficulties. But whatever your opions regarding the above may be, we surely should be interested in bringing about gradually a more equal distribution of the Nation's annual income. I grant that a redistribution of wealth would have only a temporary effect and would greatly disappoint the advocates of such a program. A more equal distribution of the Nation's annual income, however, is entirely practical and in the interests of the well-to-do as well as to the poor. Those of us who truly love our children and grandchildren will——for their own

protection——heartily unite with the Administration in its goal to bring about a more equal distribution of the Nation's annual income which varies from $40,000,000,000 to $80,000,000,000 per year.

Surely the peoples' method of endeavoring to bring about a more equal distribution through mere legislation is wrong. The goal will be reached not through the "social control of income" but rather through the self-control of individuals. The mere repudiation of gold payments, the cancellation of contracts, unwise taxation of incomes, uneconomic agricultural experiments, encouraging unprincipled labor leaders, swatting unprincipled bankers will accomplish no permanent good. Surely history teaches most conclusively that artifically-controlled prices, wages and hours always results in trouble, even although when done with the highest motives.

We prohibitionists may have made a mistake in attempting to change the personal habits of people by legislation; but if so, the present administration is surely making a mistake in attempting to change the economic habits in the same way. There is very little difference between the two "noble experiments." It does no good to legislate that water shall run up hill.

Furthermore, with the conditions existing in this nation today and the widespread poverty throughout the world, it is very questionable whether production should be curtailed even as an emergency.

Certainly, in the long run, there is more to divide only as more is produced. However much we may regret it, there are three basic laws that even a unanimous vote of congress with the support of the Supreme Court cannot change. These are: (1) the law of supply and demand; (2) the law of the survival of the fittest; and (3) the law of action and reaction. Anything we do to attempt to circumvent these three laws is time wasted. We make the pro-

gress only by taking advantage of these three laws as follows: (1) by influencing the desires of people for worthwhile things; (2) by recognizing that the "fittest" are those who are developed spiritually and intellectually as well as physically; and (3) by preventing the business depressions through curbing the business booms. Life will always be more or less like a horse race. Successful programs like successful horses cannot be discovered by merely letting them walk in front of the grandstand for the people to vote upon. Stones always sink and corks will always float.

The solution of the Nation's economic problem will come only through the developement of character. Instead of wasting money on useless subsidies——whether to industry under a Republican Administration or to the unemployed under a Democratic Administration——this money should be systematically used to develop the citizenry of the people. Some will say this is impractical, but I tell you it is very practical and possible. I remember when the Agricultural Department of the United States Government was first suggested including the addition of a member to the President's Cabinet known as the Secretary of Agriculture. For a long Period the people thought it fantastic for the government to attempt to develop a better breed of cattle, sheep and hogs, to say nothing of improving the yield per acre of wheat, corn and other products. Yet, after years of discussion, a Secretary of Agriculture was appointed and the work commenced. Instead of being a failure it has been such a success that over-production in certain agricultural lines is causing some of our present troubles.

Statistics show that character is almost the only crop that America is short of today. Although it would be a more difficult task, yet I believe that a Department for Race Betterment headed by a new Secretary of Character could accomplish wonders.

Yes, I believe that character could be developed systematically as we have developed livestock, cereals and cottons. Surely our present methods of combating war, crime, graft, class conflicts and business dishonesty has been of little avail. Surely the hundreds of millions of dollars being spent annually now in combating crime, graft and other national cancers would bring far better results if used properly to develop and strengthen the character of the nation. Of course we would never reach perfection. The fun is in the striving rather than in the arriving. If vice did not exist the nation might be obliged to subsidize it in order to develop self-control and common sense. On the other hand, there is no fear of reaching such a time for a good many generations to come. Hence, the great need of the hour is to raise the desire of the people. What a nation does depends upon what it wants. Desires are determined by inheritance, education, taxation and similar factors.

As a result of giving myself exclusively during the past forty years to a study of business and social conditions, I strongly recommend adding to the President's Cabinet a Secretary of Character and giving him a good appropriation with which to work. To make this work effective there would need be a rearrangement of some of the departments as now existing. For instance, to carry on the work effectively the Secretary of Character should surely have full charge of four departments viz:

(1) IMMIGRATION, now under the Department of Labor

(2) EDUCATION, now under the Department of Interior

(3) TAXATION, now under the Treasury Department

(4) HEALTH AND VARIOUS PREVENTIVE WORK, now under Different Departments

Of course the Secretary of Character would be obliged to give a large amount of consideration to the question of breeding. Any student of vital statistics is convinced that democracy is ultimately to fall unless nations give genetics almost primary consideration. The present system whereby parents of character have from one to three children and hence do not reproduce themselves; while parents with little or weak characters have from three to eight children, spells necessarily disaster. Compared with this question of genetics, all social and economic legislation is mere piffle. Whether the results desired can best be accomplished through subsidizing the fit, or sterilizing the unfit or by some other method is a matter for study. The important fact is that no army or navy or "new deal" or "old deal" can save democracy and conserve for us that liberty which is our greatest heritage. Only by giving our greatest concern to genetics can our nation avoid internal revolution and ultimately being swallowed up by Asiatics. Of course before that time we may experiment with Facism and Dictatorship or our plans may be postponed by a Republican landslide in 1936 or 1940.

ROOSEVELT'S PROBABLE PITFALL

SYNOPSIS OF AN ADDRESS BY

ROGER W. BABSON

at the

UNIVERSITY OF FLORIDA

March 14, 1934

REFORMS IN government — federal, state and municipal — are always needed. Further legislation in the interests of honesty and fair dealing may now be desirable. The Administration's goal to bring about more equal opportunities for all people is right. Such a goal is in the interest of everyone's children and grandchildren. The President, however, should not be discouraged if the results of his present efforts are disappointing. The Democrats were elected into office because the Republicans refused to construct a much desired recovery program. It looks now as if the Democrats will be defeated for erecting too high a structure on too weak a foundation. The failure of the leaders to construct the structure was Hoover's pitfall. The failure of the foundation to hold up the structure will, I fear, be Roosevelt's pitfall.

Hence my purpose is to discuss strengthening the national foundation, — *namely our national character.* More equal opportunities will be brought about only through the *self-control of individuals;*—not through the *state control of income.* Furthermore, our national character can even be undermined by the repudiation of contracts and unwarranted extravagance on the part of the Federal Government. Although done with the highest motives, the artificial control of prices, wages and hours has always resulted in trouble. Personal habits cannot be changed by mere legislation, as the Eighteenth Amendment has clearly demonstrated. We cannot break economic laws; — we can only break ourselves against them. Certainly in the long run there is more to divide only as

more is produecd. We come out of business depressions only by working harder and longer, — not by working less.

There are three laws that even Congress and the Supreme Court cannot change. These are: (1) the law of supply and demand; (2) the law of the survival of the fittest; and (3) the law of action and reaction. Attempting to circumvent these three laws is time wasted. We can make progress only by taking advantage of these three laws, viz: (1) by influencing the desires of the people for worthwhile things, (2) by recognizing that the "fittest" are those who develop spiritually and intellectually as well as physically, and (3) by preventing business depressions through curbing business booms. Life will always be more or less like horse races. Administration policies are much like trotting horses, — their worth cannot be determined by merely walking them in front of the grandstand to be voted upon. Stones will always sink and corks will always float. In fact, laws cannot be made; they can only be discovered.

The solution of the nation's economic problem will come through the development or character, health and intelligence. Instead of wasting money on useless subsidies — whether to *industry* under Republican Adistration or to the *unemployed* under Democratic Administration — this money should systematically be used to develop the citizenry of the nation. Some will say this is impractical, but I say it is very practical. Remember when the Agricultural Department of the United States Government was first suggested, including the addition to the President's Cabinet of a member to be known as the Secretary of Agriculture! People thought it fantastic for the government to attempt to develop a better breed of cattle, sheep and hogs, — to say nothing of improving the yield per acre of wheat, corn and other products. Yet, after years of discussion, a Secretary of Agriculture was appointed and the work commenced. Instead of being a failure, it has been such a success that over-production in certain agricultural lines has caused some of our present troubles!

Statistics show that character is almost the only short crop that threatens America today. Although it may be a difficult task, a Department for Race Betterment, headed by a Secretary of Character, could accomplish much. *He need merely do for men, women and children what the Secretary of Agriculture has done for cattle, sheep and hogs!* Surely our present methods of combating war, crime, graft, class conflicts and business dishonesty have been of little avail. The billions of dollars now being spent annually in combating these and other national cancers would bring far better results if used properly to develop and strengthen the nation's character. Of course we would never reach perfection. The fun is in the striving, rather than in the arriving. The best method of attack lies in influencing the desires of people for things more worth while. What a nation does, depends upon what it wants. Those who voted for President Roosevelt will turn against him when they find he cannot give them what they want. If "priming the pump" does not give water, they will ungratefully claim they were deceived. This applies to organized labor and big business alike. Hence the "wants" and motives of both need be changed.

Desires are determined by inheritance, education, taxation and other factors. Therefore a Federal Department for Race Betterment should have at least these six divisions:

(1) IMMIGRATION, now under the Department of Labor.

(2) EDUCATION, now under the Department of Interior.

(3) TAXATION, now under the Treasury Department.

(4) REGISTRATION OF VOTERS now under Congress.

(5) HEALTH AND WELFARE, now under various departments.

(6) PUBLIC SERVICE, emphasizing the importance of supporting the State rather than receiving support from the State.

The Secretary of Character should give consideration to the question of breeding.

Vital statistics show that democracy will ultimately collapse unless nations give genetics and eugenics primary consideration. The present system whereby parents with good character have only one or two children and hence do not reproduce themselves; while parents with weak character have from three to eight children, spells necessarily disaster. Compared with this question of race betterment all social and economic legislation is piffle. The birth standard is far more important than the gold standard. Whether the result can best be accomplished through subsidizing the fit and restraining the unfit, or by a system of sterilizing those who bear children without a license to do so, or by some other method, is a matter for study. The important fact is that no army or navy or "New Deal" or old deal is sufficient to save democracy and conserve liberty which is our most precious heritage. Only by the Federal Government giving greatest concern to character development, can our nation avoid internal revolution or fascism. A Republican reaction may serve as a narcotic to delay the evil day; but such relief will be but temporary.

In the last analysis, our national future depends upon our national character,—that is, whether it is *spiritually* or *materially* minded. No one knows this better than the President. The demand of his party for immediate results forces him to devote all his efforts to "priming the pump." This allows him no time to give the pump greatly needed repairs or to relocate it to provide a permanent source of water. In the meantime, people are impatient, selfish and ungrateful. The President's goal is right; his intentions are of the best; but the one great pitfall ahead is that not sufficient attention is being given to strengthening the foundations. He should warn the voters continually that only a revival of the nation's character will permanently save the situation. Reforming the bankers and industrialists is a step forward; but this will not save the Democratic Party unless supplemented by an effective movement to reform also the politicians, the labor leaders, and the voters themselves.

Biography of Professor I. P. Pavlov, M. D.

Honorary Director of the Institute of Experimental Medicine, Petrograd

BY

PROFESSOR W. N. BOLDYREFF, M.D.

Director of the Pavlov Institute of the Battle Creek Sanitarium; First Assistant to Professor Pavlov at the Military Medical Academy, Petrograd (1902-1912); Professor of Physiology, University of Kazan, Russia (1912-1917).

I allow it to be published
I. Pavlov

BULLETIN OF THE BATTLE CREEK SANITARIUM
AND HOSPITAL CLINIC

BATTLE CREEK · · MICHIGAN, U.S.A.

BIOGRAPHY OF PROFESSOR I. P. PAVLOV, M. D., HONORARY DIRECTOR OF THE INSTITUTE OF EXPERIMENTAL MEDICINE, PETROGRAD*

W. N. BOLDYREFF

The following sketch of Professor I. P. Pavlov, of Petrograd, briefly summarizes his activities until the year 1917, when the Russian revolution brought into the life of the Russians, and into that of Professor Pavlov as well, many hardships. The great scientist, who has done so much to relieve the sufferings of others, was himself compelled to suffer want and hunger, and, at an advanced age, to spend the time and energy so valuable to science in manual labor to provide food for his family, in addition to performing the humblest domestic duties and household drudgery. In spite of these efforts, especially in the years 1920 and 1921, he and his family suffered severely from the lack of food due to the bad harvest in Russia. During this time he was helped as well as cheered by the contributions of his scientific colleagues in foreign lands, who made great and persistent efforts to send him aid at a time when such a multitude of eminent Russian scientists and thousands of the common people perished from starvation and disease.

In the midst of all his tribulations Professor Pavlov's courage and fortitude never failed him. He even continued his scientific work in the face of great difficulties; and surrounded by his faithful though hungry pupils, hungry himself, in an unheated building, with water pipes frozen and no light other than that from burning faggots, he encouraged and inspired his assistants by his courageous example in continuing the important scientific work to which his life has been devoted. It was, indeed, during this trying period that he carried out many of the important, delicate and interesting experiments on which were based the interesting discoveries in relation to conditioned reflexes, which he has for the first time made known to the public in addresses delivered before the faculties of various universities in this country and at the Battle Creek Sanitarium during his recent visit here.

Having had an opportunity to become well acquainted with Professor Pavlov and his work during ten years of close association with him as the head assistant of one of his laboratories, I have taken great pleasure in preparing, with his approval and assistance, this brief biography and summary of his work.

W. N. Boldyreff.

Battle Creek, Michigan
July 27, 1923

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* Published with the approval of Professor Pavlov and revised by him. Reprinted from the BULLETIN of the Battle Creek Sanitarium and Hospital Clinic XIX: 1 (December) 1923.

Ivan Petrovich Pavlov

Born in the city of Riazan	1849
Studied in the University and the Military Medical Academy in Petrograd	1870-1879
First published article	1877
Worked with Heidenhain	1877, 1884-1885
Assistant to Botkin	1878-1884, 1886-1890
Worked with Ludwig	1885-1886
Doctor of Medicine	1883
Private docent at the Military Medical Academy	1884
Professor of Pharmacology at the Military Medical Academy	1890
Professor of Physiology in the Institute of Experimental Medicine	1891
Professor of Physiology at the Military Medical Academy	1896
Published "The Work of the Digestive Glands"	1897
First report on the conditioned or acquired reflexes	1903
Received Nobel Prize	1904
Fellow of the Royal Society, London	1907
Member of the Academy of Science, Petrograd	1907
Doctor of Medicine (*honoris causa*), Cambridge	1912
Copley Medal of the Royal Society, London	1915
Doctor of Medicine, Edinburgh	1923

The first operation for pancreatic fistula	1879
The first trial of "sham" feeding	1889
The first operation for the "Pavlov pouch"	1894
Discovery of kinase	1898
First experiments on the conditioned reflexes	1902

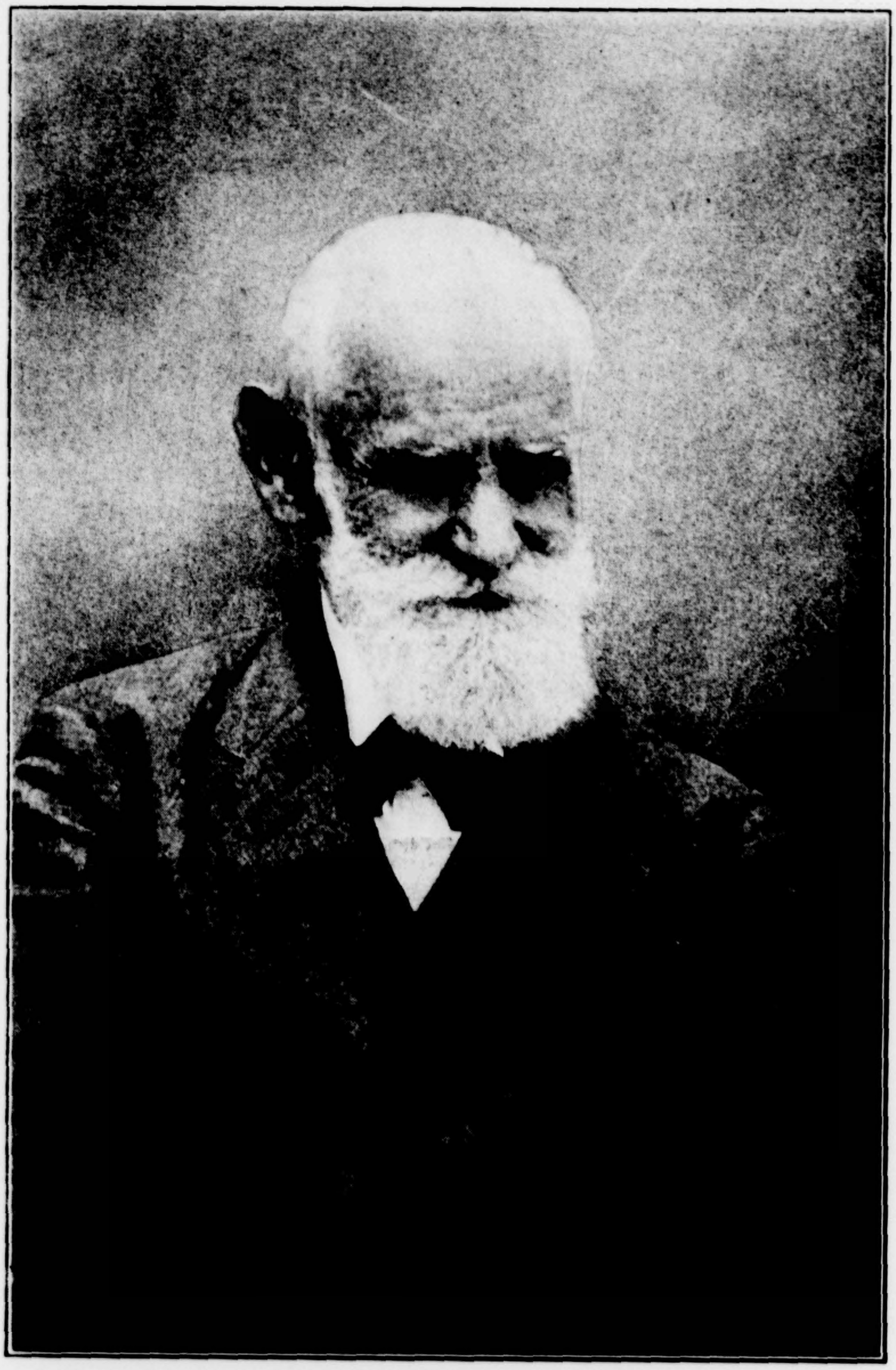
Investigation on the innervation of the heart; the circulation of the blood; pharmacology; and some experiments on the physiology of digestion	1877-1890
Special attention to the physiology of digestion	1890-1904
Special study of the conditioned reflexes (physiology of brain and sense organs)	1902-1923

The great Russian physiologist, Ivan Petrovich Pavlov, was born on the 27th of September, 1849, in the city of Riazan, Russia, about 200 kilometers south of Moscow. His father was the priest of the city and his grandfather was a village sacristan. In early youth he received a religious education at the Seminary of Riazan. He has said that the curriculum of this seminary was excellent and that the philosophy he studied there had an influence on his later work. From the seminary he entered the University of Petrograd, where he gave special attention first to chemistry and later to physiology. He studied organic chemistry under the famous Professor Boutleroff. His youngest brother, D. P. Pavlov, who was also a student in the same laboratory, became assistant to the noted scientist, D. I. Mendeleeff, and later was professor of chemistry at the Agricultural Institute.

At the end of his university course of four years, I. P. Pavlov became a student at the Military Medical Academy for another term of four years, completing his studies in 1879. During his last year he worked as assistant to Professor Ustimovitch, who held the chair of physiology in the veterinary department of the Military Medical Academy of Petrograd.

While still a student he spent the summer of 1877 in Breslau, Germany, working in the laboratory of Professor Heidenhain.

After completing his course at the Military Medical Academy, Pavlov became assistant physiologist in the clinic of Professor Botkin of the Academy, and later, in 1884, he returned to Germany for two years' work with Professor Carl Ludwig, in Leipzig, and Professor Rudolph



Contemporary portrait of Professor I. P. Pavlov, July 9, 1923, Battle Creek, Michigan

Heidenhain, in Breslau. He was greatly influenced by both these eminent scholars, but especially by Ludwig. He was likewise greatly influenced by Professor I. M. Setchenoff, who was an intimate friend of Ludwig and of Claude Bernard, and who was well known through his researches on

breathing and the physiology of the blood and his studies of the functions of the brain and the central nervous system. Professor Pavlov held Setchenoff in very high esteem and called him the "fearless knight who is above reproach."

In 1879 I. P. Pavlov published, in Petrograd, his method for establishing the pancreatic fistula, a similar method being described by Heidenhain a little later (1880). The method of Pavlov was, however, so much superior to that of Heidenhain that it was accepted by physiologists as the classical method while that of Heidenhain has been quite forgotten.

On returning from Germany, Pavlov resumed his place in the physiologic laboratory of the clinic of the Military Medical Academy as assistant to the famous Professor S. P. Botkin. Professor Pavlov continued his work in this laboratory for ten years, during which time, besides guiding the researches of many physicians in the laboratory, he published a number of important papers in relation to pancreatic juice and salivary secretion and also described a method for sham feeding. In this period there were also published under his supervision some fifteen dissertations by his pupils. In 1883 he received the degree of M. D., and in 1884 became private docent of the Military Medical Academy.

In 1890 he was appointed professor of pharmacology in Tomsk (a Siberian town), but shortly thereafter and before he had begun his work at Tomsk, he was called to the Military Medical Academy of Petrograd as professor of pharmacology. Later, in 1896, he was made professor of physiology in the Military Medical Academy, which position he still holds.

Before receiving this appointment he had already at command a good physiologic laboratory adapted to his experimental work in the Institute of Experimental Medicine of Petrograd, an institution equipped by Prince A. P. Oldenburgsky and in 1891 presented by him to the Emperor Alexander III. This institute has six departments, each of which is completely equipped and devoted, respectively, to physiology, biochemistry, pathological anatomy, pathology, microbiology and veterinary medicine. The institute also contains a number of smaller departments, including departments for Pasteur vaccinations, for the making of diphtheria serum, for practical work and experiments in disinfection, etc. These research laboratories are still the finest in Russia, having been by the founder, Prince Oldenburgsky, placed in charge of the most able scientists in Russia, men like Pavlov, Nenzky, Winogradsky and Uskov.

In this institute Professor Pavlov did most of his work and all his best work. For ten years he here pursued, with his friend Nenzky, investigations of the gastric juice and metabolism studies of dogs with Eck's fistula, the results of which he published in collaboration with Nenzky. Here, too, he developed his method of isolating a portion of the stomach, the so-called Pavlov pouch, and discovered kinase. In this laboratory, also, he made the discovery of the conditioned reflexes and carried through the researches upon which was based his book, "The Work of the Digestive Glands." He also has had charge of two more laboratories, one at the Military Medical Academy (from 1891), and the other at the Academy of Science (from 1907), but he never carried on experimental work in either for any length of time.

One may divide Pavlov's studies into three groups: investigations on (1) the heart and the circulation of the blood; (2) the digestive system; and (3) the physiology of the brain and the organs of sense.

In the first period of his scientific work, he studied in detail the innervation of the blood vessels and of the heart. As a result of this, he published a report on the work of the special branches of the vagus nerve, that is, the accelerating and inhibiting nerves of the heart. In 1885, and earlier (1877), he published papers on the accommodating mechanism of the blood vessels. Even at that time he was interested in

Pavlov's laboratory in Institute of Experimental Medicine in Petrograd, where all his most important works were done

the physiology of digestion and published some excellent articles on this subject, among them being papers on the nervous mechanism of pancreas juice secretion (1878). During the same period, under the guidance of Ludwig, Pavlov reported studies on the innervation of the ventriculi sinistri of the heart and, in collaboration with Heidenhain, he wrote an article about the nerve-muscle mechanism of the opening and closing of the volute-flap (Schneckenklappe). Early in his scientific career (1879), he described a new method of operation for the pancreas fistula.

His interest in the problems of innervation and in methods of operation came from the work of his youth. In all his ten years as an assistant to Professor Botkin, however, he never had anything to do directly with the patients, doing all his work in the laboratory.

In 1890 he made his discovery regarding the influence of the vagus nerve upon the process of secretion in the gastric glands. Simultaneously he invented his method for obtaining the gastric juice of dogs, the famous

"sham feeding method." The results of these discoveries were so interesting and encouraging that he turned his entire time and interest to the study of the nerve-physiology of the digestive organs, and shortly thereafter he perfected his method of operation for the isolated little stomach. As he had just about this time obtained the excellent physiological laboratory in the Institute of Experimental Medicine and also a pharmacological laboratory at the Military Medical Academy, he had ample facilities for carrying on his work.

To Pavlov we also owe our knowledge of the influence of the vagus and sympathetic nerves upon the secretion of the pancreas and two excellent methods for demonstrating the mechanism of the action of these nerves. The first method is to excite the sympathetic nerves by mechanical stimulation with the Heidenhain tetano-motor. The second method involves a special operation on the animal by which, with the automatic stimulation of the vagus nerve by the Dubois-Raymond inductorium, the secretion of the pancreas is obtained.

For five years (1891-1896) Pavlov lectured as professor of pharmacology at the Military Medical Academy in Petrograd. Since 1896 he has been professor of physiology there. His lectures almost always included demonstrations. He showed his students his methods of operating and let them see how the results were obtained. No lecture was without its experiments, and these experiments had been patiently tried over and over again before an attempt was made at demonstration to students. Failures and mistakes in demonstrations at the lectures were absolutely forbidden. Pavlov is a very skilful operator. Setchenoff, who knew well all the famous physiologists of his day, said that Claude Bernard had been the first vivisector in Europe and that Pavlov is now the greatest of them all. Pavlov is an eloquent speaker, but in his lectures to students much more stress is placed upon the demonstrations. He is one of the most popular professors in all Russia, and has had as students in his laboratory many men who have since become well-known scientists (Zytowitch, Ozbeli, Palladin, Smirnoff, Volbort, Anrep, and Neiz, for example.)

Professor Pavlov has been an indefatigable worker, toiling without intermission from ten o'clock in the morning till six o'clock in the afternoon and seven days in the week. However, for years he took an annual vacation during June, July, and August, when he went to his country place near the Baltic Sea, where he busied himself in the cultivation of a flower garden. He enjoys exceedingly good health and is of a jolly disposition. His family life—he has three sons and one daughter—is very happy, and that, together with his scientific work, occupies his main interest. He has always been very fond of sports and even in his old age is still a good gymnast. He enjoys bicycle riding and outdoor work. In the summer he has worked from morning till night at his country estate. When he rented this land, it was wild and stony ground, but he cultivated it and put it in order by his own hands. He has a great love of Nature in all its forms. His butterfly collection, the result of his personal labor, is a noteworthy example of this.

His habits of life are orderly, and punctuality is a marked characteristic, considering that he is a Russian and Russians are not noted for that

virtue. In the ten years during which I assisted him at the Medical Military Academy he missed but one lecture, and that because of illness, and he has never been late to appointments. He has a gift for attention to detail. In his experimental work he plans the minutest details and, if possible, does the actual work himself, at least until the procedure is standardized. This has made him especially good as a teacher.

Pavlov does not like to write up the results of his own discoveries. He has published only about fifty articles, most of them very short, but his pupils have written, under his guidance, something like 200 articles. However, probably not more than half the work on these publications was done by the pupils, Pavlov himself being responsible for a great part of it. Most of the articles which he has written and published under his own name are the work of his earlier years. His style is concise. Pavlov had about 150 pupils, of whom twenty were professors, and a great many were foreigners.

In the field of nerve physiology, especially the nerves of the heart and the digestive system, Pavlov has contributed an enormous amount to our scientific knowledge. He also studied the processes of secretion for all the important digestive juices—saliva, gastric juice, pancreas juice, and bile. He discovered the laws governing these secretions and the mechanism of their operation. He has acquainted us with the composition and properties of these digestive juices, and also to some extent of the intestinal secretions. He has greatly increased our knowledge of the physiology of the brain and the organs of sense. More important still are his careful methods of operation and experimental work. His operations are concerned with the whole digestive apparatus, from mouth to colon, and his experimental work has included, in addition to the study of digestion, that of the physiology of the heart, the brain, and the organs of sense. Pavlov's discoveries have been a great contribution to the science of medicine and because of this he has been elected an honorary member in many societies of physicians and surgeons.

Many great scientists whose work has brought about a new epoch in science were either creators of new methods or interpreters to the world of ideas and theories. Such scientists were Harvey, Lomonosoff, Lavoisier, Darwin, Pasteur, Claude Bernard, Helmholtz, Ludwig, Mendeleeff, and Setchenoff. In the scientific activities of Pavlov are combined both the creative and the interpretive. Not content with abstract theories and laboratory results he continued his studies until the practical application was found. Even in his first works, on the physiology of the heart and blood vessels, can be seen some hint of his originality and independence. Although both the subject matter and the methods of investigation show the influence of others (Ludwig and Setchenoff), it is in his studies on digestion that we find the best evidence of the keenness, originality, and independence of his mind.

He has formulated three rules which he maintains are a necessary foundation in physiological studies: (1) that it is necessary to carry on experimental work on normal, healthy animals, not merely on those poisoned or dying by vivisection; (2) that it is a prerequisite to a proper investigation of any organ previously to perform an operation which will render it easily accessible; (3) that the normal functioning of an

organ must be observed after the animal has fully recovered from the operation. Pavlov invented for the study of the physiology of digestion a series of separate operations on the different organs (fistula of pancreas, combination of esophagotomy with gastric fistula, the isolated stomach, etc.). Then he combined these separate operations into a perfect and complete physiologic surgical method. He perfected the technic of this method, studying in minute detail all possible modes of investigation.

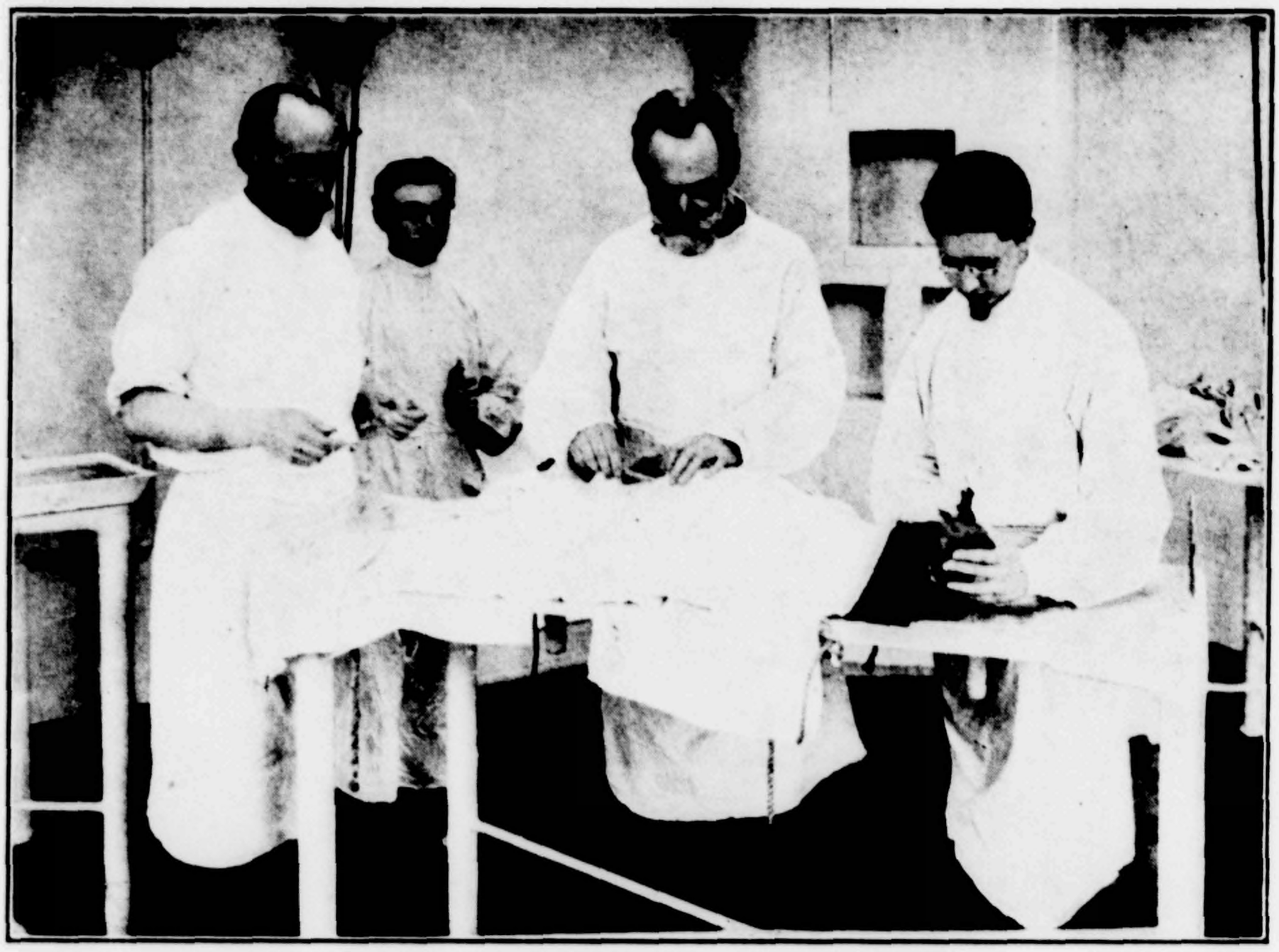
By means of his system of control experiments, using for subjects healthy animals so that the organs to be studied do not lose their normal

Operated dogs (one-half of the total number) with men in charge of them near the house where the dogs live

physiologic character, and through frequent repetition of the same experiment on many different animals, Pavlov created a real physiology of digestion, discovering the fundamental laws governing the activity of the salivary glands, the stomach, the pancreas, the liver, and the intestinal glands. In connection with this work much time and labor were consumed in freeing the scientific field from various weeds which polluted it, especially in overcoming harmful scientific prejudices against the action of mechanical stimulation as an excitant of gastric secretion, etc.

He also observed and studied most carefully various pathologic phenomena in order to discover an applicable and experimental therapy (experimental osteomalacia of dogs with pancreas fistula or with a fistula of the ductus choledochus; diseases of metabolism of dogs with pancreatic fistula and their dietary treatment, diseases of mucosa of the stomach, experiments on dogs with ex-fistula, the introduction of natural gastric juice into medical practice as a remedy, etc.).

In brief, Pavlov's work raised physiology to the level of an exact science. Pavlov's methods of physiologic surgery and the results obtained by their use have become the property of the whole scientific world. Physiologic surgical laboratories patterned after his are to be found now in all civilized countries; his methods of experimental research are recognized throughout the world; and his ideas and discoveries are applied in clinics as well as laboratories. Great discoveries require two kinds of work; the new scientific truth must first be found, and then it must be proved and explained to the scientific world. It has often been true that



Professor I. P. Pavlov operating on a dog in operating room of his laboratory (1904)

one man discovered the truth and another led the world to accept it. Pavlov was fortunate in being able to accomplish the solution of both these problems to perfection. The truths he discovered are accepted by all scientists, and the practical application of these truths has become common knowledge in the medical and scientific worlds.

While studying the digestive processes in healthy, normal animals daily, for years, Pavlov observed the great importance of the relation of the brain and nervous system to their functions. He studied in great detail such positive, co-operating influences as appetite, and negative, opposing, influences which arrest the work of the digestive glands. He accumulated an immense store of facts bearing on the relation of the brain to the digestive processes. He comprehended the great importance of these and undertook a long series of systematic experimental researches upon them. By so doing, he gave the world an admirable method of investigation of the functions of the cortex of the brain. In these experi-

ments, the secretion of the salivary glands was made a reflex of the brain function. For this purpose he invented a method of carrying on the investigation under peculiar conditions—the complete isolation of the experimental animals from outside influences. To carry on this work, he organized a special department, the only one in the world, in the Institute of Experimental Medicine in Petrograd.

For more than twenty years, this venerable scientist has been working on these problems. Besides his study of the physiology of the cortex of the brain, he has conducted researches on the functions of all the organs of sense and has, by his objective method, given the world new and interesting chapters on physiology. The basis of this method is a complete objectiveness by which are excluded surmises regarding the animal sub-

One of laboratory rooms during work

ject, his thoughts, feelings, desires, and so on. Pavlov was the first to make systematic application of this objective method in studies of the functions of the brain, although this method has long been successfully used in studying the physiology of other organs.

In order to illustrate his manner of working, I shall give a few incidents which I either saw myself or which Pavlov related to me.

Twenty-two years ago, Pavlov asserted that pepsin and rennet were absolutely identical, but his friend Nenzky did not quite agree. After a long and unfruitful dispute, Nenzky sent Pavlov a commercial preparation of pure rennet, and in this no one could discover proteolitic action. This rennet had been prepared in a special factory in Riga and was intended to be used in making cheese. No pepsin whatsoever could be discovered in it. We young doctors, then with Pavlov, thought he would be

disconcerted because from this preparation he could only get coagulating, not digesting, effects. On the following day, however, Pavlov came to the Institute and told us that he now knew what should be done. He said that in the commercial rennet preparation there were some salts or other substances which interfered with the digesting effects. If these could be removed, one would get the proper digesting effect. Pavlov planned to dilute the preparation with water.

