LECTURE TO MEDICAL STUDENTS. (Oct.28, '98.)

F E V E R S .

J. H. Kellogg, M.D.

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AT a late hour last evening Dr. Rossitter asked me