We did not believe he was right, because he got no results from his first experiment, and Nenzky, moreover, was a famous biochemist. I shall never forget the day when the dispute was settled, Pavlov the winner. Pavlov took the preparation and diluted it four times with water. Then he tested the peptic power, while we waited impatiently for the result. It

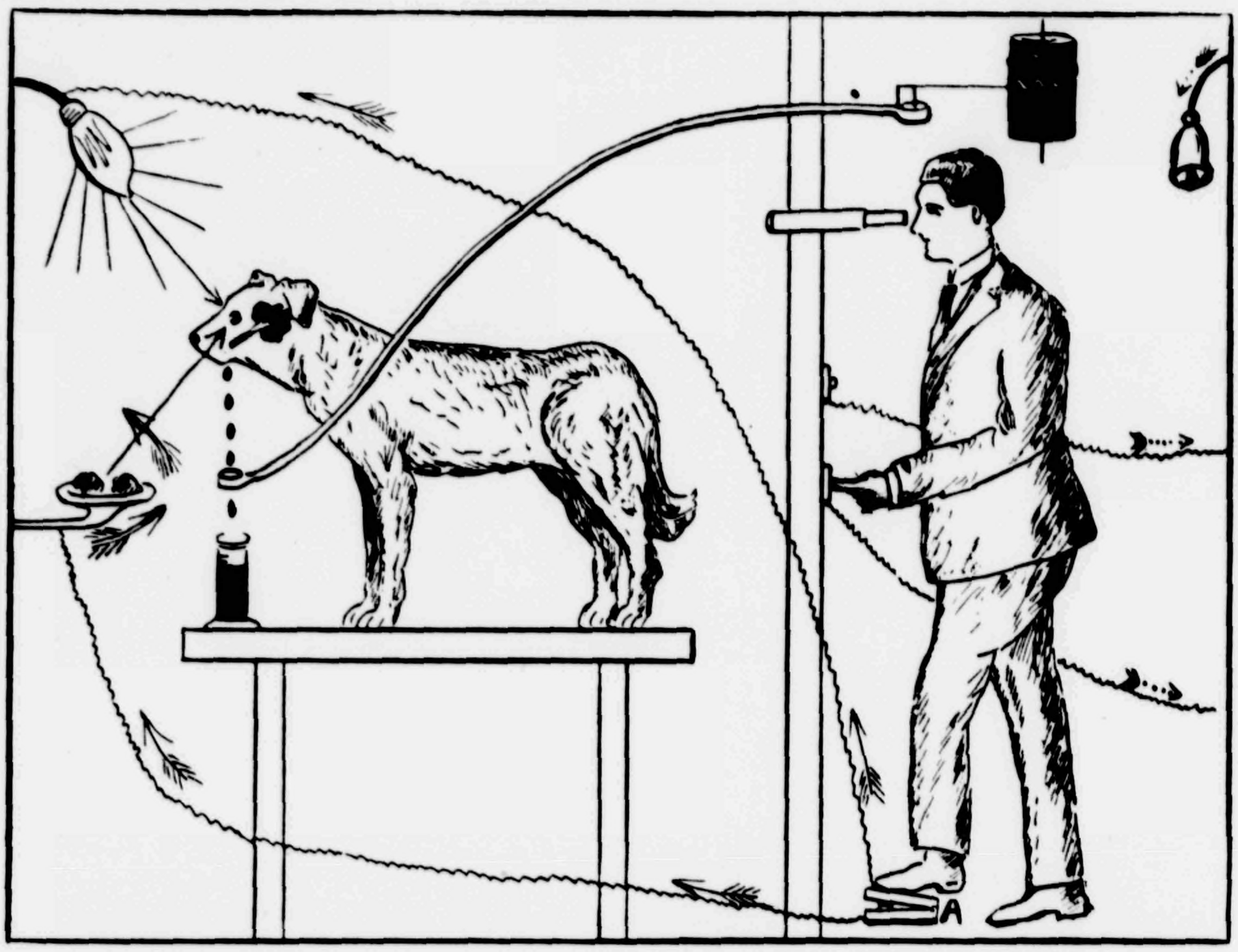


DIAGRAM.—Isolated Room for Research in Conditioned Reflexes after Pavlov. *A*.—A part of an apparatus, which simultaneously gives food to dog and irritates him with light. Dotted arrows indicate signals to and from outside.

was negative. Pavlov then diluted the preparation ten times, with the same result; then twenty times, thirty times, fifty times, but always with a negative result. All but Pavlov thought he was wrong. He continued diluting the preparation up to a hundred times, and then the preparation showed a very strong peptic effect.

Pavlov had discovered that all dogs with a pancreas fistula and also those with a choledochus fistula suffered from experimental osteomalacia and died in from six to fifteen months. On one occasion, he promised to show us how to save such dogs from death and cure them. Pavlov waited until a dog with a choledochus fistula was suffering very badly from

osteomalacia. All the dog's bones, even the spine, were so soft that the dog could not walk at all. Pavlov then cut the mouth of the choledochus away from the skin of the abdomen and sewed it back to the duodenum so that the fistula was entirely cured, and the bile could run in normal fashion into the duodenum. He had promised us beforehand that the dog would be entirely cured in three weeks, because the hardening process of the bones requires three weeks. The dog was so weak that he could not even stand. The three weeks went by, but the dog was no better. Everybody excepting Pavlov had given up hope when suddenly, at the end of the fourth week, the dog began to walk. He was soon quite well, and the only trace of his illness was a slight deformity of the spine. The dog lived for a year and a half after that, dying from an accident.

The scientific work of Pavlov has been well recognized, not only in his own country but also in foreign lands. I think he is most revered in England, Germany, Sweden, Japan, and America. When Pavlov was to receive the Nobel prize, he was introduced to the king of Sweden. When he came to the king, the latter said to him in pure Russian, "Kak washe zdorovie, Ivan Petrovich?" (How are you, Ivan Petrovich?) Pavlov, not expecting such a greeting, was so astonished that it was some time before he could answer. Later some Swedes told Pavlov that the king had studied these words for a long time before he had sufficiently mastered them to pronounce them correctly.

Pavlov's first honorary title was given him by a Mexican scientific society on January 5, 1898. Previous to 1904, he had been elected an honorary member of no less than fifteen German medical societies, and later many Russian medical societies also elected him. The following are the dates of the most important honors conferred upon him: 1904, the Nobel prize; 1907, Fellow of the London Royal Society and of the Petrograd Academy of Science; 1912, the doctor's degree from Cambridge University; 1915, the Copely Medal from the Royal Society; 1923, the doctor's degree from Edinburgh University. He is now a member of the Academies of Science of Paris, Rome, Bologne and Denmark; of the American National, Irish, Belgian, and also many other medical academies.

Throughout his whole life Pavlov has worked hard, diligently, and untiringly, and always with excellent results. His life has been valuable not only for Russia and Russian science, but for science throughout the whole world.

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TRANSLATION

October 5, 1928.

Dear Dr. Boldyreff:

Thanks for the promise to send me reprints: 50 will do.

I regret I cannot comply with Dr. Kellogg's request: in the published works of Tissier, there are no mentions of the change of flora. Ilya Iliich (Metchnikoff), in spite of the efforts of many years to change his own flora artificially, attained nothing.

Your son left the best impression with everybody here.

A few days ago I saw Dr. Westenrick, who dreams of working under you.

Yours as ever,

(Signed): A. Besredka.

8/10/28

Dr. Tissier and His Work at the Pasteur Institute

Henry Tissier was born at Roumme, Loire, October 17, 1866, and died at Paris, December 31, 1926. His life was one of incessant activity. He was the son of a carriage maker and began his education in the school of his native village. Later he entered college at Compiegne. Having received his diploma as bacholor, he went to Paris, as he long desired to do, and matriculated at the Faculty of Medicine.

From the beginning of his medical studies Tissier was greatly impressed by the ravages of gastro-enteritis among young infants. Having made himself familiar with the current literature of the question, he noted that works upon the etiology of this disease were full of contradictions. While still a young interne he conceived the idea of devoting himself to the study of the intestinal flora. He made known his ambition to his friend Veillon who presented him to Professor Grancher, of the Pediatric Clinic, by whom he was given an opportunity to work in the laboratory of the Pediatric Clinic. There were at work at that time in the laboratory under the direction of Veillon a sextet of highly talented investigators who were devoting themselves to the study of anaërobic microbes; namely, Huber, Hallé, Rist, Auclair, Cottet, and Cuillerot. Tissier could not have found a more favorable field for undertaking a study of the intestinal flora. So he entered upon the work with great energy and during four years devoted his entire time to work in the laboratory of the Hospital for Sick Children. At the end of his internship he published a remarkable monograph entitled "Researches Upon the Normal and Pathological

Intestinal Flora of the Nursing Infant" which he presented as his inaugural thesis in receiving his degree as Doctor of Medicine in 1900.

At this time Metchnikoff and his numerous students were studying old age and the role played in senility by the intestinal flora. Evidently the place for Tissier was at his side. Tissier left his own laboratory at the Hospital for Sick Children and entered the Pasteur Institute where he remained until his death.

For a long time bacteriologists had been endeavoring to determine the composition of the intestinal flora. The hope was that by an understanding of the nature of the intestinal flora it would be possible to make clear on the one hand the role of bacteria in the numerous fermentations which developed in the intestine in the normal state, and on the other hand to determine their role in digestive disorders, especially in the disorders of young infants which, as is well known, suffer a high mortality rate from intestinal disorders. But prior to the researches of Tissier it had been nearly impossible to establish a distinction between a pathologic and a normal flora, and still less between the different varieties of pathogenic flora. When the microscope revealed two or three species the bacteriologist found a great number derived for the most part from atmospheric dust. On the contrary, when the direct examination showed a varied flora it was possible to isolate only one or two species.

These paradoxical observations were evidently due to the imperfection of the technic employed. It was necessary then, before beginning the study of the pathogenic flora of the intestine, to

perfect a dependable method which would give constant results, and then by the aid of a perfected technic to study the normal intestinal flora.

Such was the plan that Tissier marked out for himself and which developed, as we shall see, in the most brilliant manner.

After having described in detail the technic of culturing the stools and the method of culture, he studied both normal and pathological stools in breast-fed infants, in bottle-fed infants, and in young children taking a mixed diet. It was only after a minute study of the microörganisms observed in these different classes that Tissier approached the problem of the physiologic role of the intestinal flora in gastro-enteritis of nurslings.

Let us note in passing that in the course of these researches Tissier found some species which had not previously been described: bacillus bifidus communis, bacillus exilis, bacillus minutus, cocco bacillus perfocteus, diplococcus griseus liquefaciens and a streptococcus which was negative to the Gram stain.

The Normal Flora of the Nursing Infant

According to Tissier, the digestive tube of a breast-fed infant is at first sterile. The first bacteria make their appearance between the tenth and the twentieth hours after birth. Bacteria appear even before food has been administered. One sees at first small cocci (staphylococcus albus) and with them cocco bacilli which lose their color with the Gram stain. At the end of 24 hours, when feeding usually begins, the bacillus perfringens (Welch's bacillus) and the bacillus III of Rodella appear and then progressively the following organisms

appear and become very numerous toward the third day; namely, cocco bacillus perfoetens, B. lactis aerogenes, enterococcus, sarcines. After this time this highly varied flora tends to become simpler. A diplobacillus with slender extremities (bacillus bifidus) develops rapidly. The other bacteria disappear gradually until the intestinal flora seems to consist almost exclusively of the one species, B. bifidus. This flora remains constant so long as the breast feeding continues, but the least error in diet or the least fault in hygiene will react upon the flora injuriously and this effect will become apparent even when neither the weight nor the external appearance of the child give any indication of anything wrong.

In bottle-fed babies the phase of increasing infection is more prolonged then in breast-fed infants. Yeasts and certain varieties of sarcines are found in the stools. Many species of bacteria are present. Besides bacillus bifidus, B. coli and the enterococcus there exist in equal numbers the B. acidophilus, B. exilis, staphylococcus albus and B. lactis aerogenes. Of all these different species no one is predominant.

In infants taking a mixed diet, if cow's milk is given from birth the flora resembles that of a bottle-fed infant. If the infant begins the use of cow's milk later, as toward the sixth or eighth month, the appearance of the stool differs little from that of a breast-fed infant.

Let us see now what is the physiologic role of the normal intestinal flora, according to Tissier.

As shown by his researches, the digestive tube is from the first hours of life invaded by the ordinary bacteria of putrefaction which set up in the intestine a process of putrid decomposition. The presence in the intestine of the nursling of certain species of bacteria is certainly harmful for an organism which is not yet able to defend itself. These species give rise to an abnormal condition and through infection such as is encountered, as we shall see, only in well defined pathological conditions. But, as has been said above, in breast-fed infants, the bacillus bifidus, a strict anaerobe, rapidly develops and so completely dominates the B. coli and the enterococcus that the action of these organisms becomes negligible.

The B. bifidus in acting upon sugars produces none of the volatile acids of strong odor such as butyric and valerianic acids. In its action upon peptones the B. bifidus gives rise to no harmful products such as indol and phenol. It even destroys the organic waste products such as urea. The B. bifidus opposes the invasion of the digestive tube by abnormal species and prevents them from becoming acclimated by producing such quantities of acid that their development is arrested and by removing from the residues such substances as the proteoses which are necessary for their existence.

In the bottle-fed infant the situation is different. On account of the large amount of protein contained in cow's milk the food residues are greater in volume. The B. bifidus is not able to develop so readily in this medium as in the residues of breast-fed infants. Because of this, other proteolytic ferments [putrefactive organisms] develop equally as abundant as the B. bifidus and become acclimated

to the intestine. It is this which explains the proteolytic properties of stools of this sort and the presence of such substances as indol, phenol, volatile acids—butyric, valerianic, etc.—which are not found or found only in small traces in the stools of breast-fed infants.

By these comparative researches Tissier has shown that in breast-fed infants the intestinal flora is inoffensive and protective and that it exercises no harmful influence upon the development of the organism.

After having studied the microbes composing the intestinal flora of the nursling, Tissier began the study of organisms which invade and become acclimated in the digestive tube of children who have ceased to adhere to a milk regimen and have adopted a more varied diet similar to that of adults. This period, known as weaning, usually begins between the twelfth and the eighteenth month and is generally completed by the third or fourth year.

Beginning with the weaning period, the flora of the infant is little by little invaded by a series of species of bacteria which tend to become acclimated in the intestine. At the age of five years when the infant's diet becomes essentially the same as that of an adult, the flora is constituted as follows: On the one hand a fundamental flora consisting of vestiges of the flora of the nursling and of similar composition, consisting of the B. bifidus, the enterococcus and the B. coli, with the addition of B. acidophilus, B. exilis and B. III of Rodella which are constant, and on the other hand a superadded flora of variable composition (B. perfringens) [Welch's bacillus],

cocco bacillus proecutus, staphylococcus parvulus and some others. The first is much the more important. It is to the second in a vegetarian child in relation of 90 to 10; 80 per cent of the colonies are still formed by the B. bifidus. In a child taking a mixed diet the relation changes to 80-20; 70 per cent of the colonies are formed by the B. bifidus. In an infant fed with animal protein this relation is 70-30, with 50 per cent only of B. bifidus colonies.

The intestinal flora is no longer like that of the breast-fed infant. The chemical products of the intestinal bacteria are not offensive. While little harmful in a vegetarian child, this mixed flora becomes more injurious in a child receiving a mixed diet and still more harmful in a child taking considerable quantities of protein substances of animal origin. This harmful action is chiefly due to the superadded flora of which certain organisms possess pathogenic products and are even capable of giving rise to gangrenous processes. In general the richer the intestinal flora is in superadded organisms the more intense will be its injurious action.

The microbes of the fundamental flora, on the contrary, possess, as in the flora of the nursling, protective properties. A diet which will enable these organisms to live in the digestive tube and there maintain a preponderate activity will be the best diet.

These views of Tissier find full confirmation in daily medical practice.

Desiring to penetrate still more deeply the processes of fermentation and putrefaction which occur in vivo, Tissier had the

idea to attempt to reproduce them in vitro by reproducing natural conditions as closely as possible. He proposed especially to study the mechanism of putrefaction in two principal aliments, butcher's meat and milk.

For a long time the bacterial putrefaction or decomposition of the protein molecule had attracted the attention of investigators. Let us recall that it was Pasteur who first in 1877, in studying the septic vibrion, demonstrated the existence of a bacterium endowed with proteolytic power. He proved the existence of anaerobic life and established the primordial role in putrefaction of organisms capable of living without air. Twenty years later Veillon and then Zuber, then Hallé, Rist, Guillemot and Cottet in a series of studies of great interest demonstrated that in all pus with putrid odor there always exist anaerobes and often anaerobes only. It is then probable that in the destruction of dead albuminoid matters anaerobes would also be found. This Bienstock demonstrated in 1900 in his studies of B. putrificus.

This last proteolytic anaerobe by reason of its resemblance to the B. bifidus especially attracted the attention of Tissier, and so much more because the protective action exercised by the B. coli and B. lactis and B. putrificus recalled the protective action of the normal flora of the nursling against certain abnormal organisms. "These two protective processes," said Tissier, "must be due to the same cause." It was thus that he was brought to isolate the B. putrificus from decomposing flesh and then to study the other species found developing in decomposing flesh in symbiosis and to determine their respective actions.

These researches had necessarily been very tedious and prolonged. Our knowledge concerning the chemical constitution of albuminoid matters is as yet rudimentary. It is consequently not possible to determine the exact chemical action of the various species of proteolytic organisms.

But incomplete as were the researches undertaken by Tissier and his collaborators, Martelly and Gasching, they must be regarded as among the most important that have been made in relation to the putrefaction of alimentary substances.

Meat taken from the slaughterhouse as fresh as possible already contained all the bacteria necessary for its complete putrefaction, germs which will multiply only when the medium is favorable to their development.

At first the fermentation of sugars is active, there being at the same time a slight attack upon the albuminoids. Cultures show aerobes, mixed ferments such as Micrococcus flavus liq., Staphylocoque blanc, B. coli, Streptocoque pyogene, Diplococcus griseus non liq., B. filiformis.

At the end of three or four days the acid reaction is less pronounced. Changes in the albumins are much more active. The odor begins to be slightly putrid. The medium being deoxidized, anaerobes make their appearance. As yet only the mixed ferments are present such as B. perfringens and B. bifermentans sporogenes.

At the end of 8 or 10 days the sugar has disappeared. The saponified fatty matters have become ammonia soaps. Glycerin is burned (oxidized). The odor is very fetid. The presence of indol, phenol, hydrogen suphide and ammonia indicates the rapid destruction of protein. The pure proteolytic ferments, diplococcus magnus anaerobius and proteus, are present.

At the end of three weeks only the most resistant species survive

along with the products of bacterial action. At the end of four months the flesh has become a black viscous, odorless mass. It no longer contains peptones. The only microorganisms remaining are B. putrificus and B. gracilis putidus. Such in brief is the process of putrefaction in contact with the air.

When the culture medium is deprived of air the appearance of anaerobes is more rapid but occurs in the same order.

In brief, in the putrefaction of the flesh of beef, Tissier distinguished two phases:

1. A phase in which mixed proteolytic and peptolytic ferments destroy sugar and attack albumin.

2. A phase in which pure proteolytic ferments complete the destruction of albumin and its ultimate derivatives.

As we have seen in the putrefaction of the solid substance of flesh, composed for the most part of albuminoid matters and a relatively small quantity of carbohydrate, the destructive process is eliminated by proteolytic anaerobes. It remains to be seen if the destructive process obeys the same laws in milk where the proteolytic matters are in solution or in suspension and where hydrocarbons are present in large amount.

This study, so far as it relates to meat, has been undertaken for the purpose of facilitating researches in relation to the intestinal flora and to throw light upon the pathology and physiology of the intestinal flora.

In the case of milk, as in that of flesh, the breaking up of the albuminoid matters is accompanied by decomposition of its hydrocarbons. Tissier desired to identify the organisms by which meat is the most readily invaded.and to determine the order in which the destruction of its various elements—

albuminoids, fat and sugars—takes place.

Tissier observed that milk as it comes from the dairy contains all the bacteria necessary for its complete putrefaction, bacteria which will multiply only when conditions become favorable.

Very soon after the milk is drawn its reaction becomes modified. There are found traces of peptone and of ammonia; the lactose diminishes slightly. Next slight changes in albumin and lactose are noted. Bacteriological examination shows the dominant species to be the enterococcus. Next comes B. coli. Thus in comestible milk there are already modifications due to the simultaneous action of mixed ferments and pure ferments.

At the end of two to four days the milk coagulates. By the method of Duclaux there may be shown to be present a mixture of acetic acid and another volatile acid, either valerianic or butyric acid. The dominant organism is the enterococcus. To this is due the coagulation of milk.

Three or four days after the spontaneous coagulation of the milk changes in the curd may be observed. It becomes dense and retracted. The lactose is diminished. The total acidity is increased. A bacteriological examination shows that another organism has become dominant in place of the enterococcus. This is the bacillus acidiparalactici. Toward the eighth or tenth day after coagulation volatile acids appear together with the bacillus lactopropylbutyricus and molds, Oidium and Rhizopus.

At the end of a month the acidity lowers. The lactic and butyric ferments are no longer the dominant species. Along with them are developed the bacillus faecalis alcaligenes or other bacilli such as the Proteus Zenckeri. Molds, playing the role of proteolytic organisms, destroy the casein and gradually neutralise the medium.

At the end of three months the casein is transformed into a viscous mass. The layer of molds detaches itself. Simple ferments develop in their turn, among them proteolytic bacteria.

At the end of ten months there remains only a fetid, yellowish deposit. Chemical analysis shows leucin, tyrocin, a quantity of fatty acids and ammonia. Peptolytic bacteria have completed the destruction of the ultimate derivatives of the albuminoid substances.

This then is the usual program in the fermentation of milk. At first a phase in which mixed ferments cause a complex acid fermentation, then a lactic fermentation and finally a lactic propionic butyric fermentation. Molds destroy the acid products and attack the casein. Finally simple ferments complete the destruction of albumins and its derivatives.

It appears, then, that while in a general way the putrefaction of milk resembles that of meat, it is evident that in the details there are differences, particularly in the longer duration, the lessened putridity and the constant presence of molds.

After having thus shown that the process of fermentation is essentially the same for the albumins of the muscles and those of milk, Tissier wished to determine if other proteins are attacked in like manner by bacterial diastases. This was a question of great importance for both the biologist and the physician. To establish an appropriate dietary should always be, in the mind of Tissier, regarded as the most important duty of hygienists and physicians.

For these new researches Tissier has chosen the principal proteolytics concerned in the spontaneous putrefaction of butcher's meat; namely, B. perfringens, B. putrificus of Bienstock, and B. proteus. To this he added

two other powerful proteolytic organisms found in the human digestive tract, B. sporogenes, isolated and studied by Metchnikoff, and B. colicogenes, isolated by himself from the stools of an infant suffering from diarrhea with violent colic pains.

Tissier cultured these five organisms in great flasks of peptonized water containing a certain quantity of albuminoid matter—blood albumins, the yolk of egg, the white of egg, vegetable albumin and fibrin, fat-free flesh, milk, cheese, lentils, beans and cereals. To determine the amount of albumin destroyed he determined the nitrogen present both before and after the culture.

It was shown by these experiments that albumins differ very greatly in their resistance to bacterial diastases. The albumins most readily attacked were those of the white of egg. Next in decreasing order come the albumins of the yolk of egg, then those of milk, cheese, flesh and fibrin, and last of all vegetable albumins of which the most resistant were the albumins of legumes. These showed double the resistance of animal albumins. For a given weight of albumin destroyed, the albumins of legumes gave twice as large a quantity of acid amins, while the proteins of cereals gave no more than the proteins of animal origin.

The physician and the hygienist who wishes to establish a rational dietary should not lose sight of the fact that if vegetable proteins are less digestible they are at the same time only half as putrescible, a matter of very great importance.

These studies have thrown light upon the etiology of certain gastro-intestinal infections. Thus, to cite a single example, Tissier has observed that in the presence of a pure albuminoid, B. perfringens (Welch's bacillus) shows

little activity, less than that of facultative aerobic bacteria. But when in addition to albumin a hydrocarbon, sugar or starch, is present, the vitality and activity of B. perfringens are greatly increased. Cultured in milk, it destroyed three quarters of the casein present before the acidity of the culture medium became sufficient to arrest its growth.

This explains the cause of the gastro-intestinal troubles observed in certain patients subjected to a diet of cereals mixed with milk or eggs. Such a diet produces gaseous distention of the bowels, colic and liquid, frothy stools which cease at once when the diet is confined to meat or meat and eggs. In these cases the gastro-intestinal flora contains numerous strains of B. perfringens, the activity of which is doubled in a medium consisting of a mixture of albumin and starch.

When the digestive residues contain only albumin, fermentation diminishes and changes in type. Gas is no longer produced. The stools are no longer soft and frothy. They become compact and fetid. However, the cause of the disease has not disappeared and whenever food rich in starch is taken the old symptoms return.

Tissier has thus demonstrated by his researches how important is the study of intestinal putrefaction both from the point of view of the growth and development of the human organism and that of the genesis of infections of the digestive tube.

As regards infants, he has demonstrated that by reducing to a minimum the putrid fermentation of the alimentary residues the liability to intestinal infections is greatly diminished, while on the other hand the danger of infection is doubled by a diet containing an excess of protein.

The World War compelled Tissier to interrupt his researches upon the intestinal flora and instead to undertake the study of war wounds. Being called to examine from a bacteriological point of view wounds of all sorts, Tissier made an observation which had for the treatment of wounds a practical importance of the first order. He especially noted that when wounds contain streptococci it is necessary to avoid closing them otherwise failure is certain to occur. Some thousands of human beings have been saved during the war, thanks to this observation of Tissier, which still retains all its value in times of peace.

This brief note, which has for its purpose to present a summary of the scientific work of one whose labors have been an honor to the Institute Pasteur, will be incomplete if we do not add that while Tissier devoted his life to laborious and continuous laboratory research, he was in addition a devotee of art and especially of sculpture. In addition he was a highly trained practitioner and was justly considered as one of the best specialists in disorders of the digestive tract in France.

Liste de Travaux publies

par

R. TISSIER

1894 Janvier. Soc. Anatomique

Infiltration embryonnaire de tubique dei iw intestine

1897 Novembre. Bull. de la Soc. Anatomique

Emphyseme suraigu compliquant une broncho-pneumonie

1899 Decembre. Le Bacterium coli et les reactions chromophiles d'Eschrich

1900 These de Paris. Flore intestinale du nourrisson

1902 Decembre. Ann. Inst. Pasteur (en collaboration avec Martelly)

Putréfaction de la viande de boucherie

1903 Aout. Ann. Inst. Pasteur (en collaboration avec Gasching)

Recherches sur la fermentation du lait

1905 Février. Ann. Inst. Pasteur. Répartition des microbes dans l'intestin des nourrissons

1906 Mai. Ann. Inst. Pasteur. Etude d'une variété d'infection intestinale chez le nourrisson

1906 Février. Tribune médicale. Traitement des infections intestinales par la methode de transformation de la flore bacterienne de l'intestin

1908 Février Ann. Inst. Pasteur. Recherches sur la flore intestinale des enfants âgés d'un an a cinq ans

1906 Fevrier. Tribune médicale. Traitement des infections intestinales par la methode de transformation de la flore bactérienne de l'intestin

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1912 Juillet. Ann. Inst. Pasteur. Action comparee des microbes de la putrefaction sure les principales albumines

1915 Decembre. Ann. Inst. Pasteur. Recherchessur la flore bacterienne des plaies de guerre

1916 Octobre. Bull. de l'Acad. de Médecine et de Phar Militaire. Recherches sur la flore bactérienne des plaies de guerre

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1917 Bull. Soc. de chirurgie (en collaboration avec Deyre). Fermeture secondaire des plaies

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1919 Février. Soc. de biol. (en collaboration avec Coulon). Action protéolytique du streptocoque pyogene sur le lait

1919 Février. Societe de biol. Action proteolytique du streptocoque pyogene sur la gélatine

1920 Ann. Inst. Pasteur. Contribution à l'etude des infection intestinales

1923 Bull. de l'Inst. Pasteur (cours de bactériologie de l'I. P.). La Putréfaction

1925 Février. Bull. de la Soc. de Biologie. Streptococoquesintestinaux

1925 10 Juillet. Bull. de la soc. de Biologie. Flore intestinale de l'enfant eleve au biberon

1925 17 Juillet. Soc. de biologie. Coagulation microbienne du jaune de l'oeuf

1926 Fevrier. Soc. de Biologie. Coccus anaerobie des selles de l'homme

To my dear friend
Dr. John Harvey Kellogg
from thankful author

THE PANCREAS AND GENERAL METABOLISM

A Physiological, Metabolic and Philosophical Concept of Nutritional Unity and Interdependence

By

W. N. BOLDYREFF, M.D., Battle Creek, Michigan

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The Pancreas and General Metabolism*

A Physiological, Metabolic and Philosophical Concept of Nutritional Unity and Interdependence

By

W. N. BOLDYREFF, M.D.†

BATTLE CREEK, MICHIGAN

THE report falls into two parts: 1. Metabolism in the whole organism and 2. Metabolism in the separate cell.

1. Metabolism in the Whole Organism.

When we discuss metabolism in connection with the function of the pancreas we involuntarily think of carbohydrate metabolism long ago studied and described in detail by the great Claude Bernard, then Minkowski and finally by many other French, German, English, Italian, American and Russian investigators. We recall also the more recent work of Macleod, Banting and their associates dealing with insulin which has so much relieved the suffering mankind in the struggle against diabetes mellitus. From this angle we shall discuss metabolism in the whole human and animal organism and the *rôle* of digestive hormones. But I am going to describe the relationship of the so-called external pancreatic secretion to the general metabolism.

If the introduction of the conception 'hormone' were necessary and useful in the past, it is now not infrequently abused. Hormones have so multiplied in recent years as to create much confusion in the study of physiology. Some substances are classed as hormones without having been sufficiently studied so that their content and action are fully understood. Physiology is thus turned into *philology*—no new facts, no explanations, but simply new words.

Even with the finely studied hormone, insulin, the ground is not perfectly sure.

Recently Ephraim Boldyreff (Pavlov Physiological Institute and University of Michigan) has established that (1) the amount and distribution of islet tissue in the pancreas apparently do not have any relation to the blood sugar; (2) the effect of insulin upon the digestive system invariably precedes its hypoglycemic action, and (3) insulin affects carbohydrate metabolism through the nervous system (Report to this Congress).

The newest findings on the duodenal hormone, similar to insulin, and found by the American doctors A. B. Maccallum and N. G. Laughton, also shake the faith in the specific action of insulin as a product of the islands of Langerhans, as well as the fact that many authors have obtained insulin, or a substance similar to it in physiologic action, from various bodily organs and even from plants (Collip).

Further, a whole series of laboratory investigations and clinical observations have shown that insulin affects not alone the carbohydrate metabolism as was formerly believed, but the fat (Bloor) and the protein metabolism as well. Hence the conclusion that our views on the physiological effect of insulin, which seemed so definite, simple, and well founded, must undergo revision. Therefore (1) insulin in reality is not 'insulin' at all, *i.e.* it is not restricted to the islands of Langerhans, but found in the whole body of the pancreas; (2) moreover, it has other effects than upon carbohydrate metabolism inasmuch as it influences also the metabolism of other substances; (3) that, as is accepted for typical hormones, insulin acts not directly on carbohydrate metabolism but through the nervous system. (For details see the works of E. Boldyreff and others).

The correctness of this view is also confirmed by some earlier work: for instance, by the fundamental and original work of de Dominicis in Italy on the influence of pancreatic juice (so-called external secretion) on the metabolism, and also my work on the same subject supplying new data and offering new explanations, first reported at the VI Congress at Brussels (in 1904) and later described in detail in *Ergebnisse der Physiologie* in 1911 and 1929 and elsewhere.

The term 'external' secretion for pancreatic juice secreted into the intestine in distinction from a supposed, though never seen and not proven 'internal' pancreatic secretion, entering directly into the blood, is unfortunate and incorrect. In former times it would perhaps serve to describe the secretion of pancreatic juice outside in animals with pancreatic fistulae. But this term should now be abandoned in order to avoid harmful and even dangerous confusion in conceptions, since it has been proven that normally this secretion is soon absorbed into the blood and thus becomes *internal*. My experiments and those of my associates have shown that in man and vertebrate animals, when hungry, there is an abundant, regular and uniform periodical secretion of pancreatic juice into the intestine about every 1 or 2 hours (described in detail by me elsewhere). In 24 hours there are from 5 to 10 such "secretion periods" depending upon the subjects diges-

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†Director of Pavlov Physiological Institute of the Battle Creek Sanitarium.

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tive activity. The more time there is taken up by digestion, the less there is left for the periodical secretion, just as the longer the night, the shorter the day.

The periodically secreted pancreatic juice, or rather its ferments, are immediately absorbed from the intestine into the blood where the proteolytic ferment is detected by means of Abderhalden's reaction (work of Dr. Kniazeff in my Laboratory). The glucolytic (work of E. Boldyreff in my Laboratory) and lipolytic ferments are also detected by other fitting and generally known methods. Prawdich-Neminsky in Russia noticed a similar periodical appearance of catalase in the blood simultaneous with the above named ferments.

E. Boldyreff in my Laboratory has proven in his published experiments that pancreatic juice in general, both the portion secreted on food and the periodically secreted portion, possesses a glucolytic action. He has also established that the sugar content in the blood of a living being falls during the periodical pancreatic secretion and rises in the absence of it. I do not doubt that such pancreatic juice is the main source of insulin. The pancreatic juice secreted in digestion possesses the same property.

According to our data, the ferments of the pancreatic juice always, though periodically, enter the blood in the absence of digestion and during it and then are carried throughout the organism to supply the needs of all the organs, tissues and cells of the body. The general metabolism—carbohydrate, protein and fat—is effected with the aid of these ferments. They supply the energy for the functions of the body and the chemical work in the organism, under constant and exacting control of the nervous system. The importance of them was first indicated and studied by Claude Bernard and later insistently stressed by E. Pflueger.

The correctness of the theory presented is confirmed by the following considerations.

(1) There is a parallelism between the work of the digestive organs and the general life processes in the organism. In the young organism with good digestion, there is rapid growth, quick recovery from injury or disease, resistance to fatigue and so forth; in old age, the digestion is poor and all other vital phenomena are slow and dulled.

(2) In severe sickness, all the bodily forces are concentrated for the struggle against the disease; digestion is at times stopped for lengthy periods or may be inhibited (due to lack of appetite), thus permitting the digestive ferments to be mobilized for intracellular work which is more important at such times since it assists the fight against the causes of disease.

(3) If the pancreas is the mainspring of the general metabolism, then in cases of pancreatic affections or outside secretion of pancreatic juice, the metabolism is greatly unbalanced. This is precisely the case in *diabetes mellitus* and in the animals with pancreatic fistulae as well as in pregnant women with pernicious vomiting. In these cases, a pronounced disturbance of carbohydrate and other metabolism is very apparent.

In diabetes mellitus we often observe presence of gangrene, poor healing of wounds, weak resistence to infection and a generally lowered vitality of cells and tissues of the whole body. This is a consequence of the affection of the pancreas and poor supply of bodily cells by the pancreatic ferments, necessary for correct nutrition and normal life. If each cell prepared its own ferments, affections of the pancreas would have no injurious effect on the cells of the whole body. This connection between the weakened work of the pancreas and the mentioned diseased condition of the whole body, observed in diabetes serves as the best confirmation of the correctness of my theory on the supply of ferments to the entire tissues and cells of the organism by the pancreatic gland.

Thus the pancreas is the chief chemical agent for all general manifestations of life in the human and animal body, as the heart is the main motor agent for the circulation and the brain for the control of coordination in the functions of all organs and adaptation to life of individuals to the surrounding conditions and environment.

2. Metabolism in the Separate Cell.

There are almost no definitely proven data concerning general chemical process in the cell, *i.e.* the phenomena of destruction and reconstruction of the proteins, fats and carbohydrates. We must therefore rest satisfied with hypotheses. There is no doubt, however, that the chemical processes in the cell depend upon the work of the ferments similar to that which takes place in the digestive tract during digestion; in other words, assimilation and dissimilation of protein, carbohydrate and fat, both in the cell and in the digestive tract, are effected by the same agents.

Claude Bernard said: "Ferments treasure the mystery of life." Later, Emil Fischer repeated the same thought in other words: "Wir dürfen . . . mit ziemlich grosser Wahrscheinlichkeit annehmen, dass sie (Fermente oder Enzyme, W. N. B.) bei allen Verwandlungen in der lebenden Zelle betelligt sind."

Each cell must contain all the main digestive ferments, proteolytic, lipolytic and glucolytic. Thirty years ago Professor I. P. Pavlov proved that proteolytic, digestive ferments are capable not only of splitting proteins, but also of recreating them from the split-products. Even earlier, Croft Hill, in England, found the same to be true for carbohydrate ferment, and later Kastle and Loevenhart in America found it to be true also for the fat ferment, which was also mentioned by Claude Bernard. To sum up, all these ferments possess a twofold property: to split and to reconstruct.

In the life economy of some cells (muscle cells) carbohydrates play the main part; in others, such as brain cells, the fats; and in others (cells of red blood corpuscles) the proteins. They all, however, must at times split and reconstruct all of the three basic substances which make up any living cell and which also serve as the main food for the whole organism, *i.e.* carbohydrates, fats and proteins.

It follows that each cell must have in it all three kinds of ferments. What is the source of supply for them? Are they made in the cell itself or borrowed from elsewhere? Only the cells of the pancreas and small intestine (perhaps also leucocytes) are capable of making all the named ferments. Even the cells of the digestive glands, which specialize in the production of ferments, are restricted to their particular product. The gastric gland cells make only pepsin; the salivary gland cells only ptyalin (in man), but neither one can make lipase or any other ferment. The less probably, then, is the assumption that the specific cells which do not participate in the elaboration of ferments, such as the muscle cell, nerve cell, kidney cell,

connective tissue cell, etc., can create for themselves all three kinds of ferments or even one of them. They are supplied to them ready made. Where is the origin of this supply?

Essentially, as stated above, the process of splitting and reconstruction of protein, fat and carbohydrate in the digestive tract and the processes of their dissimilation and assimilation in each cell are perfectly alike. Hence in both cases the same ferments are at work.

Now the main source of supply of ferments for all the bodily cells becomes clear: the main "factory" would appear to be the pancreas.

All the main digestive ferments—proteolytic, lipolytic and amylolytic—enter the blood current in profusion both during absorption of digested food and in the absence of digestion during the before mentioned phases of periodical pancreatic secretion, and are carried in the blood stream throughout the body. Thus, every cell of every organ is supplied with them. When no more useful, the ferments are cast back into the blood stream or the lymph and are either carried outside in the urine and other excretions or absorbed by the leucocytes for their own needs.

This investigation would seem to designate the pancreas as the large "factory" where ferments are being prepared for the general metabolism in the whole body. But the pancreas is not the only source of these ferments. Intestinal glands (in the small intestine), prepare a juice very similar in its properties and in ferments and their action, to the pancreatic juice and second to it only in its strength. Thus, the intestine assists the pancreas. Therefore, it is clear that removal of large sections of small intestine in various operations is not without effect on the body.

In the limited space of an ordinary report one is perforce restricted to the general points of the problem, indicating its main stages, and it is impossible to take time for discussion of even important details. I trust the reader will pardon the incompleteness and the schematic nature of this paper.

I sincerely hope that the ideas here expressed will find response in some of my readers, at least among the younger generation of physiologists whose minds are more open to the reception of new suggestions than are those of the older generation who may be prejudiced by their interests and previous conceptions in favor of the already accepted and established theories in the field of science. Therefore again I make an appeal, as I did in 1911, to all who are interested in metabolism to apply their efforts to this so fruitful and as yet so little studied field.

CONCLUSIONS

1. Apparently the general metabolism (carbohydrate, fat and protein) in the whole body as well as in each separate cell, is effected with the aid of certain pancreatic ferments. These ferments are being secreted in the pancreatic juice and are absorbed into the blood (and hence into the cells) during digestion and in fasting (during the periodical activity).

2. The "external" pancreatic secretion with all its ferments is quickly absorbed from the intestine into the blood, and constitutes the true "internal" pancreatic secretion which controls not only the carbohydrates, but also other metabolism. There is no other "internal" pancreatic secretion in the old sense of the word, *i.e.* there is no direct absorption into the blood from the pancreas of a specific substance controlling the carbohydrate metabolism, independently from the external secretion.

3. There are no endogenous ferments prepared by the cells themselves for the needs of general intracellular digestion (splitting and reconstruction of carbohydrates, fats and proteins). Only specific substances and specific ferments can be prepared in the cells of special organs (adrenalin in suprarenal glands, thyroxin in the thyroid apparatus, and so forth).

4. The pancreatic and the intestinal ferments, entering the blood very soon leave it, being absorbed by the cells and tissues of the whole body (in the liver, lungs, muscles, etc). Experiments of Ludwig's laboratory have shown that the blood loses its ferments in about 4 hours. For this reason, all digestive periodical ferments, such as pancreatic and intestinal, usually are secreted every one or two hours, otherwise the blood would become "fermentless."

5. There is evidence to support the view that the pancreas is the main agent of all general chemical processes in the organism.

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Letter to Dr. Clark

Battle Creek Sanitarium.

March 22, 1901.

Dr. J. R. Boynton,

Clifton Springs Sanitarium.

Dear Brother:-

Some weeks since, before I had heard of the death of Dr. Foster, I prepared this letter for him. Rev. W. T. Wylie, D. D., of Sparta, Ill. who is here for a few weeks, tells me that you are now in charge of the Clifton Springs Sanitarium and I write you. Many times since I was in Clifton Springs in September and October, 1895, my heart has thanked Dr. Foster for the pleasure and benefit I there received. Among other things was a little interview in his home whither I went to seek counsel how to get the fullness of the power of the Holy Spirit, when he called in Mrs. Foster to join with us in praying for the blessing he sought for me.

In coming now to America, I had looked forward with a longing to be again in the atmosphere so helpful to me, in your Sanitarium. Providential circumstances brought me here for three or four weeks, as I supposed, but an injury to my knee has kept me here nearly four and one half months.

You must know of the work done in Battle Creek, but perhaps these notes and the material I send you will give some facts of the place which will be new to you.

(1) Dr. J. H. Kellogg is an intense, exhaustive, scientific worker, and his wife has helped him much in her sphere. Over 2000 chemical experiments have been made to economically secure the best kind of health foods. To me the getting of honey from wheat is one of the most wonderful results. The blood from a finger, the fluid from the stomach, after a special "test meal," and the urine of all patients

coming here, are chemically analyzed, and from the data obtained a prescription is given to each person of the needful baths, massage, electricity and foods.

(2) The work is undenominational and to a great extent, benevolent and missionary work. Full prices are taken of them who are able to pay, but to those engaged in Christian work and often to any who are poor, all the benefits are given at half or one-fourth the cost and sometimes gratuitously. The physicians receive but small salaries. The medical and other students and the nurses receive an economical support but work for this support, the former four hours and the latter ten hours per day, all being received with the understanding that they shall engage in missionary work in the United States or elsewhere as the "Association" shall direct. Persons of any other sect than their own will be received in the same way who are to go into missionary work under their own Boards. In all cases they accept workers to eventually secure their own support from their work in whatever field. The frequent Bible lessons place before all very definitely their duty as Christians to work for others. One physician commenced his Bible course with Phil. 2:5-8, like Christ -- no reputation -- form of a servant -- and like passages.

The nurses and medical students are carefully taught the vital truths of Evangelical religion and manifest the Christian spirit in their daily lives. Among the more than fifty nurses whom I have daily met, of whom seventeen have for a time given me treatments, I have never heard a loud, angry or cross word. Though having the varied character of young persons and by no means perfect, they all seem held to the right by Christian principle. All physicians, students and nurses seem to be on a fraternal equality without in the least preventing the

proper regard and obedience toward those directing them.

The lady nurses especially have shown an attractive character and generally have endeared themselves to their patients. Evident capability is joined with a gentle spirit and the heart in sympathy with Christ. I have often seen the hand of the nurse clasping the hand of the feeble one in the wheel chair and glances of the eye which showed a close communion of spirit.

(3) All this ability and loving Christian character lead not only to Christ, but also to Seventh Day Adventism. The evident and sometimes wonderful benefits received by the patients awaken a lively gratitude in them. In some cases husbands have spoken in the highest terms of the help their wives have received when seemingly they were near to the grave. One of these cases will probably lead to the starting of a Sanitarium near New York. One man, a Boer, who was much benefited here, in connection with his brother gave $40000 for a self-supporting missionary enterprise in Chicago, and they built another sanitarium in Cape Colony which has proved very successful. An Episcopalian lady who saw the work here, gave $30,000 dollars to found here an orphan's home under the same management as this sanitarium. The evident good accomplished gains the confidence and good will of all, and a favorable regard from those not caring for religion, while not a few are won to Christ. When a sick one has received so much benefit from such capable, loving, and loved Christian benefactors, many are naturally led to feel that the church of their benefactor is the most truly Christian church, and to wish to join it.

A feeble, warm-hearted woman told me that she was formerly a Congregationalist, but is now an Adventist. Evidently she had found here that loving Christian sympathy and the Christian life which she

had failed to find in her former surroundings. A bright little girl whom I have frequently met, was led by her nurse to wish to be baptized as an Adventist when she shall be able.

While no public or special effort of any kind is made by those in charge to lead to their church, yet a supply of tractsat hand open to anyone, both simply evangelical and also denominational, and the weekly vespers of the "Sabbath commencing at sundown on Friday" and the keeping Saturday as Sabbath, with other influences mentioned, strongly draw to the Seventh Day Adventist church. (See also pp. 47, 72 and elsewhere in Medical Missionary sent you).

(4) The Battle Creek Sanitarium and its branch are a grand success. Like "Chautauqua," it has abundant means. While generously giving all its privileges to any laboring for the good of men, its charges xxxx to those able to pay enable it to have a large amount available for the poor and for enlarging its branches, which are in full sympathy with the parent Sanitarium, and for starting new work.

The Medical Missionary which I send you reports $74,895.63 of earnings for 1897 & 1898, and on the same page, of $25,000 voted towards a Sanitarium in Australia. Page 77 also reports <u>twenty Sanitariums</u> and fifty-six other kindred institutions which had been established before 1899. In a "parlor talk" on the evening of Feb. 6th, Dr. Kellogg said that they now have <u>forty sanitariums</u>, and are considering the opening of three more. He probably included some smaller places for water treatment.

The work of extention has been and is going on rapidly. Dr. Kellogg has a laudable desire to have a Sanitarium in all the larger cities of the United States and to encircle the globe with the same. (See page 15, "Seen through the eyes of a visitor".) The mother Sani-

tarium has workers to supply all the needs of its branches, and to open new ones when the way opens. Nurses and others are constantly going out for a short time to supply temporary needs, or to take permanent positions as they are called for. An increase of workers is found in the annual graduation of 20 to 30 physicians from a four years' course, and of 50 to 70 nurses from the regular course of two years, to which another year is sometimes added.

Dr. Kellogg is not a bigot in religion, but is an intense enthusiast as to his "Wealth foods" and "Hydrotherapy." His heart reaches out to all who love Christ, and all who are seeking the good of mankind. He once gathered into his own home twenty-five children of different nationalities and I was told, used the opportunity to make experiments with them in the use of different foods and all the children showed a good development in personal appearance and health. There are now as medical students and nurses, connected with the Sanitarium institutions, Negroes of various shades, Armenians from Turkey, high class Hindoos from India, and other nationalities. Dr. Kellogg is an intensely active man. In the four months of my stay, he has been in the California Sanitarium and others on his way, performing surgical operations and lecturing in various places. Then he went to Massachusetts Sanitarium, whither he was soon called again for a critical operation. On his return, he had urgent calls to three places for similar work for the same day. We then spent about a month in Des Moines, Denver, etc. I was told that he performed surgical operations in Denver, lectured twice, had La Grippe, rode in the cars home until 3 A.M. and that day and the next dictated 150 letters and performed 14 surgical operations. When at home he lectures or has a "Question box" once or twice a week. All the branches Sanitariums look to him as to a father

and he has a strong guiding influence in the carrying on of all in which there is now an annual expenditure of a million dollars.

Dr. Kellogg has no salary but, as I understand, has an abundant support, and freely gives to various objects from his receipts from the numerous books he has published.

I have marked places in the books which I send you by the same mail with this letter, with a line by the side of items to which I would call your attention and by a double line and a leaf turned down at the top to those of most importance. I hope you will give an hour or two in looking over these places and you may wish to read much more. I send you some circulars of the work carried on here.

(5) My object in sending you this letter and books is a hope that your Sanitarium may, as far as possible, do a similar work. It has hitherto been a great blessing to many and I earnestly desire that it may do far more by an enlargement of your plans. I hope that the cost of putting up the last half of the main building has been fully met and that you are now in a position to push forward. If not possible for you now to do more, cannot you soon commence to educate nurses who will work under the oversight of those who believe that the first day of the week should be kept as the Christian Sabbath? I know but little of what is being done in the line of medical work by other agencies, but a Chicago paper recently stated that it as a fact that the medical missionaries from Battle Creek are about one-half of all in the world who are so engaged.

Be that as it may, the success in this line of efforts in so many places, both in connection with Battle Creek and other agencies, is a loud call to all evangelical Christians to more widely use such means for benefiting the many who are so needy.

The great world is needy and all that can be done for it for years to come will accomplish but little of what is desirable. Should you wish to use any books for nurses or make trial of any of the foods of Battle Creek, I presume that Dr. Kellogg would make you a starting donation, or should you wish to purchase it, it would be easy to secure samples or supplies. I have used simply the Health Foods of the Sanitarium and had but two meals a day, but with these I have been satisfied.

Dr. Kellogg has promised to send some of the books to our Bulgarian libraries and four packages of samples of foods to as many places in Bulgaria and Macedonia.

I know you will pardon me if I seem intrusive. My heart often turns to your Sanitarium. While I am saddened that these here who are doing so much good are keepers of the Seventh instead of the First day of the week as their Sabbath, it is better to emulate them in that which is good rather than merely to shun them for what we think is error.

With earnest prayer for the blessing of God on yourself, your family and your work, I remain,

Yours fraternally,

James F. Clarke,
of
Samokov, Bulgaria.

To the ladies-

"If I knew where, amid myrtle bowers and flowers that never wither gushed from the ground the fountain of perpetual youth so long vainly sought by the first Spanish adventurers on the North American continent, I would offer to the lips of every one of them a beaker of its fresh and sparkling waters, and bid them drink unfading bloom. But since that is not to be, I wish what, perhaps, is as well, and what some would think better, that the same kindness of heart, which has prompted them to come hither tonight, may lend a beauty to every action of their future lives."

William Cullen Bryant at a celebration held in his honor by the Century Association, New York City, Nov. 5, 1864.

BANQUET

Tendered the Delegates to the Second Annual Convention of the

Trades and Workers Association

by the Manufacturers and Employers of Battle Creek at the Trades and Workers Home, Wednesday Evening, September twentieth, 1911, at seven-thirty o'clock.

Toastmaster: Joseph W. Bryce.

Toastmaster: It is my duty and pleasure tonight, ladies and gentlemen, to be the engineer of this train and to see that it runs on time and makes the proper stops, takes on the proper passengers and starts for the next place. I do not know of anything that has happened in my life time that has given me greater pleasure than to gather here tonight as we are gathered for the purpose of voicing and emphasizing the message of industrial peace that the Trades and Workers Association is trying to carry to this world. I think that from the inception of our convention at this particular year, we have been moving onward up to the peak which we have now attained tonight. We have a message for the world, and the man or the organization that has a message for the world can sometime, if they are persistent enough, obtain the ear of the world.

Now when we started this movement in the City of Battle Creek about a year and a half ago with a handful of sixteen people, a great many people in our own home town and in other places said it would not last a year and that we would soon find out that that method of doing business would not meet with the approval of the people of this country. Still we have the faith to go on. The knowledge that it was the right thing to do whether we succeeded or not carried us on and has brought us thus far. Many of you will remember the many remarks that have been made as to what would be done with this magnificent bulding. Many of you will know that it was said that our good friend, Mr. C. W. Post, was getting rid of a white elephant

and putting it upon the backs of the Trades and Workers Association. In fact even those who knew and were friends of Mr. Post and friends of the organization said to me, "Bryce, now you have got this building, what are you going to do with it?" And my reply at that time, and the only reply possible was that the same great Power that placed it in the heart of our good friend, Mr. Post, to give this building would find a way whereby we might utilize it. And to show yu that that faith carried the thing through, I think within two weeks from that time negotiations were entered into by the Sanitarium people ~~xx~~ and the lease finally negotiated whereby this was an income producing property instead of a white elephant or burden.

Now that is the condition with all of the things, the problems we have to confront us. They seem to be great shadows, they seem to be great burdens, they seem to be great obstacles. But if we go at it with that courage and conviction that is born of a righteous purpose, with a knowledge that the great, all-intelligent Power of this world will always uphold and give strength to the right, then we can accomplish the ~~xxxxxxxx~~ marvels that some people say can not be accomplished. And so tonight I feel more especially proud of the little we have attained so far, because I know it is only the starting point to the larger goal, to the larger accomplishment, and I want to thank all of the people who have helped to make this moement possible; I want to thank the men and the women in the employing ranks of ~~thex~~ people and in the employers' ranks, and I want to thank the ~~xxx~~organizers, and in fact I want to thank all the good people, even those who said "you can't do it", because sometimes a little opposition is necessary to make us strive to attain it. The things that are worth accomplishing after all, in this world, are the things that it takes work and strengthx ~~xxx~~ and purpose to do; and if a thing is very easy of accomplishment, you can make up your mind that we set it aside as not being worthy of our effort.

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Now, as to what we may accomplish, as to what opposition we may overcome, as to what things we may do in the future, neither a prophet nor a son of a prophet can tell, but we do know that if we hold honestly and earnestly to the foundation principles as we have laid them down in our organization that we can not fail to attain and to result in some good.

Now, I do not intend to speak very long here this evening for the simple reason that there are so many others here who are better able and more fitted to address you and perhaps can give you some better thoughts than I can with which to help you along in this work. One of the many things that came to me early in this work was the meeting of different people, different employers of labor in an effort to convince them that this movement was the right thing to do. Now, I am not what might be termed a convincing talker. I do not take anything of credit to myself for doing anything that has been done only as I have expressed the truth which found lodgment in the minds and hearts of other people and made them enlist in the aid of this association.

We have had many discouragements. We do not want to tell you for a moment here that all has been roses nor that all has been sweet, but we have had our bitters and we have had our bumps; but through all that, one of the things that has recompensed at least myself for those reverses is the fact that I have met with arious people and found them large hearted, broad minded, and ready to do what they could to bring about industrial peace in this great country of ours, because surely we have been having strife enough; surely war has been destroying our country long enough; surely it is time when men and women of this great country used their intelligence instead of their prejudice, and to find out whether something good can not be accomplished; because, I say, after all this world would not be worth a cent, would not be worth a fraction of a cent if it was not for the people

that dwell upon it, and the only good that we can do in this world is to make it better for those people to dwell upon it. And so, coming to the point when I can speak of one particular recompense to me for all of the rebuffs that I may have had, was the finding of the loyal and hardy friends who were willing to stand up and be counted in the battle for industrial peace. And one of those men is now upon the program to speak to you upon industrial peace from the workers' standpoint, Mr. Oliver M. Rugg, of Pontiac. (Applause).

Mr. Rugg. Mr. Toastmaster, ladies and gentlemen: Brother Bryce said that he was an engineer; he is an awfully poor one. In the first place, he did not obey his running orders. The running orders started this train out at 7:30. Another thing; at least one member of his crew is a poor member. I am not an orator; I am not a talker. I can only give you some thoughts that I have been jotting down at odd moments in the last few days. I received a letter from Broker Bryce notifying me of this honor. I take this as an honor to our branch in Pontiac; I take it as a personal honor that a man of Brother Bryce's position should see fit to choose me as a mouthpiece of the working man. It is an honor that I appreciate from the depths of my heart. When I received this letter, I was almost as much surprised as the good deacon was in "David Harum." You know the good deacon was a farmer, and a varmint got into his poultry, and he told his wife one drizzly morning that he would go to town and he would get some powder, and he would fix that pesky varmint. So he hitched up to his democrat wagon and he went down and got some groceries, and he put the powder in a paper at the back of the wagon, and started home. The rain got to the powder and dampened it. Well, he wanted to use the gun right away, so he took the powder and laid it back of the stove. It was not drying fast enough, so he heated a poker to stir it with. You know the result. And they picked the deacon

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out of the wreckage of stoves and pots and pans and kettles; they plastered up his wounds and finally restored him to consciousness, and he murmured, "It did go off kind o' sudden."

Organizations have existed from the beginning of time. When the Creator made this universe, he created an organization; when he created this world with its plants and flowers, and its animals, its insects, he created an orgnization. To perfect this organization he created man. When a man and a woman with a mutual liking for each other are united in the holy bond of matrimony, they create an organiation for the establishment of a home, for the rearing of children, for the glorifying of God and the upbuilding of our nation. People organize for various reasons--social, political, fraternal. Business men organize for arious reasons--for the reduction of the cost of production and for increased profits. Sometimes they have organized to destroy competition; sometimes they organize that they may increase the remuneration of the laborer; sometimes they organize for other reasons.

One thing the laboring man should do is to make friends with his employer. Likewise the employer should make friends with the laboring man. I do not mean to mingle at your homes in a social way. I mean if your man comes to yu with a financial question--he may be paying for a little home; he may be in trouble over a payment; there may be some error in his deed,--a word from his employer who is a thoroughgoing business man would set his mind at ease. Sometimes a large plant will send its salesmen out, and they cut
~~cut~~ prices on their products. Then it is up to the manufacturing department to make good, to make up this deficit. It may be made up by increased production, it may be made up in some other way. We have had many attempts to solve this question. The question has been tried to be solved for some 2000 years. A brother used an apt illustration today. I had never thought of it before. He said a young man some 2000 years ago in the hills of Judea

came into this world and preached this doctrine of universal peace. How well it has succeeded you know and I know. Mankind have warred upon each other, the strong upon the weak; and I suppose it will be so till the end of time.

There are a few people in this world who are honestly striving to bring about universal, industrial peace. I could not tell you simply of all these things, of these men who have formed unions at arious times and have thought that they would solve the question. Apparently they havd been driven into this, but note the result: The Homestead strike. I was quite a young fellow then, but I remember it. There are some here tonight with more snow on the mountaintop than your speaker possesses who remember it far better than I. We had the railroad strikes of '77. Coming down to more recent times in the memory of those youngest ones here, we have such means of settling labor difficulties as the blowing up of public buildings in various parts of the country, of courthouses, of bridges, and of semi-public buildings, in the end like unto the Los Angeles Times. Whenever you get such a body of men together, you find some irresponsible ones. Some men delight to burn, to destry, and to maim--think they are doing humanity a service. Is there any one here tonight who would advocate such methods? I think not. You and I mu st settle these questions peaceably.

We can not have labor without capital any more than we can have capital without labor. At all times the laborer is entitled to a just remuneration, and the employer is entitled to a fullday's product from his men; and the man who never does more than he is paid for, never receives anything more than he is worth. The man who is a time server and a clock watcher is not the man for the employer. I used to carry a watch in the factory. I had formed the habit before I started in the factory life, and I always carried it. Honestly, I wore the case off of my watch pulling it out of my pocket and putting it back, to tell the men the time; and I said to my wife, "I am

going to leave my watch at home." And I never see what the time is, scarcely, unless I am watching to get the time on some particular piece.

There must be co-operation between the two forces in the industrial world. Labor must organize for self-protection, but must organize on such a basis that every man is free to deal with his employer as a man; and in that way only can the thoroughly competent, efficient workman gain that just recompense for his services; and the non-efficient, roving, so-called mechanic will lose his standing and his wage and will be compelled to receive that which he really earns. So the solution of this problem has been attempted in many ways. Socialism which is unjust to every one in that it is dishonest; profit-sharing as carried on by such firms as Proctor and Gamble, Ivorydale, Ohio, makers of Ivory soap, "99.44% pure." Every one in that plant who is receiving a dollar a day or more is entitled to purchase as many shares in that plant as he can carry of common stock, paying about 12% dividend, where preferred stock pays only 6%; however, the employee may not sell this without the consent of the employer, without giving the firm itself the chance to buy it back. Twice a year they have what they call profit-sharing day. In the summer time they take a trip to some nearby town. The checks are distributed. I say a nearby town,--they go 150 miles. Checks are distributed, and they have good times--games, talks, etc. In winter, one of their large warehouses is cleared out and there they receive their dividend; they are addressed by notable men from different walks of life, and in different professions.

You must remember that we are human the same as you, the same as a lawyer, doctor, or a preacher, with the same physique, the same flesh and blood, the same bone and sinew, the same loves and hates, the same likes and dislikes, and the same passions. Employer and employee must come together on a basis of mutual respect one for the other. In other words, the so-

lution of this problem has been attempted by unions, and the result has been like the previous articles--the Homestead strike, the railroad strike, the Los Angeles Times. But we have a more peaceful method as illustrated in the Trades and Workers Association, where capital and labor, foremen and men can come together on a business basis. Shall we accept the new or stick to the old? The answer comes rolling back in ever increasing volume, "We want the new way, the way as laid down for us by the honorable J. W. Bryce and his associates. Let us do away with strikes and lockouts, blacklists and picketings, and meet each other on the broad patform of humanity and give a square deal to all. (Applause.)

Toastmaster. Somewhat early in the work that we are intending to do, a meeting was arranged for our good friend, Mr. Post, and myself to meet with a few gentlemen in the City of Detroit to try to interest them in the Trades and Workers Association. How well we succeeded I do not know yet. But I do believe that we succeeded in convincing at least some of that number of gentlemen that we were on the right track. I know that I felt amply repaid for my visit to Detroit, and if I had done nothing else but gain the friendship of the gentleman who is about to address you, I have done a good deal. And I accept that as remuneration for many of the rebuffs I have met. I now desire to introduce to you, Mr. Henry M. Leland, of the Cadillac Motor Company, Detroit, Mich., who will now address you on

INDUSTRIAL PEACE FROM THE EMPLOYER'S STANDPOINT. (Applause.)

Mr. Leland. Mr. Toastmaster, ladies and gentlemen: I feel highly honored and much gratified to stand in this presence tonight and to realize that a real, substantial, tangible, and sensible movement has been inaugurated for the establishment of peace between the employee and the employer. The problem to a conscientious man, the strife, the bitterness, the antago-

nism, the deterioration and inefficiency which grow out of the methods of militant unionism,--has been a source of great trial and at times many conscientious employers have been almost tempted to give up in despair. It was when weighted down with feelings of this character that I chanced to meet, at the time Mr. Bryce has spoken of, in Detroit, with Mr. Post, and himself, and some other gentlemen, and they unfolded to us this plan for the Trades and Workers Association. I felt then that the plan was so utopian, that so much was expected, and Mr. Bryce and Mr. Post had such confidence that they were going to succeed and eventually build up a great, strong, powerful organization which should stand for peace between the workman and the employer that it seemed to open up a new dawn before me, and I have been doing a great deal of thinking since and a great deal of hoping. And I would say this, that at whatever sacrifice, I shall do all in my power to hold up the hands of Mr. Bryce. In meeting with him, as I have had the pleasure and the honor of dóng on several occasions, I have been impressed with his sincerity, with his good judgment, with his logic, but most of all with that sweet and beautiful spirit which will be the reason if this organization ever does become a potent and powerful factor--it will be because of the spirit which Mr. Bryce has imbibed and which he is undertaking to communicate to all those who are co-workers with him. But having had more or less experience in dealing with these matters, I fully appreciate the great and at times seemingly insurmountable difficulties, and I realize at the start that there is going to be much opposition, that there are going to be many things to overcome, and that they will never be overcome except it is at the end of a long and an earnest and a serious and campaign of education which will call for the very best that there is in the orgaization that Mr. Bryce is now the head of. As I have told him before, and I wish to say it now simply and solely because I hope, if you haven't thought of

it before, that every one here may appreciate these difficulties and lend a helping hand.

What this organization needs and what it must have if it will succeed is a large number of co-workers with Mr. Bryce who will imbibe the same spirit, who will undertake to educate the people along the same lines and to proclaim to the world, especially to the world of labor, this gospel of peace. Do you know, friends, that the laboring men and women of this country read a literature that is placed upon their tables every week, coming from thousands of printing presses, that nearly every trades organisation and many of the local ones have trades papers running into the thousands? Do you know that these papers and magazines are filled from one page to the other with the gospel of hate, with the gospel of hate in the beginning and at the end, and filled in all the way through from one cover to the other that it is a case of arraigning class against class, and antagonism, and stirring up strife and turmoil and hatred? That is what our working people are reading, and the remedy and the only remedy that I have any hopes of is counteracting that with a campaign of education, with the circulating of literature that will do away with these erroneous ideas, do away with these false expectations, that will tear away the mask and let them see that much of this literature that is doled out to them as gospel truth is only inspired by malice and by hatred in the hands of men who are in their positions for some selfish and ulterior motive rather than for the betterment, the uplifting and the good of laboring men.

It was with such thoughts as these in mind that I said this afternoon when Mr. Bryce introduced me for a moment to the convention that I regretted very much that he was so unfortunate as not to have three twin brothers, all of them having his spirit and just like him. Because we need, and if this organization is going to be successful we must have trained men and

women who will imbibe this spirit of peace, this spirit of brotherly love, this spirit of kindness to one another, this spirit of confidence in one another, not only among men, but among employers and employees. That is the only way that I know of in which we may hope to build up an organizatán which will make itself felt. We must realize that you will be opposed by an organization, by a series of organizations of long standing, of large numbers, of great strength,--men who are trained in all the arts of their craft, men who have mighty power in the politics of our country, in the legislative halls of our city and our state and our nation, men who are given great resources in the way of money, who retain the ablest counsel there is in the country and who are today laying down in Los Angeles millions of dollars to defend certain men regardless of whether they are innocent or guilty. That is a question that seems to have no interest for them whatever. Every honest man and every good citizen wants those men to have a fair and an honest trial. If they are innocent, they hope they will be vindicated in that trial. If they are guilty, then they deserve all that the laws of this country have in store for them.

I can only tell you one little story to let you realize what this problem means. It is a story the scene of which was laid in St. Louis. There was a company there manufacturing stoves. The head of that company had been made the head of a larg national organization of great importance, an organization which the citizens of America owe a debt of gratitude to for the grand and the important things that have been accomplished through its efforts. This man had committed only one crime--he had been made the head of that orgnization, and for this reason there must be a case made against him. There was no grievance in his shop; there was no reason why there should be any strike in his shop. He employed in certain departments union labor and paid union wages and the union scale; there was no grievance whatever. But they loved a shining mark, and this man had allowed his name to

stand at the head of this great organization, consequently there must be a strike in that factory. That strike resulted in a boycott. The boycott in the beginning was unsuccessful. It was carried into what is known as the secondary boycott, and the people who bought goods from that factory were told they must discontinue selling those goods or be ruined. Later on I saw myself a package of contracts so high that had been returned by people who had dealt with him for years. This particular one I will speak of. They had dealt with him for 36 years, and the man who wrote it, a man now well along in years, in sending that contract back unsigned said, "It is the saddest business transaction that ever came into my business career--to return to you this contract. We have dealt with you for 36 years; your goods have been entirely satisfactory, we have made money out of your goods, our dealings and relations have all been entirely pleasant; but I must return this contract unsigned because for three years we have tried to carry it out, and for three years we have been picketed; for three years we have found our windows and our doors in the morning when we come to them, with great placards placed upon them that you must not patronize this place because it is unfair. We tore them away, and the next morning there they were again; pickets walking up and down the streets telling every one not to come into our store because it is unfair. We have stood it, and I would stand it if it was the last act of my life--I would never return this contract; but I am associated with other people who do not see things as I do. We have with us in the company widows and people who are ot business men, who have stock in this company; and for their sakes, and because our business is being ruined"--thousands of miles away from St. Louis--"I must return these contracts unsigned." And so that man, as noble a hero as ever stood on a battleship, went down, after fighting manfully year after year; and his health gave way, and he finally went to his long reward, persecuted to his death. Why? Because he had done something wrong to labor?

Never. Because he had violated some principles of ~~xx~~ right and wrong ~~in~~ between man and man, between employer and employee? No. Why? Simply because they wanted a victim and selected him because of the position that he occupied. And so James Van Cleave went down to his grave. Ladies and gentlemen, that is what it means to grapple with the Federation of Labor.

But this organization, thank God, stands upon a different basis. This organization proposes to stand upon the gospel of peace, a gospel second ody to that which has been alluded to by my brother across the table, which was instituted by the great Galilean twenty centuries ago,--a gospel, I say, second only to that, and of equal importance so far as the industrial system of this country is concerned. Ladies and gentlemen, this, perhaps, or something of a similar natus, will prevail and will secure the ends which are sought to be attained or the industrial system of this country will be a thing of the past.

It was my fortune a little over a year ago to spend several months in England. I went pretty well across the country under ~~the~~ favorable conditions because I went as a member of the American Society of Mechanical Engineers, was entertained by the institute of engineers there, consequently we saw pretty thoroughly into their industrial system. We had many important questions propounded to us by these gentlemen, and among others they wanted to know how it was that the Americans and the Germans were getting all the great contracts from South Africa and from Asia and from Egypt in building the great bridges, in building railroads, in furnishing railroad equipment and things of that kind,--a strange thing. They were right there in the midst of it, they were a part of it, and yet they could not see it. Organized labor has controlled England since the engineers' strike several years ago, and they have been organized by labor out of business, and they don't know it.

Now what they have done to England they propose to do to this country, and up to date they are having their own way largely. This gospel of hate is a canker, it is a destroyer; it spells ruin anywhere. If it comes into your family, if it comes into your church, if it comes into your city, if it comes into any organization in the world that is prospering it permeates it and destroys it; if it comes into our factories it fills our men with hatred and indifference, with distrust; it destroys our success. The loafing, the determining not to do a day's work, the gospel of militant unionism is minimum work, a minimum day's work for a maximum wage; and they have carried that so far that many of their men who go further than they expect them to are seeking to do no work whatever. A few days ago, on Monday morning, in passing by the door of a large establishemnt, there were 120 men applying for work. I said to the head of the labor bureau who was interviewing these men, "Why, there is an enormous lot of men out there wanting work this morning, isn't there?" He says, "No, they don't work, no." "What do they want?" "They want to get on the pay roll", and he was right. That is what they wanted. They didn't want work. They were saloon loafers; they just wanted to get on the payroll and get some money to patronize the saloon with next week; that was what they wanted, and that is the tendency and the result of militant trades unionism.

Your message is the gospel of peace, and in order to carry this good news of the gospel--for that is the meaning of the word "gospel"; it is simply good news or glad tidings; that is what the Galilean came into the world to bring to us; that is what the angels all meant when they sang that song that night,--good news, glad tidings, peace on earth and good will to men. Now this gospel of peace in the industrial world should have and it must have its messengers to carry these glad tidings to the ends of

the earth, and they should be carried by literature and by the human voice. The men, it seems to me, Mr. President, whom you must depend upon most largely and who have the greatest task to perform, are these orgnizers who are to go out and meet the objections and convince the people that they ought to listen to this gospel of peace, and these men must be well equipped, they must understand this gospel and this message, they must understand its importance, they must realize that without this your organization will never be a potent force. The great problem that will confront you will be the elimination from the hearts of the working men of this country of this great influence, this hate and this class antagonism that has been promulgated for years by these men. Consequently you mustsend out men of judgment and experience, and of great ability if you are going to succeed. There are, Mr. Bryce told me, over 100 people here tonight. If every one of you will do what you can to hold up the hands of this organization, to strengthen it, to give confidence to it, it will be a great thing, and will go a long ways toward making it successful. One man, two or three men, a dozen men as organizers and as officers in an association of this kind can do but little in a country of ninety million people; but a hundred men that know, a hundred men that are in earnest, a hundred men that are determined, a hundred men that say "I <u>will</u>", and mean it, can do almost anything. I know of hardly anything that they may not accomplish.

I had several things in mind that I was going to say, hoping that something that I might say might help some of these organizers when they are right up against the real thing--the organizer on the other side. But there is not time; time goes so fast I will only say two or three things.

One of the things that the organizer tells you--that militant unionism has said, and his stock argument all the while everywhere is, why should the laboring man divide any of the profits of labor with the capitalist or

the employer when the result of wealth and all property and all value is created by labor and only by labor,--why should it divide some of it with capital? Now you meet that everywhere. Every oe of their magazines is full of it; you will hear it in all their speeches; you read it everywhere, and the working men believe it. Eight out of ten of the working men of this country believe that is literally true, yet it is not true at all. There is hardly any truth in it. There are building lots in Detroit, there are houe lots in Detroit in the center portion of the city that are worth thousands of dollars eor a front foot. There never was an hour's labor put upon them, and it is not because of the labor, but becaue of the location and the surroundings. There are lots in the suburbs that are worth ten dollars a front foot, and they have had a hundred times more labor put upon them than thi s higher priced one. Labor had nothing to do with it. The hills of our country, the rugged hills of our country are in some cases worth fortunes in a single small acre, fortunes. Why? Becaue of the oil, or the iron, or the marble, or the great stores of wealth that are known to lie there which no man's hand had anything to do with; and labor has nothing whatever to do with it.

Some of you will remember that diminutive little figure that Barnum first introduced to us, called General Tom Thumb. He was a great acquisition and acquired a great fortune because he was so awfully small. It was purely a case of his diminutiveness that made him a great source of wealth. No man's labor had anything whatever to do with it. Here are two young men working side by side in the office or in the factory. They were educated in he same school, they have about the same ability, they are of about the same age, they are about the same in every way. There comes an opportunity for a man to be advanced to take a more responsible position, and oe of these young men is selected for that position, and his salary is increased right away and he makes good from day to day, and ~~xxxxxxxx~~ his

salary is increased again and again, keeps going up and up, and if he is honest and if he is sincere, and if he is in earnest, there is nothing in the universe to stop him from going up and he keeps on going, and what is true of this young man is true of every other young man that is honest and has good health and good judgment and gets hold of the right end of the rope and wants to go up; ~~xxxxxxx~~and by and by this young man has gone up, gets a large salary, becomes a wealthy man. What is the difference between him and the other man that didn't go up? They were practically ~~xx~~ alike. The one young man had proved to his employers and to the man who sent this one on the journey upward that he was trustworthy, that he was always trustworthy, and that is the only man that all employers of large amounts of labor are looking for--the man who is absolutely trustworthy; and that made a fortune for this young man, and it failed to make a fortune for the other oung man, because he was ot trustworthy. What amounts of labor made this young man trustworthy! One manIs labor. If labor is the reason why things have value, they would all have vale in proportion to the labor in them, and that value would be permanent regardless of other conditions; and yet you go into any of our art galleries and you will find a picture there by some great artist that has been growing in value every day, every year for the years of the past, and now there is a fabulous value placed upon it, and the hand that painted it has been in the grave for a long time. What has labor to do with that? If a man were to go into the center of Africa and establish a watch factory, go to making high priced watches, or reclaiming land, and go to raising wheat and corn, there being nobody there to buy the watches ar the wheat and the corn, it would not sell for a very high price, would it? What has labor to do with that? I am giving you these few illustrations, and I might continue them till tomorrow morning, to show you that this old idea which was for-

mulated by Ricardo and Adam Smith, and the conclusions thereafter given to the world, and have been sifting through for a century until it has got into the heartsoof the working men like Karl Marx, is all founded on a fact that is not true; there isn't any truth in it. It is all wrong. Well, it is the result of producing something that somebody else wants, and the value of the thing is determined by how badly the other fellow wants it. If you have got something that the other fellow wants, you can sell it for a good price, and the amount of labor in it is of very little consequence. If you have got something that the other fellow don't want, you can not get much for it.

I have talked too long. There are a great many things I have left unsaid; in fact, I don't thinkI have said anything that I intended to when I got up; but I have only said the things that came to me. I certainly hope, and it is of the utmost importance to the industrial world, that this Trades and Workers Association organizes itself rightly, and the President tells me that in Battle Creek he already has a membership of 700. I hope the next time I come out here it will be 7000, and I hope that he will get the same kind of an orgaization in every city in the Union; and I say to you frankly, ladies and gentlemen, and I say to you having had some experience and knowing something about this problem, that if it is not solved by this association or some kindred association, ~~itxwixixhm~~ which will be working along the same lines, then I say to you that the days of the industrial system of the United States of America are doomed. I am not a pessimist either. I found a little item here by my dear old friend, Washington Gladden, a man who is an original thinker and a great soul, who is just about laying down his armor, giving up hisxx work of the ministry, and he has recently writen these little verses which I want to read to you, because I heartily believe in them, because they touch the vitals and the foundation of things, and because they are the principles upon which you

can build this organization for permanency and for success.

Ultima Veritas.

In the bitter waves of woe,
  Beaten and tossed about
By the snow and winds that blow
  From the desolate shores of doubt;

When the anchors of faith had cast
  Away, dragging in the gale,
I am quietly holding fast
  To the things that cannot fail.

I know that right is right,
  That it is not good to lie;
That love is better than spite
  And a neighbor than a spy.

I know that passion needs
  The peace of a sober mind;
I know that generous thoughts
  Some sure reward will find;

That the rulers must obey,
  That the givers shall increase;
That duty lights the way
  For the beautiful feet of peace.

In the darkest night of the year,
  When the stars have all gone out,
That courage is better than fear,
  That faith is truer than doubt.

And fierce though the fiends may fight,
  And long though the angel fly,
I know that truth and right
  Have the universe on their side;

And that somewhere beyond the stars
  In a life that is better than faith,
When the night unlocks their bars,
  I shall see Him. And I will wait.

(Loud applause).

The Toastmaster. The next number on the program is one that ought to be of interest to every man and woman in this room. Somebody said today or yesterday that if we are to win this battle for industrial peace, we must have the ladies with us. In fact, it would not be industrial peace unless we did have the ladies with us. They would make war the other way. And so we have placed upon the program a lady to answer to the sentiment

INDUSTRIAL PEACE FROM A WOMAN'S STANDPOINT.

And I bespeak for her your kindly attention. I am sure that you will have something worth listening to. Mrs. Jessie E. Smith, of Hillsdale, will now speak on that subject. (Applause).

(Mrs. Smith read her paper.)

(Loud applause).

The Toastmaster. The next number on the program is one that we are all very much interested in. In fact, there are so many definitions of the square deal is, in accordance with persons' desires, that we want to know what and want to hear an unbiased opinion as to a square deal, and what it means. The gentleman whom I am about to introduce on this subject, I am proud to say, has been able to bring to us today, to our convention, the endorsement of the Manufacturers and Jobbers Club of Lansing. And he informed us at our convention today that all of the larger jobbers and manufacturers except two were there, and the only reason they were not there was because they were not at the meeting; so we are pleased to note that our sister city of Lansing has taken the requisite step to aid in ~~ka~~ upbuilding the industrial peace movement. I feel highly honored to introduce to this audience tonight Mr. W. K. Brudden, of Lansing, Mich., who will address you on

"A SQUARE DEAL" AND WHAT IT MEANS.

Mr. Prudden. Mr. Toastmaster, ladies and gentlemen: I am reminded tonight of a story of the Kentucky colonel who was very much addicted to drink, and who didn't like the criticisms that were made with reference to his drinking, and getting on a load a little more than he could carry, so he said to his darkey servant one day, "Joe, did you ever see me when I had more than I could carry?" Joe scratched his head a moment and said, "Cunnel, Ah don' no as Ah c'n say that Ah evah seed you when you had more'n

you could carry, but Ah has seed you when Ah thought it would have been better to make two trips." (Applause). Now I had thought of making quite a long speech here tonight, but I know you will be better satisfied when I tell you I am going to make two trips of it.

It is a great gift to be able to make a creditable after dinner speech. I was reading not long ago the speech of a noted orator and expressed great admiration for the language and beautiful thoughts and the convincing arguments. "Ah," said my friend, "but you should have seen and heard him. Every eye was captivated with him the ease and grace of his manner; every ear charmed with the swelling music of his voice; every mind thrilled with the vivid epigrams into which he condensed his opinions." My friends, it is not orations you are looking for here tonight, but a simple talk on what is a square deal and what it means. There is a story told of Henry Ward Beecher in which his usher went to him at one evening's service and said, "Mr. Beecher, if I find anybody in the congregation that is going to sleep, shall I wake them up?" "No," he says, "wake me up." He was the man that needed waking up.

The subject of capital and labor and the relation between employee and employer are subjects of great interest to me. When I first engaged in the manufacturing business some 25 years ago, I followed the usual beaten path of the employer which was at that time to get as much out of the employee as possible and give no more in return than was absolutely necessary. Now as a scientific, theoretical proposition that may be true, but as an actual basis of success it is not ~~xxx~~ correct. Now, to show you why I changed my policy and belief, I shall have to relate something of a personal incident.

Some eight years ago the superintendent of our factory, who is a man of great ability and the peer of any man I know in his loyalty to his em-

ployers and in his loyalty to the men under him,--some eight years ago he was taken ill, and was obliged to submit to an operation for appendicitis. Nothing was too good for such a man, and I sent for the best surgeon to be obtained. I assisted at the operation, remained with the patient all night, and went to the factory next morning bright and early. I arrived there just as work was commencing for the day. The boys crowded about me and asked how Charley was. Grouped about me in that dingy room with scarcely sufficient light to distinguish faces stood a body of earnest, anxious men. I told them my simple story of how I had sent for the best surgeon to be obtained, that I had remained with the patient all night, that it was my face the last he saw when he went under the influence of the anesthetic, and I was the first one he saw when he came from under it in the morning. I told them that the operation had been successful, and that all that he needed was rest and quiet, and to be free from worry. I also told them that his last words before I left him were these: "Mr. Prudden, I am all right, but I am afraid while I am away some one will take advantage of my absence and shirk his work." There was silence in that group for a moment, and then one big souled, big hearted man stepped forward and said, "Go back to Charley and tell him that every man is at his post and will do his duty." "Aye, aye", came thundering back the response from those men. No king or monarch ever received a greater evidence of loyalty or experienced a keener thrill of pleasure than did I at that moment. Standing on common ground, face to face with hearts filled with sympathy and gratitude for our stricken comrade, a union was there made of capital and labor, between employer and employee, a union which time has not and will not change. (Applause). I had occasion many times during the sickness of that man to go through that shop in looking after his duties, and be it said to the credit of those men that not once did I find a man shirking his work.

The sequel to my story is this: Some eight years after the event which

which I have narrated, there was a plan on foot to help pay for the Y. M. C. A. building. I said, "Why don't you go to the factories? They are interested." They said, "Will you start at your place?" I said, "You may go there, and what is more we will give the time, and I am sure they will listen if they are on our time." They came there, speakers were introduced and they were asked to subscribe to them. I don't want to make a long story of this, but as I sat there and listened to those talks, I said to myself, "What a splendid opportunity this is to thank those men for their loyalty to our company." I did so. I said, "Boys, we have the reputation of making oe of the best automobile wheels made. Now where is that wheel made? We don't make it in the office. We furnish the money to buy the material, we furnish the money to pay your wages, we get the orders and ship the goods. That best wheel is made right here in this shop. There is John Ray. If he does not get out those spokes mitered just right they will not make that best wheel. Sam Jones there, he planes the fellies", and understand, I called them by their name, and at that time, we didn't have 450 men, only 160, and I knew most of them. "If he does not get those fellies out well, they will not make that perfect wheel. Here is Jim Scott who puts on the steel rims. If he does not do it right he will not make that perfect wheel." I went through all the operations, and I said to them, "From the fact that you do make that perfect wheel and work with us, is the reason that we can get the orders and keep busy, and sell them at a lower price and get the business, and by doing that we can pay yu more and keep you busy the year round."

Well, now, that was something new with those people, but I will tell you right here, and I want to say to the employers in this room tonight, if the opportunity ever comes to you to get in touch with yuur employees, embrace it; and if the opportunity does not come, make the opportunity. You can if you will, and I want to say the same to the employees in this

room,-get in touch with your employer; let him know that you are in earnest and will give a full day's work, and you will be well repaid. Do you ask me, then, what a square deal is, and what it means? Doesn't my story give you at least a partial answer? Capital and labor can not be hammered together. Mutual confidence, adequate compensation from the employer, and earnest, intelligent effort frm the employee will fuse them into a living, irresistable force.

The walking delegate--the parasite of labor--will find no plae in a factory or community in which this interest is had. My friends, I want to tell you in a few words my definition of a true man . A true man is one who desires the giving and does give more than he receives, one who without thought ofgain or hope of fame devotes his life to humanity; one who is honest with himself, his country and his Maker; one who bears his burdens as his joys; one who is kind, considerate, just, honorable, and unselfish,--the man worthy to wear that crown is more to be envied than king or president. Money can not buy it; thieves can not steal it; misfortune or sorrow can not take it away; it is the one precious jewel which no earthly power can separate from its rightful owner. Well might a king exclaim, "My kingdom for the title and crown of a true man!" It is a crown which descends not by heredity or favoritism, but fits equally the deserving brow of employer or employee.

Perchance somebody may say this is moralizing. To such critics my answer is that he who has never striven for and acquired success for others' sake has tasted not the sweets of true success. I stand here tonight pleading for your support on a square deal. I ask it in the name of the organizers of this association. I ask it in the name of the good men and women who are working unceasingly in this cause; and finally, friends, I ask it in the name of one who has given abundantly of time and money in an effort to harmonize capital and labor--Charles W. Post. (Applause).

Mr. Toastmaster, I have sometimes wondered why it is we refrain from expressing words of appreciation to the living and immortalize the dead with fulsome eulogy. In my opinion, 'tis far better to warm a man's blood with the milk of human kindness and appreciation than to cover his dead body with eulogies made of white paper and printers ink. Charles W. Post I know by reputation only. In this community he will long be remembered for his unselfish devotion to duty, for his strength of character, and for the many qualities of mind and heart that have endeared him to every good citizen. With ~~xxxx~~ capital and labor joining hands and working in harmony, industrial peace will be achieved, and my earnest wish tonight is that this goal may be soon reached and that this great nation of ours will continue to be ruled by the three great generals in the world's history, General Peace, General Plenty, and General Prosperity. (Loud applause).

The Toastmaster. That, so far as the printed program is concerned, might be called the close of our program, but we have a gentleman here with us tonight whom I did not expect would be here, and who knows something of the work we are doing, the obstacles we are meeting, and what we have got to do to overcome them, and who perhaps might say something to the employers who are seated around our board that might arouse their interest, and to a greater extent, and to dispel some of their fears about what would happen if they would help us; and I take great pleasure in introducing to you Mr. I. H. Gates, of Baltimore, Maryland. (Applause).

Mr. Gates. Mr. Toastmaster, ladies and gentlemen, and fellow workers in this organization: This is indeed a pleasure to me, and it should be a great pleasure and a source of satisfaction to the members of this organization to break bread, to receive their guests, and to sit with their employers at their own board, beneath their own roof tree. (Applause). This evening this suggestion has presented itself to me so clearly and so forcibly that there

there has been an inspiration, not one butmany, and this one thought--as ye sow, so shall ye also reap. And I want to say to the members of tis organization, irrespectis of its president or its organizers who are in the field and hard at work,--to the individual members of this organization, that in organization you shall take out just ~~what~~ that which you put in; and that "as ye so so shall ye also reap" finds its just application in organization. You all have a responsibility. Mr. President, it is awfully hard to talk this without repeating some of the things I may have said this morning; but every one of us has a responsibility and a duty to perform, and if there is one sol or a member of this organization present with us tonight who can leave this building feeling that there is any relief whatever from the responsibility that confronts him in his efforts to upbuild and maintain this organization through the establishment of an atmosphere that will produce this long sought condition, industrial peace--I doubt it, Sir. I can not think, for one moment, that any member of this organization could leave here tonight after the addresses that have been made, after the bounteous repast that has been served, after associating with his wife, his mother, his sister, his sweetheart at a table spread beneath his own rooftree, and lose sight of his responsibility as a member of tis organization.

Mr. President, organization began, as our friend said, with the beginning of time. After creation came organization and when, in response to the divine command to increase and multiply upon the earth, tribal conditions arose that demanded governmental organization. They were crude. It is only necessary for you to draw upon your imagination in the retrospect to bring yourself down from that time in the record of the Good Book till the tables of stone produced the common law--"Thou shalt not steal",-- and after that organization has been a part of man's existence from the beginning of time. Organization may be for good or for evil,--organizations

for good, orgnizations that pretend, and intend and do upbuild conditions, make new conditions, that improve the world, are for the betterment of mankind. And organizations that lack that, that through chicanery, malice, and personal aggrandizement on the part of ~~it~~ their leaders, by disclaiming the intent of others, are organizations that not only approach tyranny, Mr. President, but they are brigand and piratical.

The possibilities of this organization have been told you by two of the greatest employers in the State of Michigan, and I think in that respect there should be an inspiration to the members of this organization, that these gentlemen, employers of labor, students of the conditions of labor, students of their own interests and commercial conditions who come here and talk with you and meet with you,-it means the dawning of a better day; it means the day when the man will come in contact with his employer, when his independence will assert itself, and when in the harbor of Boston they tipped the tea into the water, they did it because of oppression; they did it because of oppression of organization from an old gvernment that had worn itself out. And the new idea came up, and following that came the Declaration of Independence, and from that Declaration this grand country to which we all feel so loyal; and you here tonight, brothers, sisters, friends, have signed a new declaration; you have dumped the tea of Gomperism into the water; and you are going to collect around yourselves and with you, through your owntelligence and your own effort, a new party, a new condition and bring about a bettr day. (Applause.) I can conceive of no thought that is so deprocating to the intelligence of manhood and pure womanhood as to be under the domination of any man or set of men representing so small a number of the working force of a great nation as Sam Compers and his associates do, and then control a situation. My friend, the gentleman from detroit says control. I say no sir, they do not control; they have

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worked for fifteen years steadily, and for eight years ~~mat~~ previous not so steadily, to get an eight hour bill through Congress that would hamper the interests of every man in any trade that took a contract from the government of the United States. They have not succeeded; they are still fighting; they are good stickers, but they have not got control of everything yet; and it is impossible, with the intelligence of this great country, for 1665 men, women and children, and part of them in Canada, to control the intelligence of thirty-three million wag earners. I say that while there are times that the clouds are dark, that the intelligence of American manhood and American womanhood will assert itself, and they will decry the despotism of such men as Sam Gompers. We can not get away from the fact that we have our individuality; Sam has his, and the strongest feature of that is to get his salary advanced as often as he can and to pocket what he can from the other fellow. He has succeeded admirably in that, and I do not know that the Federation of Labor, Mr. Toastmaster, could not be in worse hands; for when the man at the head of a live organization has nothing to satisfy but his personal desires and increase his salary, enlarg his pocketbook, I think that the conditions of the country are in pretty fair shape and safer in his hands than they would be in those of an honest, full fledged, and true unionist.

I don't want to take up too much time on this subject of gomperism, but I never get tired, and Iknow so much of him that I could possibly make hearts ache; but I will say this that if the Lord spares my life to meet with this organization one year from now, it will be another hap py moment, and I make this prophecy that when those men signed their names to the Declaration of Independence and instilled into the minds of the people that were then and those that came after loyalty to the flag, so the little band of patriots who are today establishing this organization, the Trades

THE CONTROL OF HEALTH AFTER ECZEMA AND PSORIASIS

A Study on the Nutrition and Health of the Skin*

BY FRANCIS LOWELL BURNETT, M.D.

I. The Principles

NUTRITION, HEALTH, AND DISEASE

"FOOD is the medicine of health and medicine the food of sickness."[1] The development and maintenance of the normal tissues are largely dependent on nutrient substances absorbed from the aliment. Assimilation is the final and most essential part of nutrition; but the complexity of the nutrient molecules passed into the lacteals, transferred to the circulation, probably acted on by enzymes from the glands of internal secretion, and finally forming a chemical union with the protoplasm of the cells, is beyond comprehension at present. In the nutritive process, however, the chemical reduction of the food and the course of the aliment through the digestive system has been described as being nicely correlated.[2] On this presumption, it is fair to assume that all three phases of nutrition, or digestion, absorption, and assimilation, bear a similar relationship. While digestion and assimilation are difficult to understand, the indices of absorption can be readily determined. In the passage of the aliment through the digestive system, it is finally moulded in the colon to form the feces. Various forms of the feces and varying periods that a marked meal takes to pass through the alimentary canal have been described, but one form and one rate are evidently normal, and these are indices of normal absorption and nutrition.[3] And conversely, if one form and one rate are normal, the others are abnormal, and may be applied to determine intestinal indigestion as a slight and early, yet exact disorder of nutrition.

Normal nutrition is the most important factor in the development of a healthy body. Health, however, as it is understood at present, is a vague and variable condition, which is generally thought of as freedom from a demonstrable disease. But when the indices of normal absorption are recognized and applied, health becomes a more exact state; because it is one that must be continuously built up by nutrient molecules derived from the aliment in passing through the digestive system within the limits of normal absorption. Under these circumstances, a reserve of health seems to be acquired which enhances the factors of safety in the body. But, as the indices of normal absorption have not yet been generally recognized or definitely established, there appear to be many factors in the food consumed and the mode of living of man that diminish the digested products the body recovers from the aliment and produce deficiency disorders. Without the recognition and correction of these early and slight disorders, the reserve is not generally maintained; and with malabsorption becoming progressively worse, the factors of safety in the tissues are little by little expended, the weakest tissue becomes exhausted, compensation is no longer possible, and a recognized metabolic disease becomes apparent. The deficiency thus created acts like an injurious agent, and is evidently an unrecognized cause of some of the metabolic diseases. A disturbance in the transfer of digested products to the tissues has been thought of for some time as a cause of the metabolic diseases, but up to this time a conception of the anabolic processes and a means to improve them have not been proposed. Consequently, the cure of disease and the restoration of health is not so much a matter of knowing more about disease as it is of understanding and regulating a state of health, about which relatively little is yet known.

The understanding and restoration of this state of health is brought about for the most part by educating patients how and what to eat, the requirements of the body for rest, and when exercise is beneficial. The purpose of such a health program is to elicit the complete action of a peculiar, yet apparently essential, part of the digestive system, the proximal colon. This secondary digestive pouch is in a very delicate state of balance, because it is formed by pulsating constricting rings; and yet when acting normally moulds the intestinal contents into discrete masses that compose the normal feces, and thus serves as a readily determined control of nutrition. The regulation of the aliment to elicit this complex and sensitive mechanism of nutrition resembles somewhat the dietary measures applied in diabetes mellitus; the exception being that in one an early and functional disorder of the digestive system is recognized and corrected, whereas in the other, dietary adjustments are made from the remote results of damaged tissue.

THE NUTRITION OF THE SKIN

The precise and automatic control exercised over nutritive material by the proximal colon affords a means of determining malabsorption and metabolic disorders. Various dermatoses are supposed to be of metabolic origin, and many etiological agents of intestinal origin have been investigated. From an understanding of the factors that influence the indices of normal ab-

*From the Dermatological Department of the Massachusetts General Hospital.

The assistance given by the staff in this investigation is gratefully acknowledged.

sorption, whereby there is a failure of the normal nutrient molecules to reach the skin, a more logical inference is that this ever growing and highly specialized tissue becomes unhealthy because it is not being continually built up in normal nutrition. A relation between food factors and disorders of the skin have been noted by many investigators. Among them, Willan, more than a century ago, wrote[4] . . . "I believe that psoriasis often originates from occasional causes. . . . Food of difficult digestion, too great a quantity of acid fruits, . . . and some improper mixtures of foods, as milk and fish, are the circumstances to which patients refer the complaint." Some time later White found that infants with eczema generally passed stools in which the incomplete digestion of fat or carbohydrate was often apparent.[5] And more recently Burnett found that the elimination of faulty food factors relieved intestinal indigestion, as determined by the form of the feces.[6] Intestinal indigestion and malabsorption of this kind were commonly found in patients with eczema and psoriasis, and if relieved for sometime restored them to health. But having acquired a normal skin, many of them again got into careless ways of eating, once more afflicted themselves with intestinal indigestion, and new lesions of the skin appeared. From this deduction it became evident that the only cure of these diseases was the control of health.

Lesions of the skin associated with malnutrition in experimental animals have been described by McCarrison.[7] Diarrhoea is one of the earliest as well as one of the most constant symptoms. After a while, among other deficiency changes in the tissues, "the skin becomes rough and scaly, showing branny desquamation, and in some cases, a scaly eczematous condition. The hair also falls out easily."

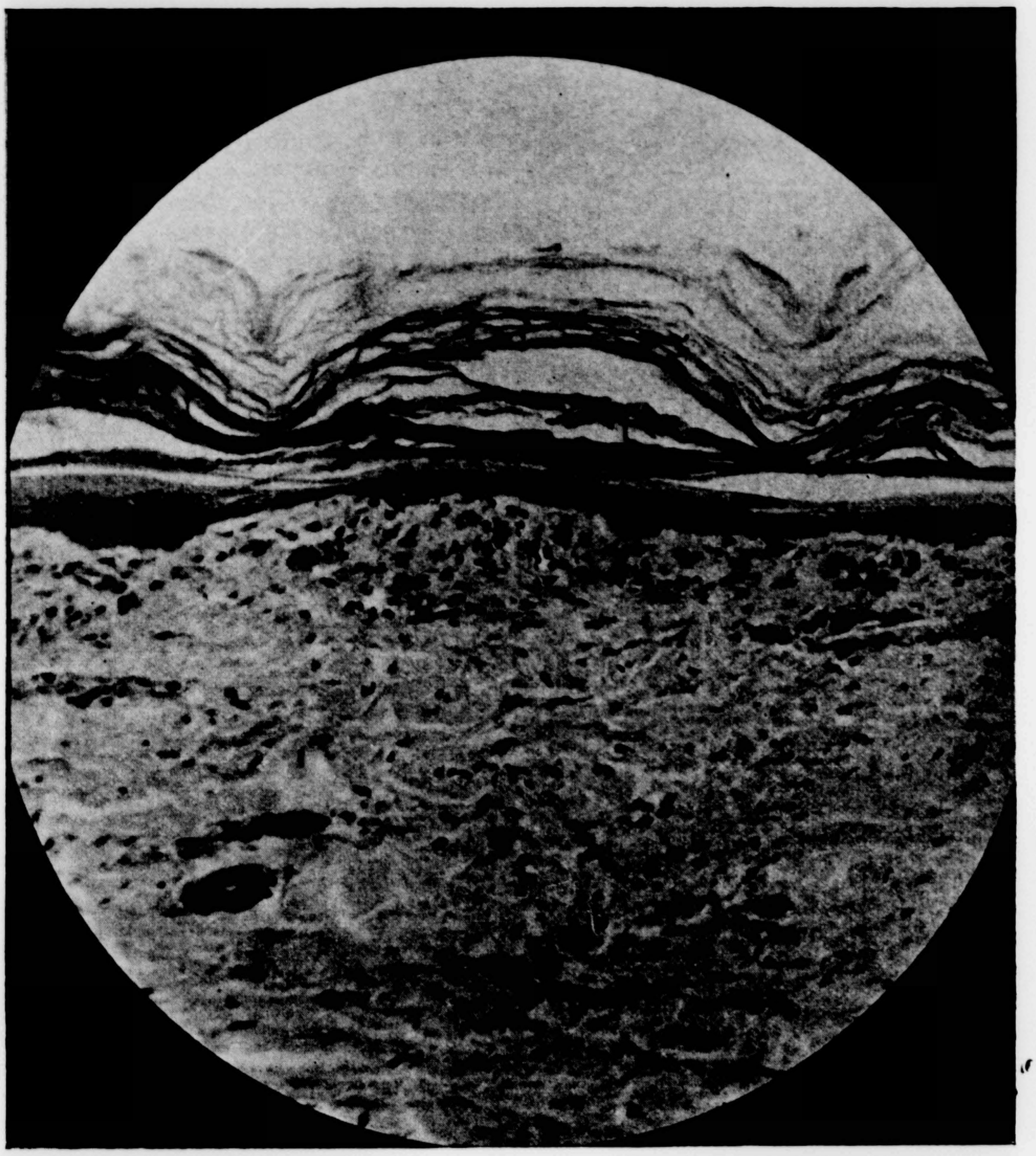

FIGURE 1. Photomicrograph of the skin in severe pellagra showing extreme atrophy of the integument. (This picture is used through the kindness of Dr. James Denton and *Tropical Medicine*.)

A further relationship between a skin disease and malnutrition is evident in pellagra. In describing one of the most prominent signs of this disease, Goldberger and Tanner write "the bowels tended to overactivity, there was looseness of the bowels".[8] And in a comprehensive and detailed study of pellagra by Denton, the skin of the wrists are pigmented, scaly, and

atrophic; but in later lesions the skin is so atrophied that the papillae have entirely disappeared and the basal layer lies directly on a dense fibrosed chorium, as shown in Figure 1.[9] Although this condition illustrates a deficiency of the skin from an extreme metabolic disturbance, it serves to bring forcibly to the attention the fact that this tissue apparently becomes weak and atrophied on account of malassimilation. The skin does not continually receive the normal nutrient substances to keep it built up and growing. This deficiency, associated perhaps with a peculiarity of the nutrient substances or variations in the cellular structure

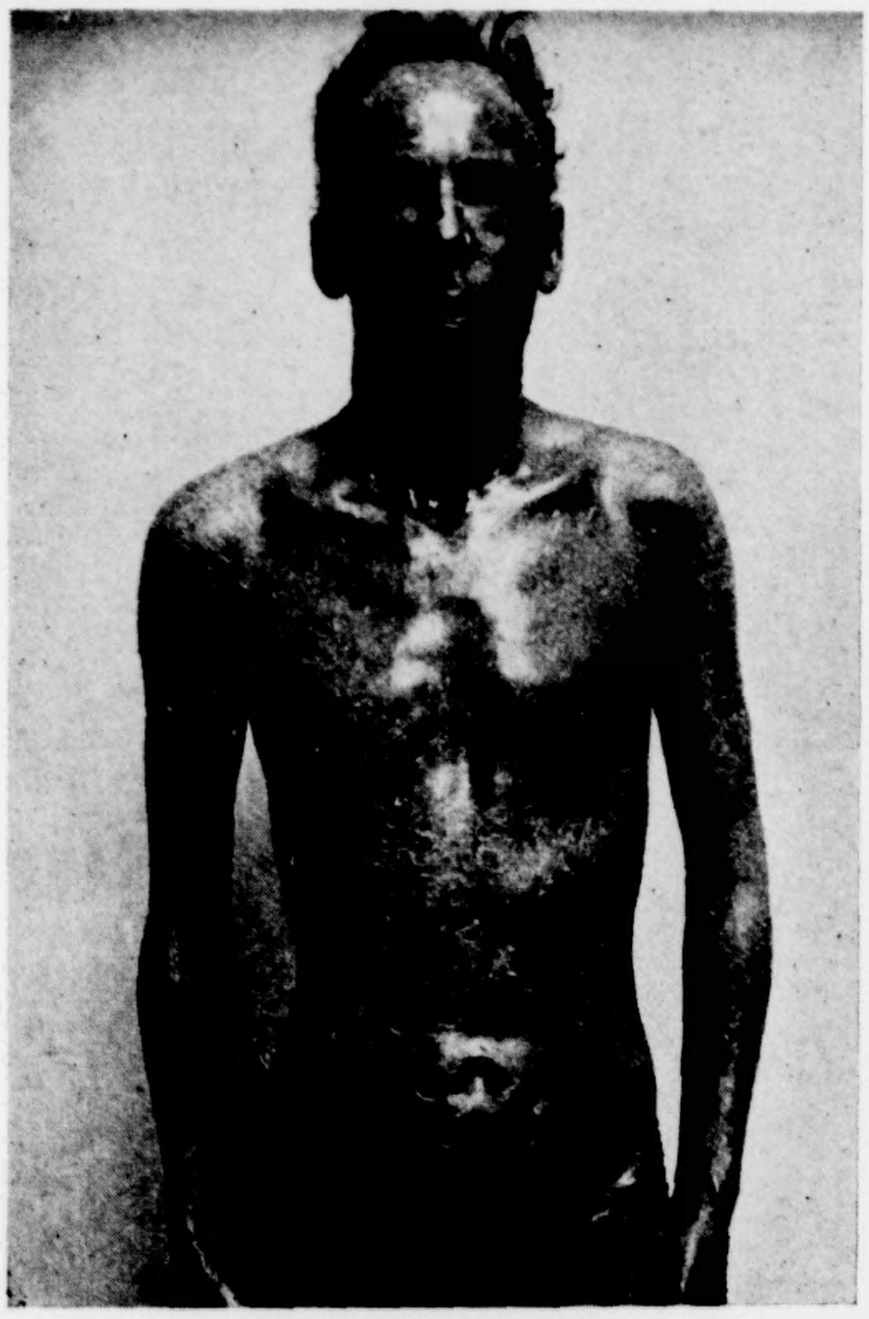

FIGURE 2. A patient with dermatitis exfoliativa, showing a very deficient condition of the body.

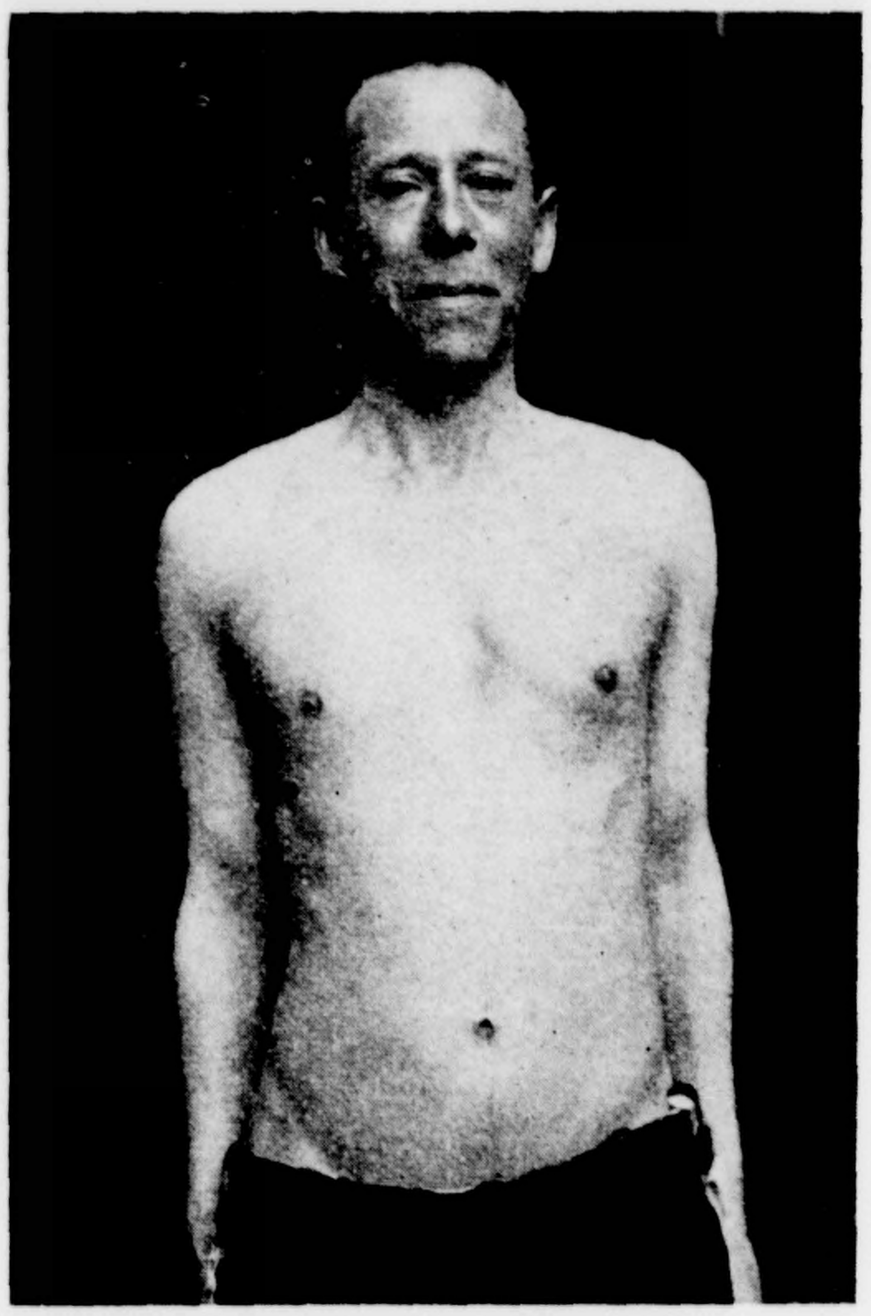

FIGURE 3. The same patient illustrated in Figure 2, after five months of normal absorption. The entire body has been restored to a normal condition through improved nutrition.

of the tissue, causes the skin to break down in the recognized lesions of eczema and psoriasis. The severe forms of these dermatoses sometimes develop into dermatitis exfoliativa, in which the skin is atrophied somewhat like pellagra. The adult body built up through normal nutrition should not vary a great deal in weight. In contrast with this requirement observe the body of the patient with dermatitis exfoliativa following psoriasis, illustrated in Figure 2. To be sure, the redness and atrophy make the skin the most prominent disorder, but malnutrition is also shown in the smallness of the waist and the leanness of the arms. Indeed, the general deficiency in this body is so apparent that it resembles that of scrawny animals fed on incomplete food. In this condition the patient was eating a large amount of food very rapidly, three soft dejections were common daily, and a marked evening meal was first seen in the feces in fifteen hours and last seen in sixty-three hours. With an intestinal rate of this kind, an enormous amount of nutritive material was passing through the body, but little was being digested and absorbed. To improve his nutrition, he was advised to prepare his food better for digestion by mastication, to reduce the amount, and to make a few minor changes in the proportion. With these adjustments in his ways of eating, the feces became formed in several weeks, and later indicated complete digestion and absorption with an intestinal rate of seventy-four and one hundred and forty-one hours. After several months of this kind of nutrition, the deficiency of his body was made up by an increase of about seven kilograms and his skin became healthy, as shown in Figure 3.

Another contrast in the weight of the healthy body through malnutrition is shown in Figure 4. This woman has an increment of fifteen kilograms of fat. From an understanding of the nice adaptation of the digestive system to nutrition and the animal economy, the accumulation of this useless material was made at the expense of the normal tissues. In this patient the skin was assessed, with eczema as the result. She had been eating too often, too much starchy food, and had been taking cathartics for several years. In dietary treatment, cathartics were eliminated, she was advised to eat only three times a day, and starchy food was considerably reduced. With these changes in the aliment, natural de-

jections became regular in several weeks, and later became normal with an intestinal rate of sixty-three and one hundred and thirty-four hours. After several months, the skin became normal and the body reduced a few kilograms.

Other seemingly successful forms of treatment have been applied in these dermatoses. Without, however, appreciating the changes occurring in nutrition from variations of a patient's mode of living, the restoration of health is likely to be due to improved nutrition. This may be the result of dietary directions given with most treatments a difference in food consumed at home as compared with that in a hospital ward, or experiments carried on by patients who instinctively attempt to correct erroneous ways of eating. But irrespective of the treatment that once relieved these diseases, the real problem is to effect a cure by preventing subsequent attacks. Such an outcome from treatment generally applied now is not to be expected, as described in a textbook prognoses. "While eczema must, in the larger number of cases, be considered obstinate, yet instances are relatively few in which relief and cure cannot be effected if proper opportunity is given to reach that end; but this does not mean permanency or freedom from future attacks, unless the etiological factors can be removed or kept in abeyance, for if these come into play, recurrence is possible or, in many cases, probable." Furthermore, "the course of psoriasis is, in all instances, essentially chronic, old patches persisting, some fading away, and new ones developing. Occasionally the disease will entirely disappear, remain in abeyance for months and years, and then become active again. In a few instances, the severe type, after persisting for some years, finally develops into dermatitis exfoliativa and in a few of these, arthritis deformans was associated."[10] On the other hand, when patients realize that the cure of these dermatoses may be brought about through normal nutrition in the control of health and that there are several ways to determine this condition, the prospect no longer may be a matter of conjecture.

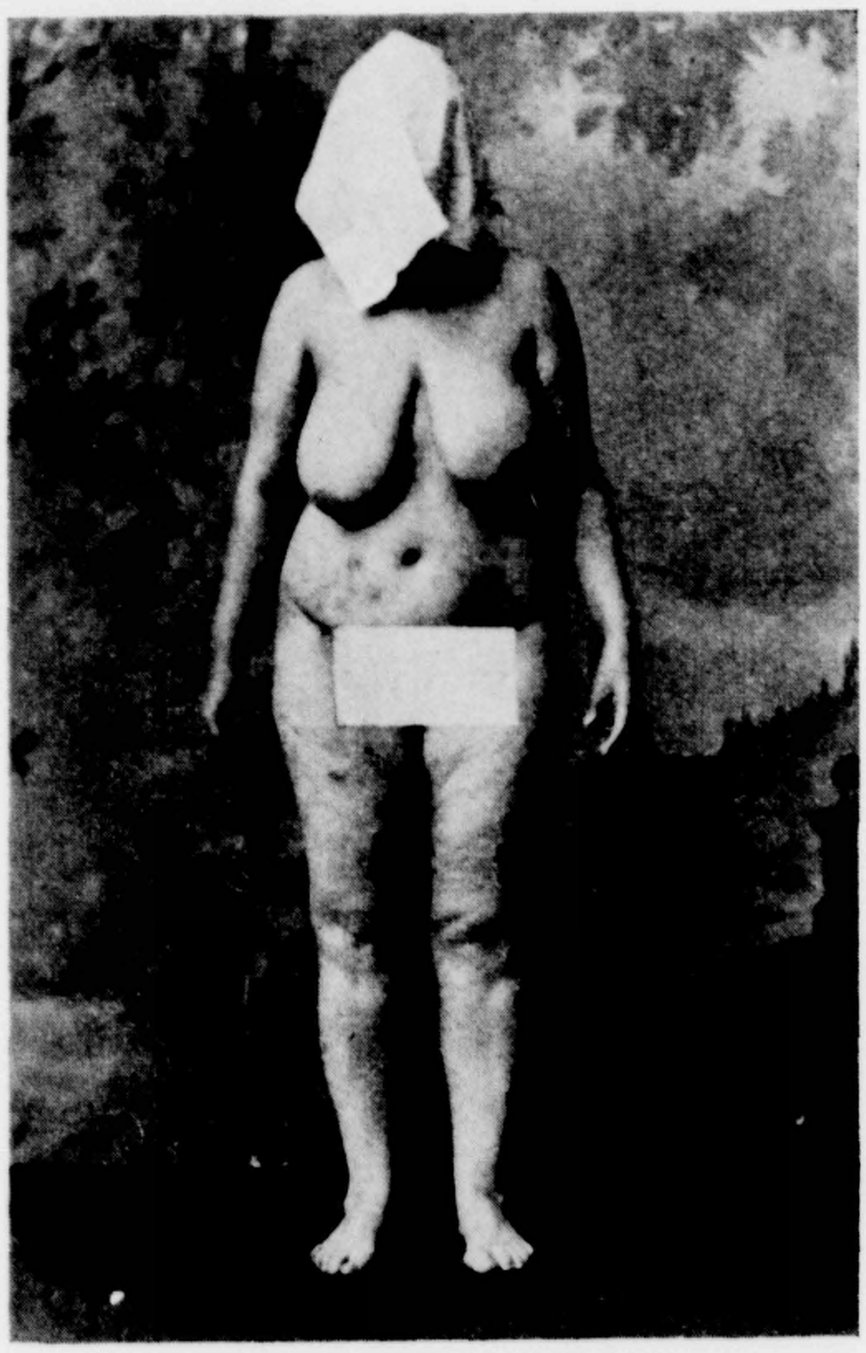

FIGURE 4. An overweight woman with eczema as a result of malabsorption. By dietary treatment the skin has become normal, and through normal absorption she now maintains a healthy skin.

II. The Practice

The Restoration of a Healthy Skin

In the practice of nutrition on exact principles, patients with eczema and psoriasis must understand that they have a weak skin, and it is because of some faulty food factor that intestinal indigestion and malabsorption have been produced and the skin has not received generally the digested products that are necessary to keep it built up and healthy. To understand nutrition from this point of view, patients must be educated to interpret variations in the action of their digestive systems from good factors and to know some of the simple measures to correct them. Patients vary considerably in their capacity to learn and also in their power to correct erroneous ways of living over a long period of time. In the beginning, all patients manifest a great interest in the simple and sensible principles of this treatment and often express an inherent conviction of the beneficial results to be derived from carrying them out.

Almost all patients have a sufficiently good digestive system to respond to adjustments in the alimentary mixture and act well enough to supply some of the nutrient molecules essential to relieve the disorders of the skin. In this study one patient acquired a healthy skin after fifty-two years of psoriasis, and another after thirty-one years of eczema. The formation of the proximal colon by dietary measures in patients who have had a fixation or partial resection of the gut is exceedingly difficult. The time taken to restore a healthy skin varies enormously and depends on how faithfully the requirements for normal absorption are fulfilled, the age of the patient, and the degree of deficiency in the digestive system. Early conditions of eczema and psoriasis often respond quickly and are relieved in a few months; but with old conditions which appear to be associated with an atrophy of the intestines and impotent digestive fluids, signs of improvement in the skin may take months, and complete recovery is a matter of years. In these patients the ingestion of dilute hydrochloric acid and enteric coated pancreatin tablets seem to aid digestion.

In obtaining a detailed history from the patient of his mode of living, a fault or faults

to correct are invariably found. The commonest error is eating too fast or too much; but an excess of sweet, fat, highly spiced food, or fruit is sometimes revealed; then habitual eating between meals, the abuse of cathartics, oils, and enemata, carelessness in defecation, the loss of sleep, and insufficient muscular exercise are some of the other factors that influence the anabolic processes. One or more of these errors in the mode of living prevent normal absorption and the ever growing skin is not continuously built up. The education of a patient to recognize early and slight metabolic disorders and to apply simple measures for their correction is best carried out with diagrams of the digestive system, roentgenograms of the normal and abnormal colon, pictures of the normal and abnormal forms of the feces, figures on the intestinal rate, and a record of a person controlling his health. With the aid of these illustrations and an explanation of their significance, a patient may be made to understand something about his nutrition. Then he is told that he has a digestive system that was especially designed to maintain the integrity of his body; but because he has been ignorant or careless of such a delicately adjusted mechanism, his body and his skin have not been getting proper nourishment from his food. The disorder is due to his ways of eating or living. The patient is given a printed protocol of food consumed, time spent at meals, time and kind of dejections, and a test of the intestinal rate; and told to keep a similar record for a week. On the protocol is also given an explanation of how to determine the intestinal rate and a description of the different forms of the feces. The itching, smarting or burning of the skin should be treated by the local application of salves, washes, or powders. When relieved of these irritating symptoms, the anabolic processes may be aided by more profound and longer sleep.

RECORD I

A Record Showing Food, Feces, and Rapid Intestinal Rate of a Patient With Intestinal Indigestion, Malabsorption, and Psoriasis

	Thursday, March 17, 1927
9-9:15	2 buttered toast, coffee.
10:30	Soft dejection.
1-1:20	Eggs, bacon, 2 muffins, prunes, cake, milk.
7-7:35	Steak, potato, peas, bread and butter, blanc mange, tea.
7:45	Seeds taken to mark this meal.
	Friday, March 18
7:35	Soft dejection — seeds — *Initial Rate 12 hours.*
9-9:12	Grapefruit, griddle cakes, coffee.
9:30	Soft dejection—seeds.
1-1:25	Egg, bread and butter, apple pie, chocolate.
7-7:30	Lamb chop, bread and butter, prunes, ice cream, cake, tea.
8:30	Soft dejection—seeds.
	Saturday, March 19
8:30	Soft dejection—seeds.
8:50-9	Toast, butter, coffee.
12:50-1:12	Lamb chop, parsnips, bread and butter, chocolate.
7:15-7:45	Egg salad, bread and butter, prunes, cake, tea.
11:15	Soft dejection — seeds — *Final Rate 51 hours.*

At the next visit, a report somewhat like that partially shown in Record I may be brought in. Such a record, with an intestinal rate of twelve and fifty-one hours, demonstrates conclusively to the patient that he has intestinal indigestion, malabsorption, and the skin does not get the nutrient molecules from the food that are essential to restore it to health. In this case the excitability of the colon was due in part to the previous use of cathartics, and also to the ingestion of too much fruit. Ordinary servings of grapefruit, apple pie, and prunes in one day will generally produce a stimulation of the colon similar to physic. On the other hand, the time spent at meals and the amount and proportion of the food are without criticism at present. Protein, fat, or carbohydrate indigestion, as determined by an examination of the feces, is often an aid in adjusting the diet.

As detailed instructions about the selection of food were not given during the first visit, the record also shows the kinds of food the patient likes and the sort of alimentary mixture he ingests to nourish his body. As there is considerable latitude in the choice of food, there is no reason to require a patient to eat oatmeal, kidneys, and parsnips, if he prefers graham toast, lamb chops, and cauliflower. At this visit, however, if he is a man taking only a small amount of muscular exercise, he is told to consume about 100 grams of protein, 100 grams of fat, and 200 grams of carbohydrate, in a light breakfast and luncheon, but a good dinner. Fifteen minutes should be spent at breakfast, twenty minutes at luncheon, and thirty minutes at dinner. He should also try to defecate regularly an hour or so after two of the meals; but those having a rapid intestinal rate are likely to go a day without a dejection for the benefit of the body. Elderly and sedentary patients get better on two-thirds of this amount divided into two meals. On this regimen, a moderate breakfast is allowed in the middle of the morning and a good dinner in the evening.

Ordinarily, if the faults are not numerous, the patient is advised to take fruit only once a day, at luncheon or dinner for a week, and without keeping a record. During the next week, however, a second test of the action of the digestive system should be described in a full record. In this record a slight increase in the absorption is often seen; for though the initial rate may remain at about twelve hours, the final rate has increased to eighty-seven hours. During this time a day has passed without a dejection, and the feces have become formed. Then, too, the patient begins to feel the less irritation from the skin, sleeps better, and many of the red areas

on the upper part of the body have become a lighter color. The weight usually remains unchanged. If the patient continues to eat about the same way, a further adjustment in the diet is unnecessary, but he must be told that the irritability of the colon is decreasing and sometime more fruit should be added to keep the aliment passing through the digestive apparatus regularly and with normal absorption.

After the second record has been examined and health measures to improve it have been advised, the patient should follow the directions about eating for two weeks and keep a full record during the following week. At this time, if the bowel is not seriously atrophied and the digestive fluids are not very low in potency, indigestion has been generally relieved, the feces have become normal, and a marked evening meal begins to be dejected in sixty-three hours and continues to be apparent for one hundred thirty-four hours. Furthermore, the skin now shows a marked improvement, there is less scaling over the lesions, the red areas are diminished in size, and new spots have not appeared. Now, too, patients often speak of being entirely relieved of obscure abdominal symptoms, and are enthusiastic over feeling in an improved state of well-being. Not uncommonly at this time, the underweight patients have gained a kilogram.

THE CONTROL OF HEALTH

From now on the disordered patient must be made to realize that he is being changed into a healthy person. The equilibrium of the body in health is in a delicate state of balance, and many factors have to be controlled to keep it so. Everyone is human and slight digressions from the even tenor of healthy living occasionally are not serious, but continued disregard of early and slight signs of disordered nutrition has invariably led to another attack of eczema or psoriasis; for the only cure of these disorders appears to be the continual building up of the integument by the nutrient molecules of normal digestion and absorption in the control of health.

Again and again the person must be told that he must keep a check on the action of the digestive apparatus. He must observe his stools and make sure that they are entirely composed of discrete masses. When a portion of the feces passed is soft and formless, it is an indication of a metabolic disorder, intestinal indigestion, and malabsorption, and the skin is not getting the nutrient molecules from the food that are essential to keep it healthy. There is a cause for this disorder. It may be due to eating too fast, too much, badly proportioned foods, too much rich food or fruit. The cause must be ascertained and eliminated; for if malabsorption continues for some time, new spots will appear in the skin. As a second check in the control of health, a determination of the intestinal rate should be made once a month and recorded. If the initial rate gets below thirty-six hours or above eighty-seven and the final below one hundred ten or above one hundred fifty-six, dietary adjustments are necessary to control health. A third check should be made on the weight of the body. The nutritive apparatus was designed to maintain a certain mass of flesh and blood, and a loss or gain of a few kilograms above or below the normal weight are again due to indiscretions in eating or in the mode of living. Careless ways insidiously and unwittingly slip into a person's mode of living. Early and slight disorders of the digestive system and nutrition must be checked before they become progressively worse and lead to a breaking down of the tissues. With these points of view in mind it is sometimes necessary for the counsellor of health to act also as mentor for those whose health he is attempting to control. And if a person does not return when told, every two or three months with a record, he should be written to, told of the consequences of not continuing to control his health, asked to keep a record for a week, and given an appointment. Such a report as illustrated in Record II, with an intestinal rate of

RECORD II

A Record Showing Food, Feces, and Intestinal Rate of a Person With Presumably Normal Absorption and Nutrition, Controlling Her Health After Eczema

	Saturday, April 9, 1927
8-8:15	1 egg, 1 toast, 1 coffee.
9:00	Normal dejection.
12-12:20	Beef stew, fruit salad, 1 cake, 1 tea.
5:30-6:00	Turnip, lamb, jello, rhubarb, tea.
6:00	Seeds taken to mark this meal.
	Sunday, April 10
8:30-8:45	Small toast, rhubarb, coffee.
9:00	Normal dejection.
1-1:20	Egg salad, 1 toast, 1 tea, orange, cookie.
6-6:30	1 potato, lamb, pears, cake, tea.
	Monday, April 11
8:05-8:20	1 egg, 1 toast, 1 coffee.
9:00	Normal dejection.
12-12:20	Toast, pears, orange salad, 2 cookies, tea.
5-5:30	Butter beans, steak, jello, 1 cookie, tea.
10:00	Normal dejection.
	Tuesday, April 12
7:55-8:10	1 egg, 1 toast, 1 tea.
9:00	Normal dejection — seeds. *Initial Rate 63 hours.*
12-12:20	1 orange, cabbage salad, 1 toast, 1 cake.
5-5:30	Beef, carrots, 1 cake, coffee, apple.
10:00	Normal dejection—seeds.
	Wednesday, April 13
8-8:15	2 raisin bread, 1 coffee.
12-12:20	Beef stew, fruit salad, 2 cookies, tea.
5:05-5:35	Spinach, toast, beef, jello, cake, coffee.
10:00	Normal dejection—seeds.
	Thursday, April 14
7:55-8:10	1 egg, 1 toast, 1 tea.
8:30	Normal dejection—seeds.
12-12:20	1 orange, sardines, 1 toast, coffee, jello.
5-5:30	Lamb, turnip, apple pie, tea.
9:00	Normal dejection—seeds.
	Friday, April 15
7:45-8:00	Oatmeal, milk.
8:30	Normal dejection — seeds. *Final Rate 134 hours.*

12-12:20	Egg salad, 1 toast, 1 orange, 2 cookies, tea.
5-5:30	Haddock, butter beans, fruit salad, 1 cookie.
10:00	Normal dejection.

sixty-three and one hundred thirty-four hours, shows a marked contrast to the absorption and nutrition in Record I, with a rate of twelve and fifty-one hours.

A fourth check in the control of health should be made annually on the condition of the body by a comprehensive and thorough health examination. Of the few made on persons attempting continually to build up their bodies by normal nutrition, only normal organs, tissues, and

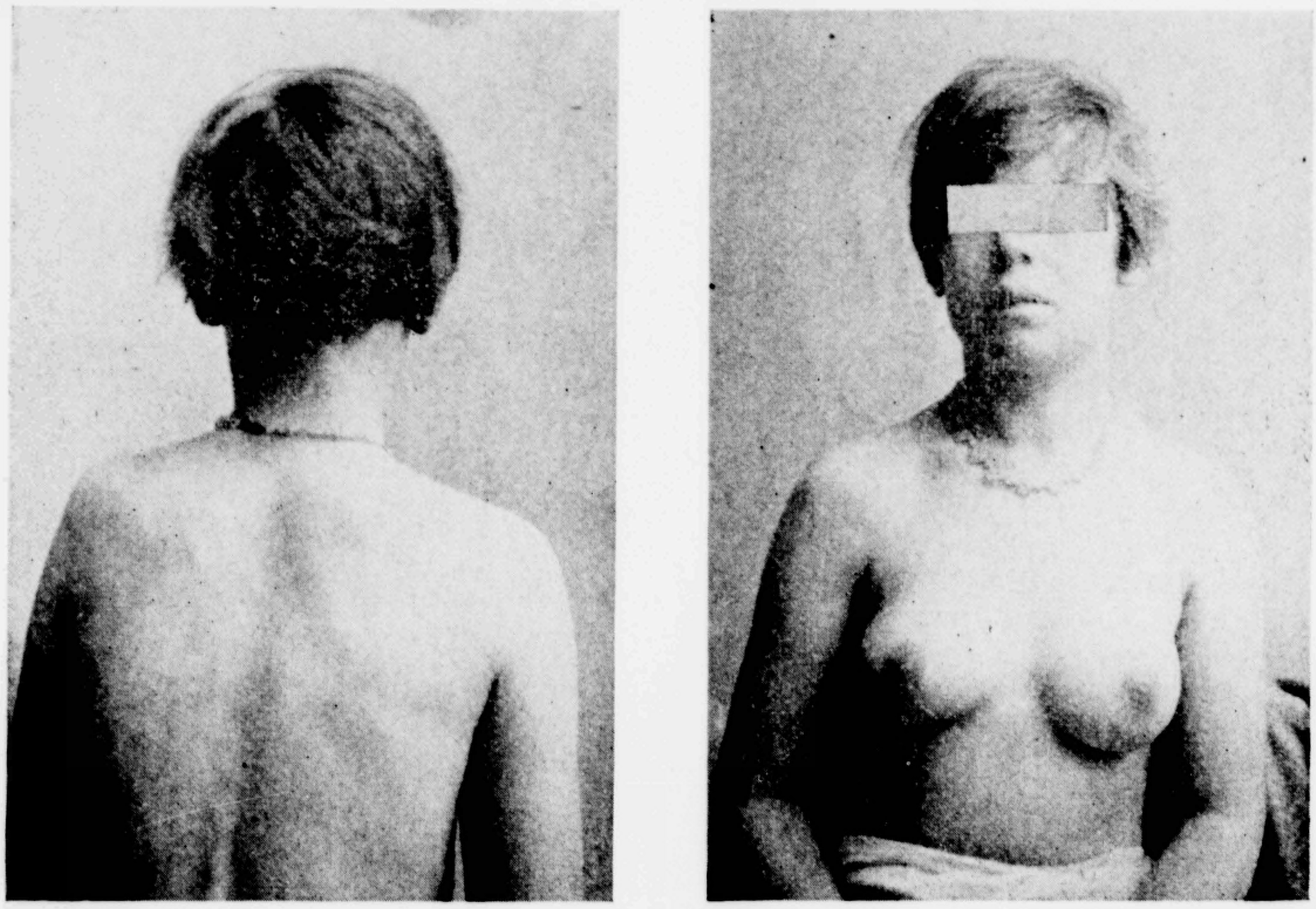

FIGURE 5. The normal skin of a girl controlling her health after eczema.

secretions have been found; but the examination serves to assure the person that he enjoys a superlative state of well being.

III. The Results

Absorption and the Health of the Skin

At present the results obtained from instructing three hundred patients in these principles of nutrition reflect the difficulties of teaching those of moderate intelligence about the action of the digestive system from food factors, as only half of those given directions returned with records and sought further advice about dietary regulations. A portion of the most closely followed patients have been classified, in Tables 1 and 2, according to their ability to learn about their nutrition and their morale to carry out the principles for the control of health after eczema or psoriasis. Here, the name in part, the sex, the age, and the duration of the disease in years, at the beginning of the treatment, then, if known, the form of the feces, intestinal rate, and condition of the skin at various periods afterward, and lastly the results are recorded. Adding this portion to all others known about, the results obtained with this treatment at present separate the patients generally into three classes.

In the first class of about thirty per cent. are those who learn readily and continue to carry out an exact health program. After becoming healthy, most of these patients are so trustworthy that, in spite of not being seen for three months, they return as directed and bring in good records. Furthermore, by improving their physical fitness in this way, they seem to acquire a reserve of health, so that if they do inadvertently provoke intestinal indigestion, the reserve is drawn on and the skin continues normal. In Figure 5, is shown the trunk of a thirteen-year old girl who had eczema continuously since infancy. She was relieved of the disease in October, 1926, and since that time has reported every few months and brought in a health record showing normal indices of absorption. Her skin continues healthy. Since treatment began she has gained seven kilograms. Another person of this class is shown in Figure 6. Four years ago this young Italian had psoriasis for a year. With dietary treatment the skin became healthy in three months and with the exception of a few weeks, two years ago, after an attack of diarrhoea, has remained so since.

"Dyspepsia," headaches, and menstrual pain are some of the minor disorders of which persons

speak of being relieved after getting into a state of improved well being. On the other hand, at the time of the catamenia intestinal indigestion is not uncommon.

In the second class of thirty per cent. the relation between the malnutrition and the condition of the skin is always readily demonstrated. These patients usually follow a health program for a while and notice a significant improvement or the skin becomes normal. At this time, careless and insidious changes occur in their mode of living, the functions of the digestive system become a little upset without symptoms or a knowledge of malabsorption, intestinal indigestion may continue for a few weeks, and then a

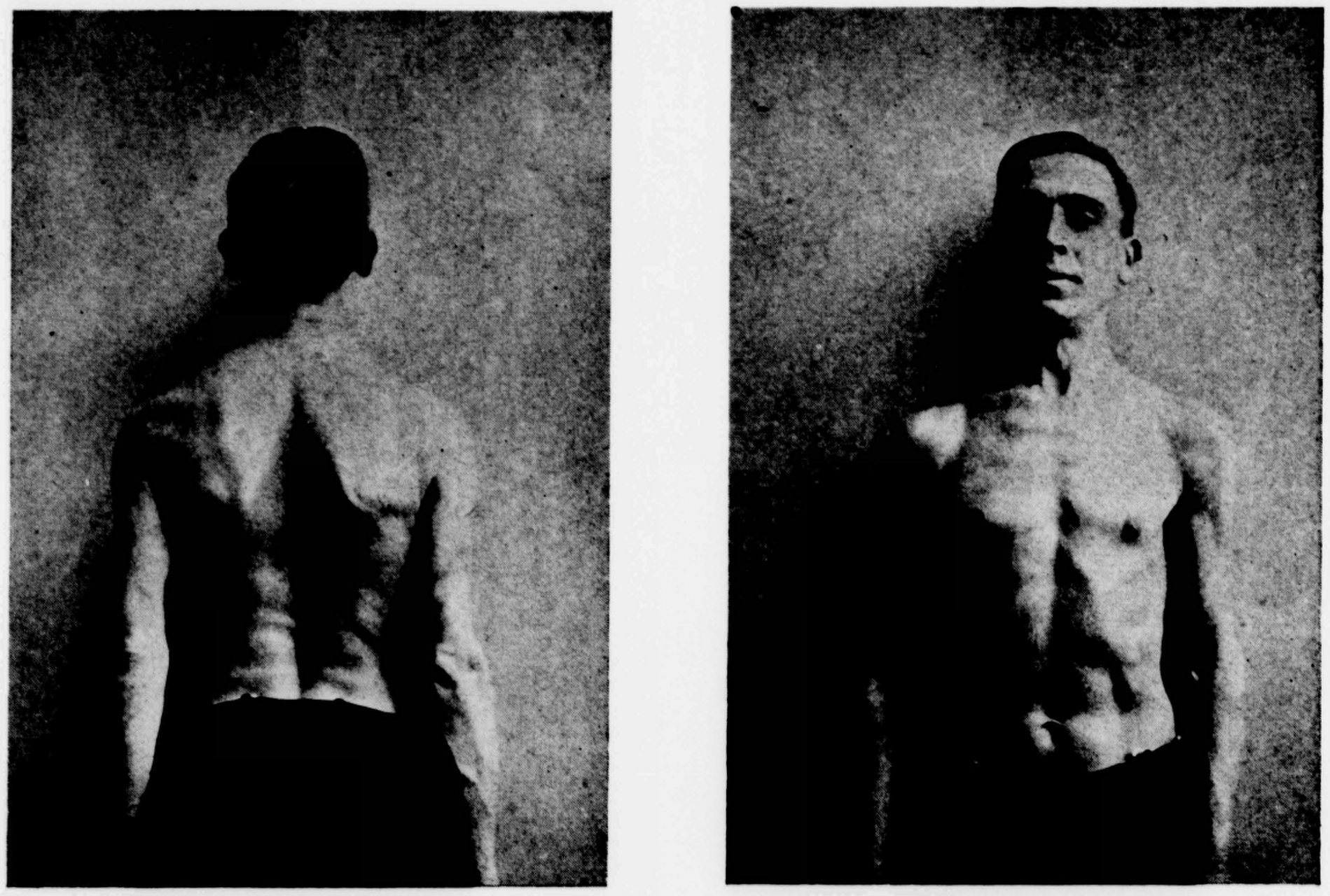

FIGURE 6. The normal skin of a man controlling his health after psoriasis.

few new lesions appear. Now these patients realize that something must be done, once more correct their ways of living, the indices of absorption again become normal and are checked, and after a while the condition of the skin improves. The condition of the patient's skin in this group varies to such an extent that it does not remain accurately classified for any length of time; but some of this class, if closely followed, might readily pass into class one.

Finally, the remaining forty per cent. of the patients are too ignorant to learn, have had so much done for them that they can do little for themselves, have ideas of their own about nutrition, or cannot control themselves. Consequently most of them continue to have intestinal indigestion, metabolic disorders, and eczema or psoriasis. But because some of these patients have not made a sufficiently good attempt to carry out a health program, acquire normal absorption, and notice an improvement in the health of the skin is no reason why another attempt should not be made later. A nutritive apparatus to accomplish a cure is generally within them if food is put into it in the right way; and some of these patients have made several attempts and a few have temporarily acquired a healthy skin.

IV. The Conclusions

Normal nutrition is the most important factor in the development of a healthy body. Health has been a vague and variable condition, and is thought of generally as one free from demonstrable disease. With an understanding of the significance of the normal feces and the normal intestinal rate as indices of normal nutrition, health becomes a more exact state; for it is one that must be continuously built up by nutrient substances derived from the aliment in passing through the digestive system within the limits of normal absorption. Under these circumstances a reserve of health seems to be acquired which evidently enhances the factors of safety in the body. On the other hand, when the feces and intestinal rate are abnormal, they are signs of intestinal indigestion; and then if malabsorption begins and becomes progressively worse, there seems to be a failure of the nutrient molecules to reach the tissues, the factors of safety become expended, the weakest tissue is assessed, and a readily determined metabolic disease becomes apparent. The deficiency thus created acts like an injurious agent, and is evidently an unrecognized cause of some of the metabolic dis-

TABLE I. THE CONTROL OF HEALTH AFTER ECZEMA.

A Table Showing the Form of Feces, Intestinal Rate, and Condition of the Skin of Subjects at Various Periods during Treatment.
(Feces and Intestinal Rate Determined According to a Previous Publication (11))

Name	Sex	Age	Duration of disease in Yrs.	First Month	Second-Fourth Month	Fifth-Eighth Month	First Year	Second-Fifth Years	General Condition of Skin Now
						CLASS I			
BAR	F	13	12	soft, ------, same	formed, 45-138, better	normal, 89-113, better	normal, 40-139, healthy	normal, 41-137, healthy	healthy
BEN	M	35	9	soft, 12-63, same	soft, 11-87, same	normal, 36-131, better	normal, 63-96, healthy		healthy
CRO	F	31	2	soft, 15-43, same	normal, 62-124, better	normal, 63-134, healthy	normal, 63-134, healthy	normal, 61-135, healthy	healthy
DOO	F	15	14	formed, 22-119, better	normal, 42-112, better	soft, 19-62, worse	normal, ------, healthy	normal, ------, healthy	healthy
GUT	M	73	15	soft, 24-87, same	formed, ------, better	normal, -----, better	normal, ------, healthy	normal, 63-110, healthy	healthy
HUB	M	4	4	soft, -------, same	normal, ------, better	normal, -----, better	normal, ------, healthy		healthy
JOH	F	20	14	soft, 25-63, better	formed, 36-86, better	normal, 72-121, better	normal, 38-110, healthy	normal, 38-111, healthy	healthy
PET	F	13	12	formed, ------, same	normal, 37-96, better	normal, ------, better	normal, ------, healthy		healthy
						CLASS II			
ALM	F	43	3	soft, 17-49, same	formed, 37-86, better	normal, 39-109, better	soft, 31-61, worse	formed, 36-41, better	improved
AYE	M	56	2	soft, 11-39, same	soft, 24-84, same	formed, ------, better	formed, ------, better	formed, ------, better	improved
BRO	F	67	6	soft, 14-85, same	formed, 37-111, better	formed, 37-87, same			improved
GOR	F	15	2	soft, 20-87, same	normal, 49-145, better	normal, 49-120, better	normal, 49-145, better	normal, 38-117, better	improved
McK	F	64	6	soft, 13-74, same	soft, 18-87, same	normal, 62-146, better	formed, 12-156, same	------, ------, ------	improved
OBR	F	17	15	soft, 12-72, same	formed, 36----, better	soft, ------, worse	soft, ------, worse	formed, 21-90, better	improved
O'N	M	18	17	soft, -----, same	soft, 20-87, same	formed, 49-111, better	normal, 62-147, better	normal, ------, better	improved
WAR	F	57	13	soft, 15---, same	normal, 41-134, better	normal, 50-135, better	soft, 13-87, worse	normal, 28-144, better	improved
						CLASS III			
BAK	F	13	11	soft, -----, same	soft, -----, same	soft, ------, same	soft, ------, same	soft, ------, same	eczema
CAL	M	39	7	soft, 15-85, same	formed, 36-135, better	formed, 38-73, better	soft, 18-62, worse	soft, ------, same	eczema
DEA	M	18	4	soft, 15---, same	formed, 37-96, same	soft, ------, same	soft, ------, same	soft, ------, same	eczema
HAZ	M	43	25	soft, 12-87, same	formed, 36-61, better	formed, 36-61, better	normal, ------, healthy	soft, ------, same	eczema
MUR	M	33	10	soft, 15-87, same	------, -----, ------	normal, ------, healthy	soft, ------, worse	soft, ------, same	eczema
PLO	M	15	14	soft, -----, same	soft, -----, same	formed, ------, better	soft, ------, worse	soft, ------, same	eczema
SHI	F	15	13	soft, -----, same	formed, 36-85, better	soft, 12-63, worse	formed, 60-96, better	formed, 37-90, same	eczema
SWE	F	16	15	soft, 16-63, same	soft, -------, same	formed, 38-98, better	soft, ------, eczema	soft, 13-87, same	eczema

TABLE II. THE CONTROL OF HEALTH AFTER PSORIASIS.

A Table Showing the Form of Feces, Intestinal Rate, and Condition of the Skin of Subjects at Various Periods during Treatment. (Feces and Intestinal Rate Determined According to a Previous Publication (11).)

Name	Sex	Age	Duration of Disease in Yrs.	First Month	Second-Fourth Month	Fifth-Eighth Month	First Year	Second-Fifth Year	General Condition of Skin Now
						CLASS I			
BER	F	23	5	soft, 12-108, same	formed, 26-108, better	formed, 24-134, better	formed, 20-138, healthy	normal, ------, healthy	healthy
COU	M	26	3	formed, 22-96, better	normal, 64----, better	soft, 17-42, worse	normal, 44-113, better	normal, ------, healthy	healthy
GOO	F	65	29	soft, 13-38, same	normal, 41-110, better	soft, 14-52, worse	normal, 42-130, better	normal, 65-136, healthy	healthy
HEY	F	35	1	soft, -----, same	normal, 37-120, better	normal, 36---, better	normal, ------, well	normal, ------, healthy	healthy
LEV	M	45	15	soft, 15-63, same	normal, 74-141, better	normal, -----, normal	soft, ------, worse	normal, ------, healthy	healthy
MAH	F	68	52	formed, ----, better	soft, 15----, worse	normal, -----, better	normal, 42-89, healthy	normal, 39-111, healthy	healthy
MOR	F	26	16	soft, 24-72, same	soft, 15-87, same	formed, 36-110, better	normal, 63-137, healthy	------, ------, healthy	healthy
STE	F	25	10	soft, 17-88, same	normal, 39-135, better	normal, 60-155, better	normal, 62-156, healthy	normal, 63-155, healthy	healthy
						CLASS II			
MAL	F	14	10	soft, -----, same	normal, 48-122, better	normal, 50-145, better	normal, 49-168, better	normal, 49-121, better	improved
MAY	M	48	15	formed, 36-135, same	soft, 15-42, worse	formed, 13-85, same	formed, 24-110, better		improved
OLE	M	26	1	formed, ------, same	formed, 27-87, same	normal, 69-112, better	normal, 87-132, better		improved
OWE	M	15	3	soft, 15-63, same	normal, 50-120, better	normal, 64-110, well	soft, ------, worse	formed, ------, better	improved
REA	M	33	7	soft, 27-87, same	formed, 50-123, better	soft, 15-79, worse	normal, 63-149, better	formed, 52-100, better	improved
STO	F	33	16	formed, 14-111, same	formed, 24-121, better	normal, 11-131, better	normal, 27-120, better		improved
WAL	F	15	7	soft, 18----, same	formed, 27-86, better	normal, 40-110, better	normal, 45-118, better	formed, 16-100, better	improved
ZIL	M	42	14	soft, 25-50, same	formed, 35-74, better	normal, 36-107, better	normal, 47-110, better	normal, 48-120, better	improved
						CLASS III			
ABO	M	11	1	soft, 14-62, same	formed, -----, better	normal, 40-134, better	normal, ------, healthy	soft, --------, worse	psoriasis
BER	F	20	1	----, -----, same	soft, -----, worse	------, ------, ------			psoriasis
CAR	F	29	15	soft, 13-91, same	formed, 14-110, ------	formed, 13-133, better	normal, 40-160, better	soft, -------, worse	psoriasis
FOS	F	33	12	formed, 13-113, ----	normal, 42-168, better	normal, 97-122, better		soft, -------, worse	psoriasis
GAL	M	33	25	soft, 16-89, ----	soft, 16-23, worse	formed, 16-100, better	soft, -------, worse	soft, -------, worse	psoriasis
HAL	F	37	18	soft, 11-21, ----	formed, 14-111, better	normal, ------, better	soft, 15-73, worse	soft, -------, worse	psoriasis
PAL	M	50	15	soft, 26-85, ----	formed, 37-110, better	formed, 37-96, ------	soft, 15-63, worse	soft, -------, worse	psoriasis
SHA	M	21	4	soft, -----, worse	formed, 24-47, better	diarrhoea -----, worse	soft, -----, worse	soft, 16-63, worse	psoriasis

eases. From this point of view, the cure of disease and the restoration of health is not so much a matter of knowing more about disease as it is of understanding and regulating factors in a patient's mode of living, in order to acquire and maintain normal nutrition and a relatively unknown state of health. The application of principles to acquire this condition consists in educating patients how and what to eat and the requirements of the body for exercise and rest, according to the indices of absorption. To carry out this treatment patients are told about the action of their digestive system and asked to record the food consumed, the dejections, and a determination of the intestinal rate, during a week. An examination of the first record invariably reveals erroneous ways of living and malabsorption. Adjustments are then made and a similar test and record of the digestive system is written out during subsequent weeks, until the indices of absorption become normal. The balance of the digestive system in this condition is very delicate and checks must be made continually in order to ascertain and maintain normal absorption.

Many disorders are supposed to arise from a failure in the transfer of food to the tissues and have been called metabolic diseases. Various dermatoses have been placed in this class and many etiological agents of intestinal origin have been thought responsible; but from an understanding of the factors that influence the indices of normal absorption, whereby there is a failure of the normal nutrient molecules continually to reach the skin, a more logical inference is that this ever growing tissue becomes unhealthy because it is not being continuously built up in normal nutrition. Having a conception of the anabolic processes and the means to improve them, an application of the principles has been made in the treatment of eczema and psoriasis. In the first place, in considering normal nutrition as an exact and very delicately adjusted process, erroneous ways of eating were invariably found to be corrected in patients with these diseases. Some of these faults were eating too fast and too much, badly proportioned meals, and the habitual use of laxatives. Subsequently, malabsorption was determined by finding a rapid intestinal rate, indicating that a great deal of nutritive material was going through instead of into the body to keep the tissues and especially the skin built up and healthy. In the second place, the results obtained in treatment show that there is a very definite correlation between metabolic disorders and the health of the skin; for the patients who generally carried out the principles and then maintained them afterward have been cured of these dermatoses and continue well through the control of health. Another group of patients, however, have improved their absorption and got the skin healthier; then, lapsing into careless and insidious ways of living, malabsorption became worse and new lesions appeared or the old ones became larger. Finally a third group that has done little or nothing to improve their nutrition continue to have intestinal indigestion, malabsorption, and eczema or psoriasis.

From these facts, it is evident that eczema and psoriasis are metabolic disorders and may be relieved by recognizing and correcting factors in a patient's mode of living that influence early and slight metabolic disorders as shown by the indices of absorption. But the prevention of subsequent attacks is only brought about by keeping a continual check on the action of the digestive system in normal absorption by the control of health.

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(From a pamphlet published by the California Fruit Growers Exchange)

U.S. Frigate Essex,
Newport, 31st. Dec.,1811.

Sir,

I have received your letter of this date, accompanied by the copy of a communication mad by you in general, and liberal use in the Hospt. Dept. of ships and vessels of the U. S. Navy.

My opinion as to the efficacy of Lime Juice in preventing and removing scorbutic complaints has been long since firmly established, founded on sources of facts mentioned in your letter, and on experience. In the Mediterranean, where the opportunity of providing fresh provisions for the crews were not so frequent as on the home station, my vessel, by the advice of Doct. Heap, was constantly supplied with Lemon Juice, which we provided at Messina, in large quantities, nearly as cheap as vinegar, and issued to the men in the crew thereof, by which means my men were never affected by the scurvy, when several cases of it appeared about the same time on board other vessels on the same station.

Salt of Lemon I have also found to have its beneficial effects more convenient because more portable, but much too expensive for general use. On long voyages through different climates where the transitions from heat to cold and from dry to wet are very great and frequent, the ravages of the scurvy are more dreadful, and Lemon Juice is found to be indispensibly necessary as a preventative to that disease, for after long use of salt provisions, fresh provisions and vegetables have not always the desired effect, as they frequently bring on dysentaries more destructive to life than the scurvy, indeed, there have been instances of persons on long voyages who have

suffered greatly by scorbutic affections that have abstained entirely from the use of salt provisions.

It requires the utmost care to preserve a northern constitution on the coast of Africa, near the line from the scurvy, and I have understood that the British ships of war stationed there are well supplied with lime or lemon juice, and that to each of the crew a spoonful is issued to be taken every morning fasting, and has been found to have the effect wished. The practice is also pursued by some of the most provident India Captains, and to that circumstance is frequently owing the preservation of the health of their crews.

I have the honor to be

Respectfully

Your Obt. Servt,

D. Porter.

Doc. Wm. P. C. Barton.

Bedding for Winter.

Helen Campbell, writing upon this subject in a recent number of Demorest's Magazine, says:-

"There is one popular delusion-popular, in so far as it is common to all womankind-that weight and warmth are synonymous, and that bed-covering that lacks weight must necessarily lack comfort. The housekeeper, as winter approaches, turns over her stock of comfortables, which have either been in a dark closet all summer, or, it may be, remained between two mattresses; either method insuring the musty fustiness that is characteristic of most comfortables. The dark closet method is decidedly preferable, if the comfortable has been thoroughly sunned again before its was laid away, and is thoroughly sunned again before its winter mission begins, But the whole question of bedding, as it stands in the housekeeper's mind, requires reconstruction, beginning with the fallacy already mentioned, that weight means warmth.

"The fact is, that no civilized bed-room should contain an article of bedding which cannot be washed or otherwise thoroughly cleansed, and herein lies the chief objection to either comfortable or quilt in which the cotton is firmly fastened down. Cotton absorbes and holds the bodily exhalations, but unhappily, when washed, loses its lightness, and becomes a species of felt made up of knots and strings. The economical housekeeper, therefore, uses benzine to remove any soil on that portion drawn around the neck, or if matters are too serious for such methods, re-cover the whole, finding this preferable to cutting the numberless

knots of a tied comfortable. The outside of the platter is fair to view, but what is there within? Concentrated uncleanliness, imprisoned disease , portable malaria, warranted to add its quota to the contributions from sewer-pipes or imperfect drainage, and to insure necessity for a doctor's visit at least once during the season.

"An anti-comfortable crusade might well be started, by some woman who loves her kind, and who knows, like the writer, what instruments of disease and death they may become. Even if this extremity be not reached, they are never tolerable after the first season, and it is far better to begin with a determination that blankets shall be substituted for them. Even a dirty blanket is far more tolerable than a dirty comfortable, for blankets are porous and allow the air to penetrate them. Every weaver of woolen cloth, in whatever form, knows that the loosly woven fabrics are the warmest, this arising from the fact that air is held in the meshes and becomes a medium of warmth. One blanket of pure wool, no matter how coarse its quality, has more warmth-producing power than a four-pound comfortable, yet, because the feeling of weight is lacking, there is immediate out-cry that it is cold, Two blankets and a light comfortable will furnish a bed amply, and the lessened weight will mean quieter sleep of a far more refreshing quality than any to be had under ten or twelve pounds of cotton. Blankets can be washed or steam-cleaned; and if children's beds are in question, soft gray or blue blankets may well replace white, which is soiled in a week of such experiments as most children indulge in with the bed-clothes, which are often

tents by day as well as covering by night,

"Granted, at once, that the first expense per bed will be far greater; but having admitted this fact, offset it by remembering that health, as well as comfort, is the question. A third of our lives is given to sleep, yet very few people understand what constitutes a healthful as well as a comfortable bed, or how essential it is to secure both."

Good Health Vol 2I

Lecture given by Dr. Alexis Carrel, at
The Miami-Battle Creek, Sunday, March 5th, 1939.

Dr. Kellogg, Ladies and Gentlemen: It is a very great honor and a privilege for me to have been asked by Dr. Kellogg to speak for a few minutes this afternoon. I am particularly happy to do it because I have for many years been a great admirer of the work and of the conceptions of Dr. Kellogg. It was my good fortune to be present at the third Race Betterment Conference which was held in Battle Creek in 1928. I was extremely impressed by that great idea that Dr. Kellogg had had for many years to improve human beings. When Dr. Kellogg created in 1926 the Foundation for Race Betterment, many people were skeptical because it was not yet understood by many that the white races were degenerating. Dr. Kellogg and his associates of that time were really prophets and, as we all know, prophets are never welcome in their own country. But I will never forget what I learned in that Conference. There were experts in every line, sociology, medicine, economics, and we heard the most interesting ideas about the condition of the great white races of today and what could be done to prevent their degeneration. Many scientists today recognize the fact that civilization has reached a crisis.

What we call a crisis of civilization is a crisis of Man. Man is a unit. We cannot make any separation between the mind and the body. The problem of the whole is a problem of nutrition on which much has been done in Battle Creek by Dr. Kellogg and his colleagues. We do not yet know all about nutrition; we are still in the period of learning and will be for a long time to come.

One method of study is the observation of animals. We may also study the nutrition of the organs and the tissues themselves. It is a small part of that very vast problem which involves the whole of human beings and possibly the whole of the race.

In the study of the body we separate it into parts, tissues, organs and skeleton. Dissection of the body isolates dead parts and so far we have been able to study only dead parts. If we want to gain a complete knowledge of the body we must study organs and tissues while they are still alive.

I am interested not only to study the anatomical structures but also their functions, by making them work outside of the body as they work inside. It may interest you if I describe in a very simple way the technique and the meaning of our experiments.

One thing I wanted to know was whether the tissues could live indefinitely; and if it is possible to prevent old age. We have made a little progress in the understanding of the effect of time on tissues when they are placed in normal conditions.

There are two ways of keeping part of the body alive; one is to take the cells of the skin, the heart, the kidneys or the thyroid gland or other tissues and put them in a fluid to keep them alive like bacteria. It is also possible to measure their activity and what is the effect of the blood of people on those tissues. If fed properly they remain alive, they do not die.

On January 18, 1912, we removed a small fragment from a chicken embryo heart (unhatched incubated egg) and we put the fragment in serum. The fragment of heart continued to pulsate for 104 days but had become so small it was going to disappear. At that time we began feeding and gave the bit of heart tissue a food that we extracted from the body of a chicken embryo. It has been growing now for 27 years. These tissues have the power to live indefinitely. Their present rate of growth is as fast as it was 25 years ago.

But we are not composed of free tissues but of organized tissues. We found that if we could get rid of the waste products, tissues will not die, if at the same time they are given the proper food.

Our method of keeping tissues alive, of growing them in flasks, gave us a lot of information about old age. We could follow the changes which happen in the blood during life. We can measure age now. We can be very young in years and very old at the same time. The condition of the blood serum which becomes modified during the course of life is the toxic effect of serum upon the duration of life and therefore the cause of old age.

We were not completely satisfied with our experiments because the quantity of tissues which can be obtained and preserved in that way is small. For many years, physicians and physiologists have been interested in the problem of keeping entire organs alive outside of the body. This idea of men of science was not the desire to accomplish a feat. It was to determine what is the influence of the changes in the composition of the blood. It was interesting for us because it has been discovered that various diseases can be studied only by observation on living tissues. Infantile paralysis virus cannot be cultivated like ordinary bacteria but must be studied on living tissues. Therefore a method of keeping tissues alive outside of the body is of great practical interest. We thought if we could take the thyroid gland and keep it alive it would open a new field of medical studies. Many attempts to do this have been made during the last century, in Germany, England, France, and in this country. I have tried, and have also failed. The organs, i.e.,kidneys or thyroid gland, would become infected and would die. Some years ago a man, a great expert in a different field, (I am referring to Colonel Lindbergh,) developed an apparatus which is quite a marvelous mechanism. It is not only the spirit of perseverance that succeeds in this field. I tried for four years and each time failed. Colonel Lindbergh, in 1935, succeeded in manufacturing a pump, in which for the first time, an organ could be maintained alive just as if it was in the body. It is not easy to describe that chamber. It is composed of glass. The artery of the organ is inserted in the glass chamber. The retort is composed of several reservoirs and completely isolated from the outside world by cotton. The great enemy is bacteria. The apparatus perforns the functions of both the heart and the lungs. Through a cotton filter a pulsating gass pressure gives the impulse necessary to establish the same type of circulation that it has in the body. We found that an organ kept in that manner would remain alive. They could be modified in form and function according to the fluid inserted. We could maintain the thyroid gland for one or two months. We observed the way to cure organs. In this manner it has become possible to make experiments on the human body which had never been possible before. We can take the organs removed during the course of operation and revive them and they will live again.

To go back: those methods are simply tools by which phenomenon can be studied in a very precise way. If an animal has been placed on a special diet we can see the changes in an organ and also in its function. If it is possible to change the kind of food, it is possible to see different results on the organ. Techniques of that kind and idea have been used a great many times and could be used today in every medical laboratory in the world, are still in their beginnings. We will soon build an apparatus of larger size. We will remove a weak organ, place it in the apparatus and give it an energetic treatment and replace it in the body. Long ago we found it possible to remove a limb, leave it for one or two hours on the table and replace it and see it live. The kidney for instance, may be removed and replaced and live again indefinitely. With the necessary progress of that technique it will be possible to take a diseased organ, remove it, and after treatment replace it in the body.

Why do some people live to be 85 or 100 years of age? What is the difference between the tissues of those people and those people who die young? What are the relations between conditions of the tissues, the blood and the mind? What are those qualities of tissues which bring about certain qualities of the mind? We do not know. There is no use to increase longevity unless we can improve the mind as well.

"We have made a great many observations on this subject. In order to get knowledge which can be utilized we have to experiment, not on rats or mice, but on animals of a higher intelligence like dogs and monkeys. In that way we may probably find the way to preserve the longevity of both the body and the mind.

"There is no doubt that we can bring about improvement in the quality of human beings. We observe more and more a lack of mental stability, a lack of equilibrium and many other defects, and we do not know as yet what is the cause of those abnormalities. If we progress not only in the small field in which I myself am interested, but in the psychobiological field, we may make great contributions to race betterment."

We have, in our experiments, to think about the dual aspect of our nature. It is for this reason that experiments which have been made so far are not of prime importance because they have been made on animals of low intelligence, such as rats and mice, but not on animals which have a high type of intelligence.

What I have told you is only a very small part of a very big field, one in which Dr. Kellogg has been a pioneer. For more than 50 years he has been attacking the problem of the degeneration of the white races. This is becoming more important every year because we are beginning to realize what are the consequences of race degeneration. By continuing our researches by the aid of the Lindbergh pump, we hope to develop a method by which organs may be increased in size.

When I was in Battle Creek 12 years ago I gave an address on this subject and I am pleased that I have had this opportunity to speak of some of the progress which has been made and of the great problems which remain to be solved and of the greater advance to be made in the future.

CAPACITY FOR WORK

UNDER A VEGETARIAN DIET

Translation of a part of "Physiological Studies on Vegetarianism," by Dr. W. Caspari. Private Student in the Hochschule, Berlin. Originally published in Pfluger's "Zeitschrift fur die gesammte Physiologie." Reprinted separately by Martin Hager, Bonn, 1905.

CAPACITY FOR WORK

UNDER A VEGETARIAN DIET

One of the most important and at once interesting questions is the one concerning the capacity for work under a vegetarian diet. It is maintained that vegetarian food must diminish a man's ability to work, because the work of digestion is increased and because the stomach and intestines are filled with voluminous, innutritive materials, which must necessarily be eaten in large quantities. In many ways this view is correct; but we have already seen that in a pure vegetarian fare, it is possible to avoid the defects just described by proper preparation of the food. But, the vegetarian side has often argued that this fare is not only equal but superior to the mixed diet.

From a purely theoretical standpoint, if we overlook the objections just mentioned, we can find no reason why vegetarian food should not maintain the working capacity of the organism. Its lack of albumen can no longer be urged as a reason for any lessened working power. But the whole question is closely connected with the production of muscular energy, which has been discussed and investigated from every side. Thanks to Zuntz and his followers, we know today that each of the three great food groups is adapted to produce muscular power, and that they are represented nearly equal in furnishing the supply of heat for muscular activity.

We may emphasize that this result is the natural one, found only after decades of research. For it would scarcely accord with the wisdom of nature if such limitations were placed upon the most important functions of the organism as to require a particular kind of food for its development.

When I began my work, as far as I know there had been no experimental investigation into the working power under pure vegetarianism. But we must except an article by Bölsche which deals with the astonishing work of the Japanese jinriksha-men, who are pure vegetarians. However, he only mentions the fact of their wonderful feats, but says nothing about the energy needed in their work, or about the adaptation of the food for it. He presented some interesting and very valuable observations, but he did not deal with a scientific experiment.

Therefore it was necessary for me to test experimentally the working power of vegetarianism. Glassner and I had no opportunity to do this in our experiments with the married couple K.; our time for it was too short. Yet this much can be said, that M.K. appeared to be capable and strong, both physically and mentally, and that he daily made considerable use of the gymnasium at Augusta Hospital.

Then I tried to find out more carefully the value of vegetarian food through a series of experiments on Captain H.

Unfortunately my efforts resulted in failure. Naturally I used the method which Zuntz devised for measuring the respiratory changes in muscular work; this method was particularly useful in determining the source of muscular power. In this case, it was shown how this method was adapted to such an investigation. It indicates exactly the amount of energy consumed in a given muscular act, since it records the amount of energy used over and above what is needed under similar digestive conditions but under absolute rest. But I could not get Captain H. into a condition of absolute quiet. Although he bore the inconveniences of experiments with praiseworthy willingness and charming felicity, he particularly hated those attempts at rest. Not that he considered the requirements too great, but he thought that lying perfectly still was unphysiological. Therefore the results that depended on rest were rendered quite untrustworthy. At first he tried repeatedly to increase the small rest values by voluntary movements. Later the remonstrance that his faulty conduct would impair the results for which he had undergone such inconveniences irritated him considerably, and evidently prevented a condition of absolute rest. By using numerous experiments, I tried to establish average rest values that would be at least fairly correct; but after comparing the manifold results, I found such a variation in the use of oxygen that it was impossible

to consider the one general average alone. The consumption of oxygen per kilogram and mimute varied between 3.27 and 5.64 ccm. But since the rest values could not be positively established, these figures were naturally of no value; hence a part of my experiments on Captain H. failed. But I wish to mention one fact, because I think it is positively proven and is not without interest. I refer to the extraordinary decrease in the respiratory quotient that accompanied any muscular exertion. This fact was evident in every experiment. This indicates that at the beginning of an experiment he had carbohydrates at his disposal, but the amount was very small and was therefore soon consumed; and for the continued exertion, body materials, fat and albumen were consumed.

It is instructive to consider the small presence of carbohydrates, if we compare the work, which in this case diminished the respiratory quotients, with the amount required to produce a like effect on normally-fed men. Similar conditions were found by Zuntz and Schumburg among marching soldiers, and the fact I mentioned is clearly pointed out by these authors. For comparison I have placed in the following table an experiment taken from Zuntz and Schumburg, for which the calorific value had been computed. In like manner I computed the calorific value of that part of Captain H.'s work that preceded the decline of the respiratory quotient,- assuming that only fat and carbohydrates are consumed by

work. This assumption may not be justifiable, but for such general average values it gives a satisfactory approximation. As a basis for calculating the calorific value, I employed the respiratory quotient of the preceding series of experiments,- this course, while not entirely justifiable, being followed because, in the first test, the respiratory quotient was constantly higher, and because the consumption of energy increased with the increase of the respiratory quotient. For, aliter of oxygen furnished 5,047 calories in the oxidation of starch, but only 4,686 calories in the oxidation of fat. Therefore, through the higher respiratory quotient, we arrive at Captain H's maximum values, made valid *a fortiori* by the result. Thus we secure the following short table, which illustrates sufficiently what has been said:

Persons experimented upon	Date	Heat value of the work rendered	Respiratory quotient
Captain H.	Nov. 25,	ca. 30 calories	1.09 0.69
" "		" 58 "	0.91 0.71
" "		" 29 "	0.85 0.74
Can. med. P. of Zuntz Schumburg. Vers. No. 25	May 28	" 1700 "	0.84 0.785

The decrease in the respiratory quotient was moreover noticed by Zuntz and Hagerman in their experiments upon the metabolic processes in the horse, which seems particularly reasonable because of its rich carbohydrate food.

Since the respiratory tests on Captain H. cannot be used to determine the working power of the vegetarian diet, we must content ourselves with data derived from common observation. For this purpose, the statement made by Captain H. himself in regard to his stay in seclusion offers a striking illustration. To start with, his physical ability must have been much reduced, which entirely corresponds with his physical condition. Through his mode of living, his organism had been impaired even before he went into seclusion. Consequently he soon had to give up the long runs which at first he had actively undertaken. This was on account of pain in his feet, due, as he thought, to an old injury. But I doubt whether, even without the pain, he could have continued the runs much longer. Not that I discredit the objective truth of his statement; but his whole strength was constantly failing during the progress of the experiments, and near the end of December took on a serious condition. I cannot even agree with Captain H. as to the significance of the pain. Indeed, I have an impression that the pain, which made it impossible to continue the run, was due to the swelling of the fat in the planta

pedis. I conclude this from the fact that at first we could find no trace of injury or swelling; neither the men in the hospital who were concerned with this matter, nor I, could find the slightest indication. Later the difficulties increased in spite of great care, and in further experiments even quiet walking was rendered difficult by pain in both feet, and at last standing became exceedingly oppressive. Also the knee-bending, which had been practiced before this, was given up when the pain set in, and only the dumbbell practice was continued. But it is difficult to state definitely the amount of work done in this practice, for Sandow's dumb-bells were used, and they are made of a number of spiral springs, which are gripped together as they are raised and lowered, so that the muscular activity can be a widely varied one, depending on the greater or smaller pressure. I also noticed that he was easily exhausted by the work-test in the laboratory. But this was partly due to the fatty swelling in his foot and to the consequent insecure, painful walking and standing; for we know from Zuntz and Schumburg's experiments that such depressions essentially increases the consumption of energy during muscular activity.

In contrast to this general decline of physical power is the fact mentioned in Captain H.'s accounts, that he wrestled with a number of men and showed quite effective

ability. He wrestled with Professor Goldscheider, Professor Zuntz, Dr. Alexander, the head of the station at the time, and with me. Each of these men was astonished at the strength displayed by Captain H. But we must state that the wrestling took place at the end of the experimentation, therefore at a time when his general condition was much better than during the earlier experimental stages. And yet we must confess his strength was astonishing, if we examine the accompanying photographs, which show his physical condition at the end of the series of experiments. These photographs speak for themselves and need no further explanation. They present a condition which we can see only in the most developed cases of cachexia; but the muscles of the upper arm are fairly well-preserved, as is shown by one of the photographs. I also want to call attention to the prominence of the abdomen, which is due to the accumulation and fermentation of cellulose food materials in the intestine.

But if we wish to judge correctly such muscular activity as Captain H. showed at the conclusion of the experiments, we must not disregard the psychical factor. It is undoubtedly a fact proven by experience, that the will has extraordinary power over physical conditions; and in fact, every one who has had to work to utmost exhaustion is aware of the influence which the mind has upon muscular endurance.

A very instructive analogy to the feat accomplished by Captain H. is offered by the ergographic experiment made by Succi on the 29th day of fasting. Although Succi's ergographic exertions are not materially inferior to Luciani's no one will come to the conclusion that a fast of twenty-nine days is a desirable form of nutrition. We shall have more to say later of the colossal influence exerted by the will power upon the maximum muscular power.

The account given by Captain H. concerning his intellectual work corresponds entirely with this idea. During his confinement he was exceedingly active, filling many pages with well-written translations from the Latin, French and English languages, with numerous German essays and mathematical treatises. How far this work was mechanical, I cannot say. But the work was almost altogether written, and therefore called for only one kind of thought-activity. However, prolonged mental activity under poor physical conditions is not so very astonishing. We know from Speck's experiments that intellectual work is possible at a very small consumption of food. Again, Goldmair shows that during starvation the brain of an animal decreases but little in weight. Furthermore, we know of great intellectual work done by men who were suffering from exhausting sickness.

Fortunately, I was able, with a number of other tests, to fill out satisfactorily the gaps left by the failure of

the respiratory experiments on Captain H. I was enabled to make use of an endurance walk undertaken by the sporting club "Comet" in the spring of 1902. Together with Albu, who had the clinical observations in charge, I have already published an account of the general conditions of this march. Here I need to consider only the data of the physiological examinations made during the training of the men. The men chosen for the experiment were the two champions of the sporting club. The one was K.H., a young merchant, born March 5, 1874, at this time twenty-eight years old. In 1894, following Professor Forster's lecture, "The Social Significance of Vegetarianism," he gave up the use of meat. After the last of March, 1901, he lived on a pure vegetarian fare, that is, without milk, butter, cheese or eggs. Since the beginning of 1898, as a follower of Haig, he has not been using leguminous foods. Since 1900, he has been using Kellogg's preparations, peanuts and "bromose". Since March, 1896, he has been following bicycle-riding as a sport; and he was about the best rider in the Bicycle Union of the Berlin Athletic Association. In 1898 he met with his first success as a distance walker. He won the walk around Berlin, going 15 miles (69.4 Eng. miles) in 14 hours and 11 minutes (4.9 miles per hour). He owed his great physical ability less to the particular sports which he followed than to Sandow's vigorous system of physical development, followed

with great conscientiousness. This general physical development enabled M., according to his opinion, to take part in any sports, and to secure good average results, or even to make maximum records.

The second favorite was J. B., a young mechanic born February 11, 1876, and at this time twenty-six years old. Since 1895 he trained regularly at walking. In the same year he won the walking championship of Berlin, covering 100 Km. in 12½ hours (5 miles an hour). From 1896 on he also took up running, and won in 1897 the championship of Germany, running 7,500 m. in 26 minutes and 6 seconds. In 1898 he secured the championship of Austria, running four English miles. After the present distance walk he won the world's record, on Sept. 13, 1903, in walking a quarter of an English mile 402.25 m) in 1 minute and 20.5 seconds. From these records it is evident that we are dealing with an athlete of the first class.

B., as far as we could determine, lived on a mixed fare which contained an abundance of meat. M., was a strong teetotaler; B., on the other hand drank alcoholic liquors. The course which had been planned was open to the walkers of all nations, and was to cover the distance from Dresden to Berlin. This is a distance of 202 Km. or 27 German miles. During their training, M. and B. placed themselves at our disposal for several experiments. These were conducted

in this way: the men selected for the experiment came out very early in the morning, and after being weighed went upon the track which has been so often described. There several breathing tests in walking were made. Then they walked from the agricultural high school building to "Saatwinkel" and back again to the high school. This road was chosen because it had been used earlier by Zuntz and Schumburg during their experiments with marching soldiers, so that the length was exactly known. The round distance amounted to 24.75 km (15.24 miles). After their return another test was made on the track; then after a short mid-day rest the same distance of 24.75 km was covered, and after the return new tests were made upon the track. During the entire day the body-weight was carefully controlled; the weight of the food and the excretion was recorded, so as to furnish data for calculating the insensible perspiration.

As for the physical condition of the two men, the vegetarian, M., was 1.635 m (63.6 in.) high, was very wide-shouldered, and had an even and powerful muscular development. The accompanying photograph belongs to a later date and makes the arm musculature a little more prominent than it was at the time of the walk. On the other hand, the thorax is very prominent in this picture. In fact, we needed only examine this man to see a living proof that a vegetarian fare, if intelligently followed, is entirely consistent with the

development and maintenance of a strong and muscular physique.

B. was larger than M., his height was 1.95 m. He made a much more effective impression and showed an unusually well proportioned build. His muscular development, on the other hand, was not so regular as that of M. This fact must be attributed to his more one-sided training. But particularly, he could not come up to his rival in arm musculature and chest measure. M.'s average weight was 61.175 kg. (134 lbs.) B.'s 63.18. To determine the albuminous contents of their bodies, the respiratory tests during absolute rest indicate like conditions. The following rest-test were made, showing the average of several harmonizing values:

Name	Oxygen used per minute	CO_2 used per minute	weight of body	O used per min. of time and per kg. of weight	CO_2 used per minute of time and kg. of	R.Q.
	ccm	ccm	kg.	ccm	ccm.	
M.	236.4	254.55	61.175	5.499	4.161	0.76
B.	298.4	217.0	63.18	4.723	3.435	0.73

If we compare these records, we find that M. consumed an extraordinarily greater amount of oxygen than B. Among the strong men, who, for example, are mentioned by Magnus Levy, the greatest amount of oxygen consumed per minute and per

kilogram of weight is 4.53 ccm. by a young man of 24 years. For can. med. P., Zuntz and Schumberg found a consumption of 4.12 ccm. of oxygen for a kilogram of body-weight. The records of the experiments state that P. was a man of strong muscular development. As far as I know, the consumption of oxygen per kilogram of weight by M. during absolute rest is the greatest that has ever been recorded for a healthy man. The amount consumed by B. is also very large, but there are several records that surpass his. Lowy's reports show that by very strong men the amount of oxygen consumed during rest is similar to M.'s; he has records of 5.36 and 5.14 ccm. per kilogram of body weight. The reason for this large consumption must be found in the strong muscular development of the particular individuals. Of the factors which enter into the consumption of energy,-- of which the oxygen consumption is only a measure,- the one pertaining to the body surface must in this case be neglected, for the small differences could scarcely affect the result; therefore only the one factor remains as a sign of differentiation, namely, the amount of albumen consumed, especially through the muscles. The significance of this is shown by several appropriate experiments, but particularly well by the records of Zuntz and Schumburg. They found, during the series of marches, that the rest-value of consumption advanced in proportion as the size and strength of muscles

increased. In case of P., who was mentioned above, the consumption rose from 4.04 to 4.30 ccm. of oxygen; in case of cand. med. B., from 3.74 to 4.24 ccm of oxygen. In regard to the two men M. and B., it is possible, then, to draw the following conclusion from the amounts of oxygen consumed during rest; M. was muscularly the stronger of the two men.

The results of the tests on the track may be compared in the following table. Columns six and seven contain respectively the total amount of oxygen consumed and the amount of carbon-dioxide thrown off; column ten contains the respiratory quotient. Columns eight and nine contain the oxygen consumed minus the rest-values.

Date and No. 1902	Time	Distance per minute	Weight of body	Volume of breath reduced	Oxygen per minute	CO_2 given off per minute	Meters of distance	Oxygen used Meters of distance / Kg. weight	
I M									R. Q.
		m.	kg	l.	ccm.	ccm.	ccm.	ccm.	
Apr. 25	A.M. A.M.								
I a	7:27 - 7:46		65.380	(25.75)	1926.1	1624.9	---	--	0.84
I b	7:52 - 8:00	142.9	65.380	25.34	2166.5	1827.0	12.81	0.196	0.84
XX a	11:26 - 11:395	138.9	62.986	25.97	2156.1	1605.4	13.13	0.209	0.74
XX b	11:50 - 11:58	142.9	62.908	28.29	2271.9	1702.8	13.56	0.215	0.75
XXX a	P.M. P.M.								
	3:58 - 4:6	137:6	61.267	24.04	2109.7	1482.3	12.83	0.210	0.71
XXX	4:13 - 4:21	134.9	61.267	25.58	2016.1	1532.5	12.45	0.203	0.76
Average		139.44	63,185	25.84	2142.5	1630.0	12.65	0.207	0.76

Remarks. For Test Ia, the distance-measure was not properly applied. The distance is not accurately measured. The test is not considered in the average values.

Apr. 22.										
2 B										
K a	7:10 - 7:32	A.M.	107.6	67.220	27.81	1713.1	1629.1	15.15	0.196	0.89
K b	7:38 - 7:47		122.2	67.220	24.25	1864.4	1430.4	12.82	0.191	0.77
XX a	11:09 - 11:17		126.5	66.510	25.98	2100.6	1518.5	14.85	0.218	0.72
XX b	11:23 - 11:32		132:8	65:510	26:07	2091:2	1634.9	13.50	0.206	0.78
XXX a	3:37 - 3:45	P.M.	130.7	64.540	26.51	2057.7	1505.7	13.45	0.208	0.73
XXX b	3:49 - 3:58		134.3	64.540	26.37	2112.2	1574.0	13.82	0.209	0.75
Apr. 26										
I a	7:07 - 7:16	A.M.	129.1	67.081	23.55	1966.3	1575.4	129 2	0.194	0.80
X b	7:21 - 7:29		134.4	67.081	24.08	2190.3	1731.3	14.08	0.211	0.79
XX a	1:18 - 1:28	P.M.	133.1	63.860	22.55	2108.6	1472.8	13.60	0.213	0.70
XX b	1:32 - 1:40		134.9	63.860	23.26	2002.8	1509.6	12.63	0.198	0.75
XXX a	5:45 - 5:53		135.7	63.900	24.67	2145.0	1517.0	1360	0.213	0.71
XXX b	5:57 - 6:05		134.9	13.900	24.09	2052.4	1474.3	13.00	0.204	0.72
Average			131.7	65.351	24.67	2062.8	1540.4	1343	0.206	0.75

Remarks. For test Ia, irregular movement on the track; test therefore is not considered in the averages.

1	2	3	4	5	6	7
Date	I M. Hours	Oxygen used per minute ccm.	CO_2 Thrown off ccm.	R.Q. of the work	Meter distance to kg. weight: Oxygen ccm.	Meter distance to kg. weight: Use of energy calories
April 25	7.52 A. M. - 8.00 A.M.	1830.1	1572.4	0.86	0.196	0.952
	11.26 - 11.395	1819.7	1350.8	0.74	0.209	0.982
	11.50 - 11.58	1935.5	1448.2	0.75	0.215	1.018
	3.58 P.M. - 4.06 P.M.	1765.3	1227.7	0.70	0.210	0.979
	4.13 - 4.21	1679.7	1277.9	0.76	0.201	0.961
	Average	1806.1	1375.4	0.76	0.207	0.979

Remarks: Departure at 8.09; return 11:06 A.M. Or, 24.75 km. in 177 minutes. One kilometer in seven minutes. No food. After the walk some biscuit, apple "sine," bromose, figs, all together 257 g. 387 new wine, free of alcohol, 60 g. water

Departure 12.30 P.M. Return 3.35 P. M. Or, 24.75 km. in 185 minutes; or, one milometer in every minute. During the walk, he drank 367 g. of new wine.

The striking result of these experiments is the absolute uniformity in the consumption of oxygen by the two men, determined both per meter of distance and per kilogram of weight. Even if the likeness of the values at times depends upon the third decimal, yet the general agreement of the individual tests is so marked that it is difficult to consider it a coincidence. This result is particularly interesting because the methods by which the muscular exercises were carried on by each of the two men differed altogether. The vegetarian, M., walked according to Marcoys leaning walk, which is characterized by the fact that in long steps the knees are never straightened out. Thus, according to Marcoy, the most effective and rapid system for walking long distances is secured. It is generally known that this system of marching has been adopted by the "Bersaglieri" of the Italian, and by the "Spahir" of the French army; and in the German army repeated attempts have been made to introduce this system in the infantry,- a system which in its entire nature is an intermediate process between running and walking. On the other hand, B., of the mixed diet, walked with an athletic "turner-step," lifting the upper leg quite high, and then, during the swing of the leg, pushing the knee forward,- a system which did not make such an effective impression as the one selected by the vegetarian M. If there is a general law at the bottom of these results,- which seems

Date	Dist per min meters	Weight of Body kgm.	Volume of respiration liter	Oxygen consumed per min. ccm.	CO_2 used per min ccm.	Oxygen consumed: Per meter of distance ccm.	Oxygen consumed: Per m. dist. & kg. of wt. ccm.	R.Q.	Values during rest: Oxygen consumed ccm.	Values during rest: CO_2 exhaled ccm	Values during rest: R.Q.	Calorific value of work per m. dist. and kg. wt.
1902	182.6	63.47	42.74	3111.3	2816.4	15.20	0.2395	0.905	2774.9	2561.8	0.92	1.184
May 27	172.0	63.47	38.80	2902.3	2545.4	14.92	0.235	0.88	2565.9	2290.8	0.92	1.154
Average	177.3	63.47	40.77	3000.6	2680.9	15.06	0.237	0.89	2670.4	2426.3	0.90	1.169

According to this table we find the following results:

At a speed of 139 m. per minute, a consumption of 979 calories per kilometer of distance and kilogram of weight; (720 per lb. per mile at rate of 5.17 miles per hour.)

At a speed of 177 m. per minute, a consumption of 1169 calories per kilometer of distance and kilogram of weight.

According to these figures, for a speed increase of 38 meters per minute, the consumption increases by 90 calories per kilometer of distance and kilogram of weight. And, for an increase of one meter per minute, consumption rises five calories. (less Cal.)

Now let us compare these results with the data which Zuntz and Schumburg collected from all the material extant. They made the following variations in the speed of the men under experiment: With B. the rate was increased from 62.71 meters per minute to 89.06 meters per minute: With P.

quite likely because of the uniformity secured in individual tests,—then the following formula may be derived; Maximum trained individuals perform equal amounts of work, for which they are specially trained, with equal amounts of consumption, particularly of albumen, irrespective of the kind of food-supply, conditioned only upon a sufficiency; even the particular system by which the work is accomplished does not affect the amount of energy used, if only the muscles that are used have a maximum training.

These conditions become equally apparent if we consider the calorific value of the work done. We can do this by the plan adopted by Zuntz, which was particularly applied by him and Schumburg to their experiments with marching soldiers. The fundamental idea of this problem is the difference in the amount of oxygen consumed and the carbon-dioxide exhaled during the work and rest period. From these values a deduction is made corresponding to the albumen used during the work, for which the ratio is presented by the nitrogenous secretion in the urine. After the deduction of the oxygen needed to burn up the albumen, and of the resulting carbon-dioxide, we secure new figures for the consumption of oxygen, the excretion of carbon-dioxide and respiratory quotients. These values must be referred to the fat and carbohydrates consumed in the work. The proportion of these foodstuffs consumed in the work can be determined from the

respiratory quotient. The sum of the calorific values of the food used during work above that used during rest gives the calorific value of the work.

Unfortunately, in the case of our men the nitrogenous contents of the urine could not be ascertained during the practice walks; but both gentlemen volunteered to preserve their urine during the final distance walk. But as we shall see later, the course was completed by only one of the men, M., so that we know the amount of nitrogen secreted by him alone. During the entire course he passed off through the urine 19.01 g. of nitrogen. Moreover, the perspiration contained in his clothes was gathered and its nitrogen content determined. Through perspiration 1.5 g. of nitrogen were thrown off during the course,- a total amount of 20.51 g. Since the walk lasted 27 hours, there were thrown off per hour 0.76 g. of nitrogen, per minute 13 mg. This last corresponds to 78.8 ccm. oxygen, 62.5 ccm. carbon-dioxide, and 352.8 calories of heat. I have made my calculation from these figures, although I know that I committed an error. But this error has no particular significance, because, if I do not consider the destruction of albumen at all and assume that only fat and carbohydrates were consumed, I secure values which are almost identical with those given in column 7 in the following table:

Date	2 B Hours	Oxygen used per minute ccm.	CO_2 thrown off ccm.	R.Q. of the work	Oxygen ccm.	Meter distance to kg. weight	Use of energy calories
Apr. 22	7.38 A.M. - 7.47 A.M.	1566.0	1213.4	0.77	0.191		0.906
	11.09 -11.17	1902.2	1301.5	0.72	0.218		1.020
	11.23 -11.32	1792.8	1417.9	0.79	0.206		0.984
	3.27 P.M. 3.45 P.M.	1758.6	1288.7	8.73	0.208		0.981
		1813.8	1357.3	0.75	0.209		0.991
Apr. 26	7.07 A.M. - 7.16 A.M.	1667.9	1358.4	0.81	0.194		0.924
	7.21 - 7.29	1891.9	1514.3	0.80	0.211		1.005
	1.18 P.M. - 1.29 P.M.	1810.2	1255.8	0.69	0.213		0.996
	1.38 - 1.40	1704.4	1292.6	0.76	0.198		0.938
	5.45 P.M. - 5.53	1846.6	1300.0	0.70	0.213		0.996
	5.37 - 6.05	1754.0	1257.3	0.72	0.204		0.952
	Average	1764.4	1323.4	0.75	0.206		0.972

Remarks. Taken before arrival at the laboratory, 60 g. white bread and $\frac{1}{4}$ litre of milk. Departure 7.55 A.M., return 11.00 A.M. 24.75 km. covered in 185 minutes, on the average 7.5 minutes per kilometer. On the way he ate 20 g. of cakes. After the walk he took 209 g. of cotelette and rolls, 262 g. of wine and 371 g. water.

Departure 12.12 P.M. return 3.24 P.M. 24.75 km. in 192 minutes, 7.8 min. for each kilogram. During walk and just before 306. g. wine and 710 g. of water were taken. Departure 7.35 A.M. return 1 P.M. Taken 219 g. water and 27 g. cakes, 325 minutes for 24.75 km. or 13 minutes per kilometer. Taken after walk, 246 g. cotelette and rolls, 149 g. wine, 476 g. water. Departure 2.15 p.m. return 5.30 P.M. or 24.75 km. in 195 min., therefore 7.9 min. per kilometer. Taken during the walk, 27 g. cakes, a large measure of pale beer.

It seemed to me worth while to indicate in this table the food consumed during the tests.

Thus, in spite of the difference in fare, the two men showed that there was an entire uniformity in calorific expenditure, agreeing entirely with the uniformity of oxygen-consumption.

Naturally, I have tried to find in available literature accounts that would serve to illustrate and substantiate the law which I have set up. But, unfortunately, there are but few data in existence that can be compared with the ones presented. None of the men experimented upon by Katzenstein, Magnus-Levy, Zuntz and Schumburg, chose during their walk a gat that compared in speed with that selected by M. and B. as the most desirable, for which their training was apparently the most adapted. But Lee Zuntz, in his investigation concerning the changes in gas an energy of a bicycle rider, made several tests in which he selected a similar rate of speed. If the values are computed under the supposition of a uniform body weight of 72.7 kg. then the following figures represent these values:

Consumption of Oxygen

Date	Number of the Experiment	Meter of distance per minute	Per meter of distance	Per meter of distance & per kg. of Body wt.
Oct. 26	I	145.5	15.928	0.219
	II	140.5	16.783	0.231
	XXX	135.74	16.215	0.223
	XV	137.09	15.563	0.214
	V	143.68	15.953	0.219
	IX	138.12	17.608	0.242
	Average	140.11	16.342	0.225

In this case, the consumption for the same amount of work is greater, but that proves nothing against the law formulated above. The marching speed chosen by Lee Zuntz was the greatest possible for him, and we know that the consumption per meter of distance and kg. of body weight increases as the movement becomes more rapid. It is therefore not surprising that the amount of oxygen consumed by Lee Zuntz per meter of distance and kg. of body weight is 9% greater than that of the distance walkers, although his speed was approximately equal to theirs. In this saving of 9% we find the results of the training undergone by the distance walkers. And yet we must remember that nearly every young man is more or less trained for the activity involved in walking, and particularly that Lee Zuntz was an active, well-trained walker.

Let us examine once more the calorific values of the consumption per kilogram and meter in case of the distance

covered by the two men of our experiment. If we compute

the average values of the tests that belong to the same period, we arrive at the following results:

Persons experimented upon	Rate	Number of the experiment	Calorific equivalent of marching work per meter of distance and kg. of weight
M	Apr. 25	I	0.952
M	" "	II	1.000
M	" "	III	0.971
B	Apr. 22	I	0.906
"	" "	II	1.002
"	" "	III	0.986
"	Apr. 26	I	0.965
"	" "	II	0.967
"	" "	III	0.974

If we compare these individual figures, it becomes apparent that in the tests made upon M. on April 25, and upon B. April 22, the walk No. I required a greater consumption than walk No. II. If this increase results from exhaustion, then exhaustion must not have been great, because, after food was taken, the consumption was approximately equalized. This is shown in the decrease of values in the tests No. III, which was made after a considerable amount of nourishment was taken, but also following upon another walk of 24 km. But the consumption in test No. III constantly shows an increase over No. I. In the test upon B. on April 26, tests No. I and II give almost identical results. Only test No. III shows a small increase.

It was constantly found in all our experiments, that the consumption increased as the rate of speed increased.

This fact is substantiated by Katzenstein, Zuntz and Schumburg; by Lee Zuntz in case of men, and by Zuntz and Hageman on the part of horses; but in experiments with dogs, this has not yet been proven.

Even among these best-trained men whom we could examine, we found a rise of consumption following upon increased speed. To illustrate this, we have two experiments upon the vegetarian M., in which the rate of walking was so raised that even he found the movement rather a fast one. (Consult the table below).

from 53.58 meters to 93.33 meters per minute. They found with B. that the increase of one meter per minute caused an increase in the expenditure of 4.8 calories, and with P. an increase of 2.3 calories. In case of Lee Zuntz, the ascending values of speed and consumption have the same ration as P.'s. These values indicated an increase of 2.4 calories for every meter as the speed advanced from 60 to 100 meters per minute. Much greater, however, was the ratio of Lee Zuntz between the speed of 100 and 143 meters per minute. Here the consumption advanced 10 calories, which is twice the rate of increase shown by the distance walker M. in spite of his greater speed.

The advance which is demanded for the same amount of work performed at higher speed -- showing that increased speed does not per orm the work economically -- is clearly indicated if we compare the two tests made on M., the one at a higher speed than the other. Just as is shown in the table given above, we find that for a speed of 172 meters per minute there is a consumption of 1154 calories; and for a rate of 183 meters per minute, a consumption of 1184 calories.

That means, for an advance of 11 meters per minute in speed, an increase of 30 calories, that is, for every meter of distance an increase of 2.7 calories. This rate of increase is much smaller than that between 139 and 172 meters. But this fact can be explained; the test at a speed of 183 m.

preceded the other. The first one exerted the man and caused considerable exhaustion, because of which the consumption in the second test may have been increased.

The race began at Dresden early in the morning of May 18, 1902. It resulted in a brilliant victory for the vegetarian M. He accomplished a colossal work,-- one that in its kind has never been equalled as far as I know; he covered the distance from Dresden to Berlin, a distance of 202 kilometers, in 26 hours and 58 minutes. Concerning the effect of this enormous activity upon this young man's physical condition and mental functions, Albu and I have already published our reports. Therefore I shall limit myself here to a few short remarks. I met M. near a mid-station. Juterbog, 134 kilometers from Dresden. He was the first to arrive there. His face was pale and his lips cyanotic. He was very much excited. There was not enough time for a thorough examination. Only after he arrived at Berlin could he be carefully examined. Here, his face was pale and his lips a livid blue. The temperature in the rectum was 38.2^{0} ; the pulse weak, almost "thread-like," 110. His urine contained albumen and blood, granulated and transparent disks, and some epithelium of the kidneys. The heart-beats were faint but clear. An examination made two hours after his arrival by Dr. Levy-Dorn with the Roentgen rays indicated normal conditions about his heart.

Sense-tests and memory-tests of numbers made a half hour

after his arrival showed no essential differences from the results we secured during the period of training. Indeed, his intellectual function did not suffer the slightest loss. After he went home he slept about two hours, and then busied himself with correspondence and mental work.

On the other hand, the mixed dieter, B., fell far behind and gave up the contest even before he had finished half the course.

Perhaps it would be interesting to picture for ourselves the work performed by the vegetarian M. during his walk. Of course the values can be calculated only roughly, yet the facts before us are certainly sufficient to give us an approximate idea of the task accomplished. In 26 hours and 58 minutes he walked 202 kilometers, which is a rate of 125 meters per minute. This, however, is a slower rate than the one from which I computed the experiments upon the track. There the slowest rate was 135 meters per minute. But our figures for the final walk will not be too high if, for computing the energy consumed by M., we take as a basis an average value of 139 meters per minute. For, during the course, short stops were made for eating, etc. The first part of the course was certainly made at a much higher rate than the average, while during the latter part, the amount of energy consumed must have been affected by exhaustion. At a speed of 139 meters, -- which we shall take as a basis for our

calculation,--there were used 12.95 liters of oxygen, estimated according to the experiments on the track. Therefore the total consumption from the walk of 202 kilometers amounted to 2,616 liters. Likewise, there were 1,990 liters of carbon dioxide given off.

The total secretion of nitrogen in the urine during the walk amounted to 21.51 grams. This corresponds to 124 liters of oxygen, 99 liters of carbon-dioxide and 570 calories of heat. Accordingly, 2492 liters of oxygen and 1893 liters of carbon-dioxide represent the oxidation of carbohydrates and fats. The respiratory quotient amounts to 0.76 . In the oxidation of fat and carbon-hydrates, 2492 liters of oxygen and a respiratory quotient of 0.76 corresponds to a heat production of 11,842 calories. The calorific value of the entire work rendered during the walk amounts to 11,842 + 570 = 12,412 calories; or, expressed in a mechanical measure,. 5,275,100mkg. Since the results of most of our experiments, made expressly for this purpose, agree that one-third of the consumed energy could be employed in useful work, it follows that during this walk M. performed useful work amounting to 1,564 mkg.

Notwithstanding this unusual activity, it is not the greatest work of 24 hours that has ever been observed. Although we have not enough data for calculating the amount of work done in other individual experiments, yet we can sufficiently show that greater results have been secured than those of M's.

entire distance walk. One of the maximum services is the record made by the bicycle rider Miller in a six days' course in New York. Concerning his muscular output, we have the excellent observations made by Atwater. During the first day, Miller rode a distance of 441.8 miles. This amounts to 710.9 kilometers. Taking the records made by Lee Zuntz as a basis--those however give only an approximate value of the work since no respiratory records were kept in cases of Miller--I have computed his 24 hours' work at 3,288,000 mkg. However, several reductions have to be made from these values. First, Miller had the benefit of superior training; secondly, Lee Zuntz's work was rendered more difficult because he carried a gas meter and therefore had to keep his mouth covered; also the quality of Miller's wheel must have lessened the amount of exertion. But if we make the greatest possible reductions, according to Magnus-Levy, even then the smallest possible value we can get for Miller's first day's ride amounts to 2,100,000 mkg. This amount is considerably greater than M.'s 24 hours' work.

A record approximately as great as Miller's is given by Tissie in case of a bicycle rider. This rider covered in 24 hours a distance of 620 kilometers, which, taking Lee Zuntz's values as a basis, amounts to 3,169,000 mkg.

Now, if we ask for the causes underlying M.'s splendid victory over B., especially whether it can be based upon his

vegetarian fare, then we must consider the striking fact that not only was H. the first, but the five first to finish the race were vegetarians. But we might mention that several of these belong to the lacto-vegetarians,-which I myself found out in the course of the walk. The question, then, is a revelant one, whether the vegetarian fare renders the human organism particularly fit for prolonged activity. This view has been repeatedly defended by vegetarian followers. Especially do they present the analogy that the herbivorous animals are valuable to man because of their great powers of endurance, and that the carnivorous animals are capable of greater momentary activity. Even Bals adopts this idea, but the statement that the carnivorous animals are less adapted to prolonged activity than the herbivorous is scarcely true. According to Heuchecerne, Albu is correct when he points out the extraordinary endurance of the Eskimo dogs in the Polar regions. Again, for the opinion that vegetarian fare is particularly suited for work of endurance, we might mention the extraordinary cases of prolonged activity which are mentioned by Bals in his description of the vegetarian Japanese jinriksha men. This same idea is enforced by the reports concerning Japanese and Chinese coolie labor. But again, the opinion that a mixed fare is unsuited for work that requires endurance stands the fact that the greatest results of which we have positive records were not secured from vegetarians,--

for example, Miller's and Tissie's records that are mentioned above.

But in the realm of walking, the extraordinary accomplishments of the well-known walker Weston must be mentioned. These were reported at the time by Flint and later quite thoroughly by Pavy. The feats of this professional are scarcely inferior to M.'s. In a two days' experiment, which was reported by Pavy, he walked daily 90 miles, which is equal to 149 kilometers a day; and later, in a three days' test, he walked 88 miles a day, or about 142 kilometers. During these experiments he did not live on vegetarian fare.

Therefore vegetarianism cannot be considered the exclusive reason for the vegetarian's victory. Then we must look for other causes to explain his great achievement. Here we must return to the discussion which we raised in regard to the exertion of strength which Captain H. showed at the end of his series of experiments, the question which came up in our experience with Succi's fasting, namely, the effect of the will upon muscular activity. In fact, it is clear to start with that the vegetarian was superior in this regard to his rival. To follow an absolute vegetarian fare today is conditioned upon many privations and difficulties which are overcome only by conquest of self, conquest of social obstacles, and by disregard of numerous criticisms. To start with, then, we can state positively that any one who is able to

follow up a vegetarian diet must for that very reason have developed considerable will power. Furthermore, the same difficulties with which the followers of vegetarianism have to contend in carrying out their principles do not only strengthen the will, but also immediately lead to fanaticism. To substantiate this statement we need only to survey the vegetarian literature; we shall see in what extraordinary manner fanaticism became the champion of this principle. But history illustrates amply the effect upon physical and mental achievements when the will is enlivened by fanaticism. It is possible that, while the mixed dieters considered this contest simply as a sport, the vegetarians were making a complete fight for their ideals of life, and were thus, from a moral view, superior to their rivals. These ideas, it seems to me, explain the fact that five vegetarians were the first to pass the winning post (if we include here the lacto-vegetarians).

And yet, this view does not appear satisfactory to explain M.'s victory over B. In a contest of this kind, a man like the latter, who had won the highest athletic distinction, who represented several associations, who held several records, and one world record, is most naturally enthused by the greatest will power and by a peculiar lust for glory. To explain fully this man's failure, we must look for other grounds.

In the first place, we must consider the fact that M. was not only a vegetarian but a teetotaler, while it can be

shown that even during the final walk B. drank a bottle of wine mixed with water. It is not an easy matter to decide the question whether the effect of the wine which B. drank during the walk was the cause of his failure. This question leads us to the rather difficult problem,- the effect of alcohol upon muscular activity. In general it may be well to avoid the use of alcohol during heavy prolonged physical labor; there are enough illustrations to show that the increased physical ability that follows upon the use of alcohol is only temporary and gives place to a greater depression. From this we may conclude that during physical exertion a man should use alcohol only when he is greatly exhausted and lacks but little of completing his work; then the depression which follows upon the use of alcohol, and which is caused by its effects upon the nervous system, cannot exert its destructive influence.

The results of an ergographic experiment made by Fry are in perfect accord with these facts, and I think he has successfully defended them against the attacks made by Forel and Krapelin. From Fry's experiments it was found that alcohol has such an evil effect upon the unwearied muscles that their maximum working capacity is essentially lowered. But the feeling of fatigue was kept down by the use of alcohol, and consequently the work of the tired muscles seemed lighter. Of course it cannot be denied that the uncertainties of the

ergographic method entered into these experiments, and it is therefore necessary to test the reaction of alcohol upon muscular work by experiments upon the metabolic processes. For this purpose, as far as I know, we have only Atwater's and Benedict's copious and exact tests upon men. These authors express themselves very carefully as to the results, and they conclude that apparently alcohol has a valuable effect upon muscular work, but that this was not positively established by their experiments; but their experiments did not show that alcoholic energy could not be used with advantage in the performance of work. Chaveau's well-known experiments on dogs are opposed to this idea, but we can give them no particular value. That his experiments did not prove the inadequacy of alcohol for the production of energy has been shown quite clearly by me, and particularly by Roseman in a number of articles in opposition to Kascowitz's contention. But even if we are inclined to accept the theories of to-day, that alcohol can bring its chemical energy to the service of muscular activity, yet we cannot disregard the dangers that are occasioned by the use of alcohol during great physical exertion. That the dangers are great in such cases, when the limits of prudence are not kept in sight, -- according to Roseman's and my own views, -- is indicated most clearly by the above cited experiments of Chaveau. It is well, then, to advise any one against the use of alcohol who has to undergo

great physical exertion.

And yet it seems to me that the small amount of alcohol used by B. during the walk cannot be regarded as the cause of his poor results. Opposed to this idea, too, is the fact that he used wine even during his training, and not in very small quantities, as recorded in the table on page 576. But he worked altogether economically during the experiments upon the race track, and his work was surely not much inferior to that of his rival.

Also our experience with other works requiring endurance oppose decidedly the idea that small quantities of alcohol under such circumstances can bring about such disastrous effects. It is true that Atwater has this to say about Miller: "He never uses alcohol or tobacco in any form, and his system of training involved no special deprivations." But from the table that recorded his daily consumption of food, we find that during the first day, when he performed his greatest work, 441.8 miles, Miller drank over 7 liters of Kumish. As is known, Kumish is an alcoholic beverage made of milk, though its analysis gives quite a small alcoholic content, only 0.52% and yet not at all a negligible quantity. But the amount of alcohol used by Tissie's man, when he made his records, was far greater. Unfortunately, the amount of rum and champagne was used not reported; and yet the kind of drink shows that the amount of alcohol could not have been insignificant.

In fact, Tissie declares that a momentary increased activity followed upon the use of rum, but that a reaction soon followed.

But all these considerations are not sufficient to decide just what effect alcohol has upon muscular activity. This question can be answered only by a new lot of experiments; and in this connection, the particular question must be kept in mind, one that has never been thoroughly investigated, namely, how alcohol effects the working power of men who are accustomed to its use. Heretofore, only total or partial abstainers have been used for experimentation, - a procedure entirely justified if we wish to determine only as nearly as possible the effect of alcohol upon muscular activity.

Our considerations in this place are to serve only in determining whether B.'s defeat can be attributed to the use of alcohol. I believe that, after what has been said, this supposition is highly improbable. Indeed, if the destructive reaction of the alcohol did set in, then it could not have lasted long, because of the small quantities used; and since, at first, together with the vegetarian M., he was far ahead of his fellow walkers, this reaction could not have kept him from winning at least a place in the contest, even if he could not carry away a complete victory. I think we shall come nearer the truth if we consider the following as the cause of B.'s defeat by the vegetarian M.; the latter was superior to B. in muscular power and working capacity, and this idea is

supported by M.'s great consumption of oxygen during absolute rest. But B.'s falling behind and his giving up the contest shortly after, can be easily explained; his will power was broken when he saw that he had forfeited the first prize. The consequent discouragement caused him to lag farther and farther behind, and finally to give up the contest, and completion of which would have been at best a matter of shame to him, a sportsman of the first class.

Perhaps, it would be interesting to consider briefly the heat adjustment during the walk, as far as our data will answer that purpose. I have made the following calculations:

During the tests, the insensible loss of weight was recorded for nearly every walk. To secure this the weight of the men experimented upon was taken before the walk, and again after the walk; in the first case the weight was increased by the amount of food consumed, and in the second, by the amount of excretion; and the second value was deducted from the first. We have to make small corrections in these values because of the difference in weight, between the oxygen and the exhaled carbon dioxide. The value thus secured represents the loss of water. By multiplying this with the heat given up through evaporation, we secure the calorific equivalent of the water-loss. By the same method which we used above, we can determine from the data of the respiratory tests the calorific equivalent of walking. From this value we deduct the calories.

lost by evaporation, and thus we find the heat-value given up by radiation and conduction. We thus secure the following data:

The insensible loss of weight by M. on April 25, 1902 from 7 A.M. to 11.15 A.M., amounted to 2.06 kilograms. During this time he walked 24.75 kilometers upon the turnpike and 2.911 kilometers upon the track (Test 1 a and 1 b), all together 27.661 kilometers. To determine the calorific value of this work, the corresponding records of the tests 1 a and 1 b were used. Then I found the calorific equivalent of walking, by using the method of computation shown on page 575. During the entire walk there were taken in 27.661 - 12.97 = 359 liters of carbon dioxide, and thrown off 27.661 X 10.36 = 287 liters of oxygen. 359 liters of oxygen weigh 513 grams and 287 liters of carbon dioxide weigh 562 grams. Therefore there were 49 grams more thrown off with the carbon dioxide than were taken in with the oxygen. These 49 grams must be deducted from the insensible loss to secure the value of water loss. Accordingly this loss amounts to 2,011 kilograms. One kilogram of water during evaporation consumes 580.8 calories; therefore 2.011 kilograms multiplied by 580.8 amount to 1168 calories.

For the entire walk there were consumed	1718	calories
Calorific value of evaporation	1168	"
Therefore, the amount given up by radiation and conduction	550	"

These amounts were over and above those consumed by the resting organism.

The amount of heat taken up by evaporation, other things being equal, naturally depends upon external conditions, particularly upon the surrounding temperature and movement of the atmosphere. Also the humidity of the air plays an important role of more than one significance. On April 25, 1902, the average temperature was 13° C. The air was very dry, at 40% relative humidity. The day was entirely free of wind; the velocity amounted to one meteorological scale,- that is, there was only a slight movement of the atmosphere.

The conditions of M.'s second walk on April 25 were similar. I must state that I used only the respiratory value of test IIIa, not the average form IIb and IIIa. The reason for this is that the chief meal was eaten between test IIa and the final walk for the day; therefore it seemed to me that the values of IIIa were the ones which would represent the values of the walk.

In this way I secured the following results:

Total heat production,	1654 calories	
Given up through evaporation,	989	60%
Given up through radiation and conduction,	665 calories	

The average temperature during the walk was 16°6. The relative humidity was extraordinarily low, amounting to only 30%. April 25th was the dryest day of the year. The velocity of the wind was one.

In like manner I have determined the conditions for b.

The following values stand for April 22, 1902, for walk I.

Total heat production,	1948	calories
Given up through evaporation,	983	= 50%
Given up through radiation and conduction,	965	calories

The average temperature was 9°. relative humidity of 50% wind velocity, one.

For walk II :

Total heat production,	1712	calories
Loss through evaporation,	1047	= 61%
Loss through radiation and conduction	665	calories

Average temperature, 13° relative humidity 50%, wind velocity 2 (average wind).

Walk I for April 26:

Total heat production,	1749	cal.
Loss by evaporation,	1506	= 86%
	243	cal.

Average temperature 8.5°, wind velocity 2 (weak wind).

The relative humidity during this hour varied in an extraordinary manner. The average was 50%, but there were values of 36% and other correspondingly above 50%.

Walk II:

Total heat production,	1727	cal.
Loss by evaporation,	1050	= 61%
Loss by radiation and conduction,	677	cal.

If we disregard B.'s doubtful values for April 26, walk I, then the calorific values of the perspiration secreted by B. and M. were almost equal, namely, between 50% and 68% of the total heat excess produced during the walk. But the conditions

of the weather during M.'s walks were more favorable for the secretion of perspiration than they were during B.'s and yet M. did not perspire more than B. This was due to the nature of his clothing, which was made of such material that the air could easily circulate through it and the perspiration evaporated right from the skin. Zuntz points out that the water secretion of the skin, — which we figured above in the water-loss,-- is not identical with the water evaporation; for, according to the kind of clothing, a part of the perspiration remains in drops within the clothing and is thus not a help in cooling the body. Again, a part of the perspiration evaporates from the outer tissues of the clothing, and thus serves little purpose in cooling the body. M. was clothed during the training walks with porous underwear. B. on the other hand, performed his training dressed in an ordinary linen shirt without collar and in a jacket and trousers.

Also, during the final distance walk, M.'s clothing was adapted to its purpose. He wore thin, wide linen trousers which reached to his knees, and short socks, which left the calves free. His upper body was covered only with a netting shirt. The clothing, then, was appropriate so that the greatest possible absorption could take place through radiation and conduction; also the gathered perspiration could evaporate immediately from the skin as easily as possible.

It follows, then, that in case of M., the formation of

perspiration during his walk from Dresden to Berlin was strikingly small; but the low temperature of 8° average, and above all, the rain that fell intermittently, must have had a very important effect.

According to the weights taken carefully at the start at Dresden, and at the end of Berlin, M.'s total loss in weight during the walk amounted to 3,385 kilograms. But the insensible loss amounted to considerably more, and the weight of food and drink consumed during the walk surpassed significantly that of the urine excrement. We found thus an insensible loss of 5,618 kilograms.

For the entire walk, the amount of oxygen taken in was 2616 liters, the amount of carbon dioxide given off, 1990 liters, 2616 liters of oxygen weigh 3,741 kilograms, 1990 liters of carbon dioxide weigh 3,792 kilograms. To the respiratory changes there is due, then, a loss of 51 grams, which have to be neglected in such approximate figures as we have given. The later-loss corresponds to the heat production of 3263 calories. The calorific value of the total work, as calculated above, amounts to 12,412 calories. Through evaporation there was a loss of 3263 calories, or 26% of the whole. Through radiation and conduction, then, there must have been 9149 calories above the rest-requirement. We may notice here that heat is given up in two kinds of evaporation,-with vapor of the breath and with perspiration. According to calculations

based on data taken from Zuntz and Schumburg, I find that of the small amount of heat lost through evaporation, about 28% is given off with the passage of the breath.

If we look once more upon the results which are to bear upon the significance of the vegetarian fare from a physiological standpoint, then we must take into account that, according to the testimony of the men experimented upon, pure vegetarianism was followed mostly as a temporary mode of living. Captain H. did not live exclusively as a vegetarian, but ate "occasionally both cooked, roasted and baked vegetarian food, milk and bread and butter." After the tests, he returned to cooked, eating-house board. Similarly, the vegetarian distance-walker M. told me that when he returned home after the victory, the first thing he did was "to drink a mighty bowl of sour milk."

But we have learned conclusively from our experiments that a pure plant food, particularly uncooked food, can maintain a strong young organism at the highest point of physical and mental vitality and capacity. And yet this kind of diet seems undesirable, for these reasons:

1. The total food-stuff of this diet is not thoroughly assimilated, particularly the albumen. This fact has been shown in all experiments known to me. Even in the most favorable case (Taniguti) the loss of nitrogen in the excretion was as large as it was in an exceptionably unfavorable experiment with the mixed diet (Loury, Zuntz).

2. The vegetarian food is unattractive.

3. Too large quantities must be eaten (Mori.)

But objections 1 and 3 can be partly overcome by the use of Kellogg's preparations; and objection 2 by the application of spices as the Japanese use them.

The poverty of albumen in plant food comes forth only when the food is not properly prepared.

Among the advantages of a vegetarian fare, its cheapness is of great importance.

But the view is not sustained that, because of its lack of uric acid, the vegetarian diet is superior to the ordinary mixed food. On the other hand, the indication is clear that there is a small amount of purin bodies when compared with an excessive meat fare and with cases that belong to the realm of pathology.

Concerning the working power, in general the vegetarian food certainly offers no advantage over the mixed.

I believe that through the physiology of nutrition we can now answer all questions about this phase of vegetarianism in a clear, unequivocal manner. Only the question about uric acid demands further investigation and more positive decision.

Dr R. W. Corwin of Pueblo, in the New York Modern Medical Science gives an interesting account of the medicinal practices of Ancient Egypt. The doctor says:-

~~MEDICINE IN ANCIENT EGYPT.~~

~~BY R. W. CORWIN, M.D., PUEBLO, COL.~~

At the very dawn of the world's history, medicine was given a place to be envied- a place beside the gods and rulers. If the position of the doctor be questioned today, there was a time when he occupied a station beyond dispute. He may never again be so appreciated, but once he mingled with gods, and was no less than a little god himself.

Chnemu, the god and physician of the Upper Nile, put together the scattered limbs of the dead body of Osiris. On the beautiful temples at Philae, he was represented making man out of clay on a potter's wheel.

Isis, goddess of Philae, demonstrated her eminent medical skill by recalling to life her son, Horus.

Imhotep, the Egyptian Aesculapius, whose temple stood at Memphis, and Chunsu, the counsellor of the sick, are often mentioned, but were of lower rank.

Thot, a god represented with the head of an ibis or a dog, enjoyed great respect as inventor of art in general, and especially of the healing art, and Thot is supposed to have been the author of the oldest Egyptian medical works, whose comments were first engraved upon the pillars of stone, and subsequently formed part of the so-called "Hermatic Books."

The cat-headed Pacht exerted such influence over parturient women, that the cat was made sacred to this goddess, and the killing of a common, nasty, lemon-colored cat was punished by death. Today tons of mummy cats are being exhumed, having been preserved thousands of years with great care and ceremony.

The gods were worshiped through the priests or doctors. In the early period of Egypt's existence, we are led to believe the doctor played a most important part as the representative of the gods, and perhaps he may be pardoned for having felt at times that he was a little deity. But even then he was more modest than some healers of the twentieth century, who claim to be a large part of God, if not the whole thing.

Each city and place had its gods; each god, his doctors. People moving from place to place took their little gods and their great gods with them. This confused matters and multiplied the places of worship and the number of doctors(as badly as now). So great and rapid became the confusion and multiplication, that a reaction was created, and a change was found necessary. The number of gods made it difficult for the people to get around to pay their respects; the numerous places of worship became expensive, and the offerings burdensome.

It was clear that the number of gods must be curtailed, the places of worship made fewer and expenses reduced. All this necessarily affected the doctors. There was but one way- namely, consolidation- and an amalgamation of divinities was instituted. A trust of, if not in, gods was formed. This is one better than Mr. Morgan has proposed, but there is no telling what he may have in mind.

In the early days of Egypt, patients were sent to the temples for treatment if able to move or be moved, or sat beside the road where they might be seen and prescribed for by those who had had similar

ills.When a priest doctor was called to the bedside of the sick, his only hope of curing thepatient was through prayer. In those days it required no thought or knowledge to be a doctor, no expreience was of service, no scientific investigation desired; dissection was considered unholy; vivisection criminal- even the undertaker who made the incision for disemboweling for embalming was mockingly whipped, stoned and chased. Prayer and faith were the "All-in-all;" incantations, the only possible means of cure. These ignorant, superstitious healers depended entirely upon mental impression. If the malady was slight or the endurance of the patient great, the prayer healer got the credit of effecting a cure. If the patient died (although in that day it was claimed there was no death,) evil influence, stronger than the power of the gods, predominated, and the prayer of this self-appointed, ignorant priest, doctor or healer, like those of the sinner of the present time, availed nothing. The world still moves in cycles.

If you go to Sakkarah, some twenty miles from Cairo, and search among the step pyramids, you will find a small and unostentatious tomb, but one of deep interest to any physician. It is the tomb of Dr. Sek-het-enuanch. Dr. Sek-het-enuanch was the chief physician to the Pharaoh Sakura, who lived about 3133 B.C., and the first physician of whom we have authentic record. As represented upon the tomb, the doctor carries twoscepters, the emblems of power and rule, which were alone for the highest dignitaries. He wears a panther's skin, which formed part of the dress for a noble.

The inscription on the tomb states that the doctor healed the nostrils of Pharaoh, and, as a reward, the king gave him two limestone slabs, which the temple masons inscribed.

Eber's Papyrus is the oldest authentic history of medicine extant. This papyrus bears the date of the 16th century B.C., and was one of the most important discoveries of the 19th century.

While in Luxor, Prof. Ebers met an Arab who gave him a roll of papyrus, which it was stated had been found twenty-four years before, along with the bone of a mummy in a tomb of the Theban Necropolis, which which is some miles further down the Nile.

This papyrus, which was 20 meters long, just 66 2-3 feet or four rods, and a little less than a foot wide, divided into 110 pages, contains many marvelous statements regarding medicine. The calendar, as deciphered, proves this medical work to have been written in 1552 B.C., thirty-five centuries ago. This was prior to the Exodus of the Israelites; Moses had just reached his majority. The following are the heads of chapters:

(Page) 1. Of the preparation of medicines. 24. Of salves for removing the uhan. 47. Catalogue of the various uses of the teguem tree. 48. Medicines for alleviating the accumulation of urine and diseases of the abdomen. 55. The book of the eyes. 65. Medicaments for preventing the hair turning gray and for the treatment of the hair. 66. Medicines for forcing the growth of the hair. 79. Salves for strengthening the nerves and medicines for healing the nerves. 85. Medicines for curing diseases of the tongue. 89. Medicines for the removal of lice and fleas. 91. Medicines for the ears hard of hearing. 99. The secret book of thephysicians. The science of the beating of the heart and the knowledge of the heart as taught by the priestly physician Nebsecht.

Rameses 111 punished with death the sorcerer and magic healer. It is fortunate for some that Rameses 111 did not reign thirty-five centuries later.

It is thought by some that the Egyptians went very extensively into specialties, that physicians confined themselves very closely to a single class of cases. It is known that there were those who gave their whole attention to the eye, probably for he same reason that there are those who do so today in Egypt, i.e., on account of prevalence of eye diseases.

Diseases of the stomach, abdomen, and urinary bladder received much attention, as well as the nose, ear, and ulcers. The bowels undoubtedly gave the early Egyptians much trouble, and no doubt the appendix commenced on its miserable mission thousands of years ago.

Pills, potions, plasters, inunctions and inhalations were used. The last chapter of the papyrus treats of tumors, and recommends that they be tested with the finger, and generally operated; but there was one kind which became covered with pustules, and caused sharp pain- they advise no interference. This they called the tumor of the god Chensu.

Considerable attention was paid to gynaecalogy. On page 170 prolapsus of the uterus is mentioned thus, "A remedy to enable the uterus of a woman to return to its proper region." The remedies are, "Honey and petroleum," applied locally with the finger, and the uterus pressed into place. Also the fumes of wax and hot charcoal were recommended to be allowed to penetrate the uterine cavity. Page 171- a receipt is given to enable a woman to give birth to a child, and on the next page, abortion is apparently alluded to.

Also remedies for the corrosion of the vulva, producing round postule in the vagina; a remedy to prevent disease starting in the

labia, and against shooting pains in the vagina; to prevent inflammation of uterus, which consisted of an astringent wash of palm fruit and cypress blended with oil.

"When fluid escaping from the vulva is like water"- a medicated linen pessary was introduced into the vagina and left for four days.

Vaginal suppositories were used. Vaginal and rectal injections resorted to, and fumigation not unknown.

Between the time of the writing of Eber's Papyrus and the establishment of the Greeks in Egypt, the Egyptians retrograded and resorted to sacerdotal offerings and superstition. There seems to be a period of darkness, like that which possibly is threatening our people to-day. Was the exhibition witnesses in Chicago, but a few days ago, of a burned woman and child, whose friends, father and husband denied her rational assistance, anything less than a sacerdotal offering? A burned woman placed upon a bed or altar, around which gathered a number of ignorant, superstitious inhuman beings, asking their godsto appease suffering and heal and restore burned tissue?

Or the woman who died in childbirth in the presence of this class of fanatics, and could have been relieved by a light operation, according to the testimony of the physicians who afterward examined the body?

It is said that there are a million people in the United States who are desirous of plunging this country into the depths of darkness and degradation of the Egyptians of the 25th dynasty.- Denver Med. Times.

L.H.Jl. By Samuel Crowthers.

PROHIBITION

The production of the country has increased within ten years by between 25 and 30 per cent instead of at the normal rate of about 15 per cent. We have had a clear gain of about 15 per cent. The margin between "bad times" and "good times" is rarely as much as 15 per cent; when in the past we went down 15 per cent, we were flat on our backs and the bread lines were everywhere.

In ten years we have not only increased by more than the margin between good and bad times but have added another 15 per cent. It is in this extra percentage that we find the cause of our abundant prosperity.

The one great and fundamental change that has taken place in this country during the past ten years has been the coming into force of the Prohibition Amendment.

It is a great economic experiment in changing the direction of the spending of money.

Prohibition is an economic success.

It is absurd to trace any of our prosperity to the war; one does not gain wealth by squandering it.

The farmers have, most of the time, been in straightened circumstances.

Coal-mining industry and textiles have been in a bad way much of the period.

There is a keen desire to work.

The outstanding fact of Prohibition is that, by diverting expenditures from drink, it has made the country prosperous.

During the last ten years, the United States has become infinitely the richest country that the world has ever known..... We everywhere regard poverty as an abnormal condition.

Mr. Edison thinks"we have about a 60 per cent enforcement. We can never expect a 100 per cent enforcement of the Prohibition or any other law.

" If we get an 80 per cent enforcement, no country anywhere can compete with us in anything..... We are steadily developing to a point where drinking will not fit into any of our programs in or out of the shops."

The total income of the nation for 1919, as found by the President's committee, stood at not quite $66,000,000,000. It dropped to $63,000,000,000 in 1921. For 1928, it was put at $89,000,000,000

Money diverted from drink to goods can be counted as new money.

Professor Feldman, of Dartmouth, the only man in the country who has made a real study of the economic effects of Prohibition.

Absolute unanimity of opinion that wage earners are spending more on their families than ever they did.

Increased savings accounts.

There are fewer cases of distress among employees reported from time to time.

Men either own or are paying on homes, own automobiles and many other present-day conveniences.

Families are saving more and they are buying things they could never afford before.

The chief executive of a company said that before Prohibition it was usual to have from fifty to one hundred women in the office on the morning after pay day asking for advances because their husbands had spent all their money in the saloon before coming home. In the past three years, he has had exactly two such applications.

A supervisor in one of the larger cities estimated that $200,000 a week was now being taken home that formerly went into saloons.

Testimonies of different firms were given showing that their workmen were spending less money for drink than before Prohibition.

A LECTURE TO THE SANITARIUM FACULTY IN THE SANITARIUM CHAPEL, BATTLE CREEK, MICHIGAN, MONDAY, OCTOBER 26, 1925, AT 2:00 P. M. BY DR. E. P. CUMBERBATCH, DIRECTOR OF THE PHYSICAL THERAPY DIVISION OF ST. BARTHOLOMEW'S HOSPITAL, LONDON, ENGLAND.

Dr. Stewart: We are very fortunate in having with us this afternoon Dr. Cumberbatch who is chief of the Physical Therapy Division of St. Bartholomew's Hospital in London and a man well qualified to speak on the subject on which he will speak this afternoon. (Applause)

Dr. Cumberbatch: Ladies and gentlemen:- The use of electricity or of light in the treatment of disease has a long history. Electricity has been used in medicine for 175 years but it made no progress at all until the beginning of the present century, 1900, and the reason for that is the fact that nobody could give any explanation why the various kinds of current could cure or relieve disease. They were applied empirically on the chance that the wonderful electricity could drive the disease out of the body. The reason why electricity or electrotherapeutics has advanced to a science that occupies its present position in England, a position in which it is regarded as a definite branch of medicine and has a diploma granted to it by Cambridge University, is the fact that we know now how electricity acts in curing disease. We know its method of action and we can say in a sentence that electrical currents owe their power of curing or relieving disease to the power of producing well known chemical or physical or thermal changes in the tissues. That is one proposition. Electricity cures not because it is electricity but because it produces definite changes,either thermal or physical or chemical--chemical, physical or thermal.

We know these changes. Therefore, we can tell how it acts in curing disease and we can also in that way get a clearer estimate of the type of disease likely to be benefited.

In the matter of light, we are fortunate in having well known chemists, physicists, physiologists and pharmacologists in England who have worked the thing out from basic principles, and we can say that ultra voilet light owes its power in producing the results we see to its power in producing either thermal or chemical changes. Now I want to give you some instances to show why that is the case. You have probably heard of a treatment called high frequency. High frequency was introduced into medicine in the late nineties of the last century by d'Arsonval of Paris and he found the current possessed certain therapeutic advantages but he could not give any explanation of how diseases were cured by high frequency, and high frequency treatment after a year or two of great expectation was followed by disappointment and it was going fast toward the rubbish heap but it has been shown in the early years of the present century that these high frequency currents when passing through the tissues,heat them up. If you pass this high frequency current through any part of the body like a knee joint, it heats it up, and we have as a result of that diathermy which means through heating. Since that has been established the treatment noticeably diathermy has increased far and wide and its scope is larger than before and at the present day it is one of the most valuable agents in the whole of therapeutics--diathermy--through heating, so these high frequency currents passing through the body heat it up and are able to produce shock or stimulation in the part to which it is applied and it heats them up. Let me give you a few examples of how valuable diathermy is in the treatment of disease. We can put it rationally into four groups of four maladies for which diathermy is an extremely valuable treatment. One of those

is a disease which has no name but is very common and if you look around you will see many cases in need of attention which should be given. The patient, generally a woman, complains of cold, cold hands and cold feet, sometimes dyspepsia, headache and if you take her temperature you will find it subnormal. You have a patient before you who resembles a fire which has burned low and it wants to have a poker used to it. That patient is not making enough heat. All the physiological processes of the body are working less effectively than they should. They require heat. You can give them heat by diathermy. You can elevate the temperature of the body one degree, two degrees, three degrees, four degrees or five degrees of temperature to the whole body andhaving supplied it with heat which it cannot supply itself, the symptoms disappear. The patient may have perhaps neuritis or deficient circulation or swollen hands and feet, numbers of maladies, but if you can get the temperature of the body up to normal and make it stay there, the malady in itself spontaneously improves and can be further improved by other treatment. Yes, why not get near a fire? Why not get into a hot water bath? (21518) Why not expose yourself to radiant heat? There is all the difference in the world in healing through those methods and by diathermy. In all other methods you heat the surface of the body and much of the heat is lost, but with diathermy you heat the body through and through. Patients with subnormal temperatures accompanied by other symptoms, if they are treated by general diathermy will increase in weight . The second malady is cerebral neuritis associated with pain. If you will apply diathermy to the region to which the pain is referred,you will get relief in a good proportion of cases which have resisted other methods. The third malady is arteriosclerosis. This being hardening of the arteries and high blood pressure will show a lowering of blood pressure to a considerable degree, and a disappearance of other symptoms. The fourth is still more romantic and that is a subject upon which I have been working for the last few years in St.

Bartholomew's Hospital, social disease, one of the curses of modern life and a world-wide problem, that is, the disease caused by infection with the gonococcus. It afflicts all races and as I say is one of the scourges of civilization. Ordinary treatment has very small effect upon it. The gonococcus happens to be sensitive to slight rises of temperature. It can be killed at a temperature which is insufficient to destroy your living tissues. Suppose we have a patient infected with gonococcus-- and it can produce a very severe form of neuritis. Apply electrodes front and back heated to a temperature of 105° or so and the gonococcus will be killed. The temperature is too hot for it. It dies by heat stroke. There is even a better method of treatment and a method which we have now adopted in all our cases and that is to treat the primary focus from which infection takes place, that is the cervix uteri in female subjects and the prostate gland and seminal vesicles in males. Those are the gates to metastasis, and if you apply diathermy to those parts and kill out the organisms there, those conditions will come to an end themselves. For gonococcal rheumatism and for infection of most parts, diathermy is a specific treatment. We talk about treatment by high frequency. We have not talked about using it for infections, but now we know it is a correct treatment for infections by this heat sensitive organism. Those are some of the instances of the use of diathermy for medical diseases. It is also valuable in surgery because you can raise the temperature of the malignant growth through and through to make ot coagulate in situ. A red hot metal will carbonize if the parts come in contact, but if you direct the diathermy current through your malignant tissue this temperature rises and rises and rises and rises until it is just sufficient to coagulate your living tissues like the white of egg. They will coagulate inside of you and all malignant cells in that region are destroyed. Bacteria are destroyed, small blood vessels and the lymphatics are

sealed and therefore there is far less risk of dissemination. That form of treatment has been adopted inpreference to the knife by my colleague, Dr. Harner, of St. Bartholomew's Hospital. If a thing is adopted and recognized in England, it is a good credential for it because England will not adopt new things unless she is sure of their value.

I must pass on to another proposition--That electrical currents are able to produce curative effects by the powers of chemical or physical changes in the tissues. Supposing you happened to have a couple of electrical needles. Put them on a piece of moistened paper. They will grow red on one end and blue on the other. Anybody can demonstrate these changes. Suppose we happened to have a naevus which is such a common thing in infancy and young children. Suppose you take four or five needles, connect them alternately to the positive and negative poles of a battery, you get acid on the positive and alkali on the negative. Then destroy the vessel wall in the naevus. It will change the naevus from a fluid tumor to a solid one. The coagulum is ultimately replaced by fibrous tissue and you have cured the naevus. That is a chemical action. You may take a single needle if you like, put it along the base of a wart. Use either positive or negative and produce either alkaline or acid caustics, just as you want, at the base of the wart, using a weak current and your wart will shrivel up and break off after a few days. That is due to chemical changes. What is the advantage over nitric acid? In nitric acid you have got to wait for it to wear off, a slow process, and it may get on your trousers or on your skin and is bad for them, but with the electricity you can regulate the treatment by the strength and power of the current. It is an elegant way of treating a wart. Those are instances of chemical action. Suppose we have a patient with a dislocation or trauma of any part, or inflammation, particularly caused by injury with their exudation of fluid. It is well known that if you pass a galvanic current through a conductor,

the water migrates away from the positive pole to the negative pole. In other words, the negative pole becomes softer, more watery and the positive pole becomes drier. If you pass an electric current and put your positive pole over it, then the fluid will run away from one electrode to the other one and that aids absorption of inflammatory products. That is a physical change. Take an extremely difficult ulcer, one of the eye, a type of corneal ulcer known as Murons(?) ulcer, which is semi-malignant. Nothing will stop it. It is a slowly growing, untractable ulceration. The only treatment which is valuable for that is electrical treatment. When the positive pole is connected to the current what we call ions of metal are detached and migrate into the tissue. It is a migration of the ions--ionization, or ionic phoresis. You can see the transparent, comedular tissue becoming white around. You can make it just as much as you like or as little as you like or where you like. Every cell, every nucleus, every nucleolus is permeated with the ionized current and destroyed. That is the only method of healing that sort of ulcer. That is an electrical-chemical method. The subject of ionization--if you dissolve a salt in water, the molecules disintegrate and form what we call ions. Some ions are positive as metals and alkaloids, and others are negative. Supposing you put in contact with the body a solution containing ions and connect that to one pole, the ions given the same charge, will be driven away into the tissue. That is what we call ionization, and is a method of introducing metals into the tissues which has advantages of its own. Every cell is penetrated by the ions. The penetration is not a particularly deep one but where it does penetrate it is a most excellent method of making an introducation of ions. Supposing you have a scar following trauma as from a bullet wound. The chlorine ion is admirable for softening scar tissue. It proved its value during the war. If you make a solution of common salt, soak a pad

with it the chlorine ions being negative, will be driven away into the tissue if you connect the electrode to the negative pole. This will cause the negative ions to be repelled into the scar tissue. If you persevere with that treatment you will soften the scar tissue and reduce adhesions. Of course, you could not expect results in one application or two or three, but it should be applied twice a week for six or eight weeks. The value of the results is uneustionable and is attained also by radiant heat. It has passed the stage now of experiment and has become an established fact.

Another ion is also useful as a pain reliever, the salicylic ion. If you have pain in certain areas, soak a pad with salicylate and you can induce a very satisfactory form of counter irritation without damage to the tissues.

Just one instance of mechanical action.If you set the machine or a Leyden jar and discharge it through the body,you get a tremendous contraction. In the modern form of static machine, a much bigger affair using a much bigger charge of electricity, it is possible by using such a method to apply an electrode over any soft part you like and make the sparks go readily across the discharging area and you get a rhythmic contraction of the muscles;and that form of treatment is a very useful one if you get a myositis with adhesions common enough in the lumbar regions. It is not the electrical influence but the mechanical influence. You have produced a violent muscular tug and adhesions to themuscles and the fascia are closely broken down. This is a mechanical effect entirely and not electrical. Those are a few examples of what we said of all electrical effects, but thereare other effects--physical and chemical,or thermal influence in the body. When you are giving ultraviolet light, either mercury-vapor or the carbon arc, the light which we use in England, you are giving not only ultra-violet but

other forms of radiation as well. You are giving heat radiation and luminous physical light radiation. These ethereal waves which produce the ultra-violet are all measured in definite units. I want to put down some figures which I shall not explain but will give you an idea of what I want to convey to you. First and foremost you must remember that if any wave of radiant energy pass through the body without absorption, it has no effect. It is only when the waves are stopped partially or entirely in the tissues that they have action whether good or bad upon the tissues in which they are stopped. I will draw a section of the skin. This represents the horny layer of the skin and through it the living epidermal cells and these represent diagramtically the capillaries and papillae. Then this represents the deep fascia and underneath the superficial muscles. The shortest ultra-violet light is measured in units which I will put down as eighteen Armstrong units. The ultra radiation goes from eighteen up to 39. The shortest, 18, 19 and 20 do not reach the skin at all because they are absorbed by the air. The shortest ultra-violet rays are stopped by the air and do not reach the skin. Therefore, they cannot have any effect--from 18 to 20. The next four, 20 to 24, wave lengths are stopped in the horny layer. They are stopped by this layer and since this layer is a dead tissue, it represents the dried bodies of dermal cells which have no action. The next, 24 to 29, go through the horny layer but they are stopped in the superficial epidermal cells. The next 29 to 33 go down to the deep epidermal cells. We might say that 33 covers the extreme bottom layer and 29 the layers above. From 33 to 39 they go clear through the living epidermal cells and they are stopped by the blood in the capillaries. They have no action at all upon the epidermal cells because they go clear through them. We come now to the visible light rays. Those are from 39 to 78. Those penetrate and the red ones and the

yellow ones go right down to the deep fascia and to the superficial muscles. They go in a tremendous distance. Those are the red rays. The green ones do not go so far and the violet ones least of all. They practically do not go any farther than the capillaries. Now we come down to the infra red. These are radiant waves which you feel when you put your hand in contact with a hot lamp. Those are absorbed and only penetrate a short distance. You can see we are dealing with the whole spectrum and this shows the effects which the different rays produce. The infra red rays heat the skin and heat the surface of the skin most of all and when you get ever so short a distance below the surface the heat rapidly comes to an end. Other layers of skin or the surface heaters never heat deeply. The visible rays of colored light have in themselves no definite effect but the colored rays are first absorbed by the tissues, are transferred into heat, and these red rays which are absorbed down in the deep fascia are transformed into heat and you can raise the temperature in these muscles whichlie down below. The 30 to 39 lengths are stopped by the blood capillaries and produce heat--heat the capillaries. The remaining ones are stopped in the cells. We know that the ultra-violet light radiation is stopped in living epidermal cells which produce certain changes. The first is a bactericidal effect, particularly the shortest ones just going through the horny layers of a bactericidal action. The longer ones produce certain changes in the epidermal cells which ultimately result in cure. What those are we do not know altogether, but one of them is known and that is a substance which is produced by the action of the ultra-violet light upon cholesterol. Cholesterol is activated as we may say by ultra-violet light. Wherever living cells are, we find cholesterol, activated cholesterol--it must be activated before it can fulfill its function. If you have an animal or a child with ricketts the reason why ultra-violet light will cure it, the

reason why it is specific is because it produces these changes upon the cholesterol present in the epidermal cells. It is present incod liver oil and can be activated in the cod liver oil by ultra-violet light. There are probably other substances which are formed in the epidermal cells which are absorbed into the body and have therapeutic action. When the light shines upon the skin it is latent but after three or four hours the skin reddens and that is followed by a desquamation and later after a numberof exposures you get pigmentation of the epithelium. Those are the outward signs of the changes taking place in the epidermal cells. Now with regard to the action. These heat rays act only as heat. Heating the tissues is helpful in chronic inflammation. Infra red or surface heat produce heat action in the blood and capillaries. The rays which fall from the living epidermal cells produce chemical action and most important of all of those is this that if you irradiate the living epidermal cells with ultra-violet light you get increased hemo-bactericidal power of the blood. That is established beyond doubt. The power of the blood for dealing with infecting organisms can be increased by ultra-violet light. That is one of its most important actions. The action of ultra-violet light falling upon the skin has also been proved to increase the number of blood corpuscles, also the number of white blood corpuscles; and also in addition to that it increases the amount of iodin in the thyroid gland. That represents the pharmacology of the ultra-violet light, the rays which produce chemical action.

Just one or two words about the therapeutics. What are you going to treat? What are you going to cure? What are you not going to cure? What are you going to make worse? No. 1. Specifically ricketts. You can just as well claim that ultra-violet light applied to children with ricketts will bring the process to a close. Calcium and phosphorus are increased in

the amount absorbed in the body. It can be demonstrated upon animals experimentally and upon human beings. Another malady called tetany. It is an uncommon one and ultra-violet light is a specific for tetany as well. 2nd. Calcium in which ultra-violet light is not a specific but it is effective. First of all the wasting baby, a baby who apparently has not any organic disease but does not thrive,is poorly nourished. It is cautiously and gently irradiated with ultra-violet light. The majority of those cases will become perfectly nourished. Occasionally you get the reverse.

We come to tuberculous patients--tuberculous infections of the skin, lupus. Ultra-violet light is an excellent form of treatment. Also in tuberculosis of the glands it is a valuable treatment. Sometimes glands shrink into hard nodules; sometimes they get soft but you can then aspirate them. The ultra-violet light softened them up. It is also valuable in the treatment of the bones and joints. If there is in addition septic infection and discharge, ultra-violet light is admirable for this. You must choose a case which is preferably chronic and afebrile. It is unadvisable as a general rule to apply ultra-violet light to acute infections. Now we come to the third. A lot of people are working and some rushing into printin which they claim to show that headache, biliousness, high blood pressure, insanity, undescended testicle, irreducible hernia, etc., are all benefited by ultra-violet light. It is possible that ultra-violet light is of value in some of these but do not rush into print over it. Work it carefully and cautiously and consult with the determatolgist or some other specialist who can advise you. I should mention septic infections, acne vulgaris, boils and carbuncles.

Now last of all cases in which you must not apply ultra-violet light and of those one is pulmonary tuberculosis. It has been shown that it will wake up the infection and make it worse. I do not say that nobody is ever again to treat consumption by ultra-violet light but you must be an experienced physician and in employing ultra-violet light must be sure you are using it properly. Rollier treats pulmonary tuberculosis by sunlight but he has something else also and that is fresh, clean air. Do not forget that. Another contraindication is acute febrile cases. Again I say it is not the universal rule, but be careful. It is inadvisable in highly nervous people. Some people say it should not be used either in extreme old age. I am afraid I have attempted to give you rather too much of electrotherapeutics because it is naturally a very large subject and nobody knows it all even now. Electricity and ultra-violet light are simply branches of electrotherapy, chemotherapy or physiotherapy." (Applause)

Dr. Stewart: I am sure we are all greatly indebted to Dr. Cimberbatch for his illuminating talk and I want to extend to Dr. Cumberbatch our sincere thanks.

DEMENTIA PRECEDING AND FOLLOWING INEBRIETY.*

T. D. CROTHERS, M.D.
HARTFORD, CONN.

A study of the early history of inebriates, particularly of the period preceding the use of spirits, indicates the presence of psychosis, and frequently, degrees of dementia which are unrecognized at that time, but later develop into the drink symptoms.

In persons with a traceable heredity and history of degenerative parents, neuro-psychopathics are easily recognized, but in others who have no hereditary history and seem well up to the beginning of the drink period, previous psychoses have not been studied or recognized.

The theory prevails in most circles of medical literature that the onset of inebriety is a mere chance condition, or an accident which might have been prevented, and is largely under the control of the person. There has been no recognition of an earlier preliminary stage leading up to the alcoholic psychoses. This failure has resulted in confusion and conflict of theory and treatment, with consequent quack remedies and charlatan means for cure and prevention. When this early preliminary stage is examined in persons without any hereditary history, many distinct neuro-psychoses appear associated with changes of character, conduct and physical vigor.

A grouping of some of these conditions will be of interest and throw light on the mysteries which surround the history of the cases. In a general study it would appear that traumatic and chemical injuries are often followed by the use of spirits. Of traumatic causes, early injuries, such as blows and falls on the head, broken legs or contused wounds, with periods of invalidism, more or less severe, are most common. Many persons have a history of such injuries, attended with unconsciousness, great feebleness, slow recovery, and much debility and pain, with nervousness; they suffer from distinct changes in health and vigor. When these causes occur before puberty, this period is often followed by a disappearance or interruption of all the symptoms enumerated. If they occur after puberty, in early manhood, often complex neuroses follow, which lead up to inebriety. Cases of this class may be outlined in the following examples:

A boy, 10 years old, in previous good health, received a concussion from a fall, and after a long convalescence suffered from morbid fears when on high places, and was extremely sensitive to every possible danger from falls and other injuries. At puberty these fears developed into hysteric states of alarm at falling from wagons or from windows of houses which he was in. From this he slowly recovered, and later began to use spirits to give him courage to walk over a bridge on the street he lived in.

In a second example, a young boy of 18 suffered from contused wounds in a runaway accident. He was unconscious, and afterwards suffered from great nervousness, never regaining his customary strength, and showing extraordinary timidity for a long time. Then he began to use spirits, and this nervousness passed away.

A class of injuries in which great mental excitement precedes and is associated with some accident, frequently induce the use of spirits. Thus, a healthy man was in great peril from drowning, and escaped with but slight injury and shock. The effect of the psychical shock was diminished vigor and strength, which continued for a few months, and then he became a drug-taker and later used spirits.

In another case, two men, both temperate and well, were severely shaken by a railroad accident. The alarm and sudden peril of impending death so impressed them that for a time they were partially paralyzed. A long period of invalidism followed, ending in both using spirits and drugs.

Many very marked cases have been reported of persons who from sudden profound grief at the loss of friends or members of their family, have become invalids, and afterwards developed inebriety. Sudden overwhelming joy has likewise produced profound disturbances of the co-ordinating centers, and afterwards culminated in inebriety. These traumatic causes include almost every possible injury in which there is associated with the physical injury great mental disturbances and depressions. Common injuries associated with drains upon the system, such as protracted hemorrhage or mental strains following pain and suffering, leave an impress on the nerve centers which can be traced in changes that develop spirit and drug-taking.

Many cases which have histories of sudden, unexpected development of the drink psychosis can be referred back to fevers, inflammations and acute diseases which have left a profound impression on the nervous system. Thus, a typhoid or pneumonia, with a long period of convalescence, marked by distinct mental symptoms and extreme prostration, impairs the vigor and leaves entailments which develop the drink psychosis. Sunstroke and heatstroke are also causes which seem to alter and change the normal rhythm and vigor of life, leading to the same results.

It is claimed that a large majority of nervous cases treated with alcohol have developed spirit or drug psychoses in later life, particularly persons who had suffered injuries or diseases which were followed by great exhaustion and long convalescence. In such cases dementia is marked, but it is difficult to say whether the dementia following from alcohol was due entirely to the alcohol given as a remedy for the neurosis or to the injury produced by the disease, but at all events their frequency and intimate association point to cause and effect.

A second class of causes which are becoming more and more apparent from careful researches may be termed chemical or autogenetic. The chemical poisons are intoxications from alcohol or drugs. The profound stupor and delirium which follow from an excessive dose of alcohol taken for the first time may so profoundly impress the system as to leave it permanently injured. Many instances are recorded of persons whose invalidism and debility dated from the first intoxication. They may never use spirits again until middle life or later, but the mental and physical impression dating from the first intoxication has been so pronounced that there can be no doubt of its persistence. Cases like the following are not uncommon:

A young man at the time of his graduation from college became profoundly intoxicated. The depression, both physical and mental, following this event continued for years. Then he was given spirits as a medicine in typhoid fever. From this time he became an inebriate.

A second case was that of a temperate man who, after a snake bite, consented to drink large quantities of spirits until he became intoxicated. He recovered, but was

* Read at the Fifty-second Annual Meeting of the American Medical Association, in the Section on Nervous and Mental Diseases, and approved for publication by the Executive Committee: Drs. Frederick Peterson, Hugh T. Patrick and H. A. Tomlinson.

never well after this, always complaining of debility and mental dread of disease and death. Some years after he suddenly began to use spirits to excess, and became an inebriate.

Cases are not infrequent of persons who have taken large quantities of spirits without a visible exciting cause, and become suddenly intoxicated, recovering with great mental depression, and ever after showing changes of character and conduct that finally developed into inebriety. A few cases have been mentioned where profound narcosis from opium has resulted in some obscure changes and final inebriety. A dose of arsenic taken by mistake, producing gastritis, was followed by a long period of indigestion and invalidism, and finally ended in spirit excess. No doubt there are many cases of this kind in which the early causes are overlooked, but from the few cases reported it is evident that a severe poisoning of the system from either vegetable or mineral drugs not infrequently precipitates states of degeneration and dementias which lead up to drug and spirit taking.

Another field of early poisonous influences has been traced to the formation of toxins in the body. Persons who have neglected many of the common rules of living, and who suffer continuously from what is termed dyspepsia and imperfect nourishment, frequently develop states of mental debility which go on in a progressive march to inebriety or some complex form of insanity.

Cases like the following are often noted: A temperate man, from neglect and defective eating, became a hypochondriac with delusions about food; he suffered from an attack of fever and began to use spirits to great excess, and died from delirium tremens.

Persons who overwork, and are in constant mental strain without proper rest, and who neglect the nutrition of the body, frequently have periods of invalidism and defects which lead up to inebriety. The underfed and the overfed who neglect the ordinary rules of living are subject to auto-intoxications and auto-infections which profoundly impress the organism and develop some disease later. In the study of a large number of cases, many of these common conditions of poisoning have been prominent in early life and have caused debility and invalidism, which has finally culminated in the drink craze. Some of these cases develop a drug-taking mania with the hope of curing real or imaginary diseases, accompanied with fears of death and intense desire to avoid pain and discomfort. They are often tea and coffee drinkers, and have fads in regard to foods, with intense introspection and constant watchfulness to discover signs of oncoming disease. They frequently develop inebriety. In such cases there are many symptoms of dementia, with mental change and debility. In some instances this is apparent in certain organic changes of the body; in others it is seen in the general decline and failure of the functional activities. The mental vigor and power of restoration grows less, and exhaustion increases and becomes more and more prominent.

In the second class of causes, namely, dementia coming from spirits taken regularly in small quantities, or at intervals to excess, the symptoms are more pronounced and more readily treated. The man who uses spirits continuously to excess will always exhibit changes of both the mental and physical organism, which at first may be slight, but which increase steadily. The delusion that it is possible for any one to drink regularly any length of time and not suffer from it is dispelled by the study of such persons.

Dr. Clouston writes: "I am confident that no man who uses spirits continuously, even though he is never intoxicated or never appears to have any mental impairment in his social and business relations, is physiologically changed for the worse. If the practice goes on for ten years serious organic changes will follow, and in most cases, in much less time."

Many persons use spirits daily and boast of their strength to drink in moderation and not be injured. This is a delusion. They may possess inherent strength which will resist degeneration for a time and mask the symptoms, but in the end the dementia which is inevitable from this source will appear. Many such persons carry on business along accustomed lines without much change, but their real condition is apparent when called to take up some original work or engage in some activities requiring originality, spontaneity and vigor. Usually some intercurrent disease appears, with fatal termination, or some form of invalidism which is ascribed to other than the real causes.

The evidence of dementia is more apparent in so-called moderate drinkers who use spirits continuously than in those who take spirits to excess at times and follow indulgence with a free interval of sobriety.

There is in persons who use spirits continuously, or occasionally to excess, a tendency to assume one of three forms of degeneration: 1. The periodical drinker belongs to the epileptoid class where distinct exacerbations and explosions of nerve energy are apparent. 2. The continuous or so-called moderate drinker is of the paretic class. 3. The irregular, uncertain user of spirits is of the insane or maniacal class with a constitutional tendency to mania and melancholy. In all these cases there is a progressive dementia, sometimes masked; at others there are apparent degrees in which both character and conduct undergo a progressive change.

Many of these persons while following accustomed lines of thought and conduct seem very little impaired, yet a careful examination will show more and more automatic activity, less spontaneity and less original work. If thrown out of their accustomed line of life the feebleness is at once apparent. Their inability to take up new subjects, or to act wisely upon a new class of facts is often startling. Thus, a so-called moderate drinker who apparently conducts his business with skill and judgment, will show idiocy in his estimate of new questions and new requirements. Some of the most extraordinary and unexplained acts of men previously sound and wise in their accustomed line of work are explained in this way. Thus, a business man and continuous drinker whose business was conducted with skill and acumen accepted the position of counsel and adviser to a large estate, the investments of which were new in his experience. His imbecility and childishness wrecked the property, and his responsibility was settled in the courts to his great disadvantage. The chagrin and sorrow of this event caused his mental breakdown and death. In reality he was demented before he took up this new business, and yet his friends did not recognize the fact.

Almost innumerable instances occur of the failure of moderate or occasionally excessive users of spirits to adapt themselves to new conditions with the same judgment exercised in their accustomed line of work.

The epileptoidal cases have distinct periods of egoism and over-confidence in their ability to grasp new situations and to control new events. This is a most suspicious symptom, particularly when associated with the constant use of spirits or drugs.

In the epileptoid cases there are distinct paroxysms during which the demented states are readily recognized. Sometimes these paroxysms last many days or weeks before recovery. The mistake is made by friends who suppose that recovery leaves the brain intact, and capable of acting normally and as wisely as before. If the man continues his old business and family relations, taking them up after the attack in about the same way, there is no opportunity to show the damage done, because the work is largely automatic. The mental failure and demented condition would be apparent if these persons were required to take up some new work or enter upon new conditions of life and living. Then the excessive nervousness, feebleness of judgment and instability of connected thought or act would appear.

In the maniacal and melancholic cases, there is the same uncertainty of thought and act, with extreme sensitiveness to conditions and surroundings and exaggerated conceptions of events and their influence. In many of these cases there are symptoms of malaria, rheumatism, neurasthenia and heart failure, with general muscular and mental fatigue. These conditions suggest spirits as a remedy, which only intensifies the very conditions they seek to prevent. They are in reality stages of dementia which should be recognized and treated by change of surroundings, habits of living, and conduct generally.

Associated with the continuous or occasional use of spirits there are always found changes of nutrition. The metabolism of the body is always broken up and the presence of toxins and toxemias are common in all cases. How far these poisons contribute to the dementias present it is difficult to determine, but that they exist and have an influence can not be doubted.

It is now recognized that notwithstanding the apparent immunity which is provoked in the system by the regular use of spirits, there is a continuous shock or concussion to the higher brain centers as an effect of alcohol.

These concussions are literally anesthesias and paralyzants, which depress and alter nerve activities, at the same time breaking up the nutrition, so that in addition to palsy and depression, there is starvation and weakness. The effect of the continuous use will be really an intensification and persistency of effect from which recovery becomes more and more doubtful. A certain number of these cases go on to develop well-marked symptoms of dementia, which is described often as "alcoholic epilepsy" or "general paresis" from alcoholism, or "alcoholic insanity," with mania and melancholia. These are names for the extreme stages of the disease.

Most of the cases die from intercurrent disease before these stages become prominent. Pneumonia and acute inflammations of the liver and kidneys, with heart failure, are the more common forms of terminations, but are indirectly caused by the use of spirits.

In many cases cerebral hemorrhages occur, either causing death or partial paralysis, which continues during the rest of life. Accidents are responsible for a large number of deaths. The paralysis extends to the senses, impairing their power and thus increasing the liability to injury, and when such injury occurs the resisting power of the system is so impaired that full recovery seldom follows.

The craze for drugs and medicines in these drink cases is another phase of dementia. Persons of previously good, sound judgment in other matters will show infantile credulity and confidence in strange methods and unreasonable means that promise help and freedom from pain. This is seen in the unusual demand for certain proprietary drugs which contain spirits, opium, or other narcotics. After a period of the use of certain drugs they are abandoned and others take their place. Such persons, if wealthy, make long tours to different watering-places, health resorts and sanitariums in search of health, and are always dissatisfied. In the meantime they continue the use of spirits at intervals or constantly. There is always a failure in the system, a state of unrest and discomfort, which they seek to overcome by chemical means. Dementia is also apparent in the gambling spirit and craze for making money rapidly, dealing in stocks, and new ventures or short cuts to fortune. This in a drinking man is often pronounced, the same as the erotic impulse manifest in sexual intrigues and infidelities. These and various other symptoms are seldom recognized as having a pathological basis, but are always explained by moral theories.

The moderate drinker, who is a gambler, or sensualist, or delusional politician, is a dement, and should be recognized as such. The moderate drinker who is delirious at times, or intensely melancholy with suicidal symptoms, is also a dement, and should be treated as such.

In the treatment of these cases, the removal of alcohol is of the first importance, but this will not always cure. Serious damage has been done, and the use of alcohol is not a cause, but often a symptom, and as a symptom it indicates greater intensity and increase of the causes.

The presence of poisons and starvation should at once suggest the remedies which are not found in drugs or specifics, but in eliminatives and nutrients, with continuous hygienic care. The nutrition of the body must be corrected, and all sources of poison removed, and long continued nerve and brain rest be secured.

The exhaustion and general debility occurring in persons who have previously been very actively engaged in mental or muscular work, may be the first stage of dementia, and alcohol given as a tonic may have special degenerative action on the brain and nerves, and become a powerful exciting cause.

If there is a tendency to any special form of psychosis, alcohol will increase it by bringing new poisons and destroying the vigor of the body, as well as the functional power or repair and elimination.

States of cerebrasthenia and general exhaustion treated with compounds of spirits, as wines and beers, frequently develop into inebriety and other marked psychoses. Hence alcohol in any form is a dangerous remedy, and its so-called tonic effects in debility are doubtful and perilously uncertain. Any long continued use of alcohol should suggest dementia as a most natural sequence, and the treatment must be based on this prognosis.

The general facts I wish to make prominent are:

1. States of dementia precede inebriety and become both predisposing and exciting causes.

2. The continuous or occasional use of spirits is often followed by dementia in many forms.

3. All use of spirits reveals certain degenerative tendencies along the marked lines. viz., the paretic, the maniacal, and the demented or idiotic types.

4. Alcohol as a tonic is dangerous by increasing the toxins and conditions of poisons with starvation, and should never be used in brain and nerve psychoses or any other condition of neurosis.

5. Alcoholic psychosis in every form should be care-

fully studied before treatment can be given with any degree of accuracy.

DISCUSSION.

DR. C. A. DREW, State Farm, Mass.—I am in hearty sympathy with Dr. Crother's paper. I believe that by habitual drinking a man's inhibitory power becomes impaired, particularly that associated with the higher functions of the brain, which we term the moral sense. I believe the habitual moderate drinker will think differently and act differently, where ethical considerations are involved, than he would think and act were he not a moderate drinker of alcoholics. This is a manifestation of the lesser subtle effect of regularly repeated small quantities of alcohol circulating through a fairly good brain. When weaker brain cells are daily subject to the stimulating or anesthetizing influence of alcohol, according to the dose, there is no question about the resulting condition deserving the name of dementia. More than a thousand cases were committed for drunkenness to the prison department of the State Farm in Massachusetts last year. While many of these men are intelligent, in the common sense, they all seem lacking in moral sense; hardly one ever intended to be anything more than a moderate drinker. These men seldom blame themselves. They have unlimited faith that they can drink or let it alone. They do not appreciate their own weakness nor their obligations to others. I think it is fair and scientific to call these men demented. There were 77 men patients admitted to the Massachusetts State Asylum for Insane Criminals during the last fiscal year; 64 of the 77 cases admitted were free drinkers. No reliable history could be obtained from 7, while 6 were abstainers or only moderate drinkers. There was a clear history of intemperate fathers in 38 of these cases, and 10 of the cases testified that their mothers had been hard drinkers. One of the 6 temperate cases was a moral imbecile whose father and mother were both hard drinkers, the former having suicided while insane. We occasionally meet an imbecile child of an intemperate father and mother who has no taste for alcohol, tobacco or other drugs. This deviation from the rule may perhaps be due to the revolt of a developing organism against super-saturation while in the embryo.

DR. CROTHERS, closing the discussion—The subject of inebriety will probably receive a fuller discussion at future sessions of the Association. Every year brings us nearer to this great dark wall of alcoholism, and neurosis which can not much longer be neglected by physicians.

DYSPEPTIC ASTHMA.*

MAX EINHORN, M.D.

Professor of Medicine at the New York Post-Graduate Medical School.

NEW YORK CITY.

Asthma due to digestive disturbances was first described by Henoch[1] under the name of asthma dyspepticum. The original communication of this clinician referred to the occurrence of the condition during acute digestive disturbances in children. His cases all ran under alarming symptoms—the dyspnea being of a high degree and attended with cyanosis and cold extremities—and failed to improve under the ordinary stimulants, but entirely recovered after a treatment directed against the disturbances of the digestive tract. In his paper Henoch accepts Traube's explanation for the dyspeptic origin of asthma, which is as follows: "The gastric irritation causes reflexly a vasomotor contraction of the small arteries, which explains the cold extremities, the imperceptible pulse, the congestion in the venous system and in the right heart, cyanosis, accumulation of carbon dioxid in the blood and as a consequence thereof the frequent dyspneic respiration."

A short while afterwards Silbermann[2] described four cases of dyspeptic asthma which were identical with those of Henoch. Silbermann assumes the presence of a paralysis of the inhibitory fibers of the vagus as well as of the heart itself. On this account the ventricles, especially the left, can not empty themselves completely, and as a result of this there is a stagnation in the pulmonary circulation and the right side of the heart. Owing to the disturbance of circulation the blood becomes overcharged with carbon dioxid, which in turn causes the dyspnea, cyanosis and cold extremities. Edema of the lungs need not be present, as the paralysis of the left ventricle is only of a moderate degree.

While the two writers just mentioned discussed the subject of acute asthma in children, Barrié[3] was the first to describe cases of dyspeptic asthma of a more or less chronic nature in adults. He first showed the intimate relations existing between stomach, heart and lungs, and entered in detail upon our subject of dyspeptic asthma. He says: "Cardiac complications, the result of certain affections of the stomach or bile ducts, present a very great variety in their symptomatology and prognosis. Sometimes there are only slight disturbances in the frequency, intensity or regularity of the heart-beat; sometimes the symptoms approximate those of angina pectoris; at other times the symptoms refer both to the heart and to the lungs; dyspnea then sets in, which may amount even to suffocation, and at the same time dilatation of the right ventricle of the heart may be diagnosed. The disorders are characterized by a respiratory embarrassment varying from the merest feeling of oppression to true dyspnea; at times even we have orthopnea, which may lead to suffocation. Whatever the clinical form may be, the respiratory difficulty appears immediately after meals, the quantity of food having no influence upon its appearance. With predisposed individuals the smallest morsel suffices to evoke an attack. Chomel, who observed the dyspnea of certain dyspeptics, says: 'The patients, after having taken merely a few spoonfuls of soup, experience a respiratory embarrassment of a more or less severe nature lasting throughout the whole time of digestion.' We have here then a very special kind of dyspnea, independent of any distension of the stomach by gas during digestion, differing also from the transient and purely mechanical kind of oppression, observed in large eaters after a copious meal. It is not in the respiratory tract that the obstacle is to be looked for, but in the pulmonary circulation. However that may be, the air hunger, not being appeased, soon produces inexpressible anguish with imminent asphyxia. The face, at first pale, is covered with cold perspiration and becomes purple, especially around the eyes, lips and cheeks. The extremities are cold and livid; the pulse is accelerated, soft and compressible. The pupils are dilated; speech is impossible; the body immobile, excepting the thorax, which works incessantly, and the patient appears in great danger, as if he were about to succumb to an attack of suffocation. Digestive troubles being the cause of these cardio-pulmonary symptoms, therapeutic intervention must be directed to the stomach. We have two indications to meet: 1, to put the organ at rest; 2, to supply it with food of an easily digestible nature. A milk diet answers most admirably both these purposes."

Lauterbach[4] next described a case of dyspeptic asthma. The patient had been suffering for three years from severe dyspnea, occurring as a rule from three to four hours after meals, preceded usually by malaise, vertigo and occasionally even by fainting spells. These attacks lasted one-half to one hour and ceased after patient vomited. In dyspeptic asthma, according to Lauterbach, we

* Read before the Buffalo Academy of Medicine, Oct. 8, 1901.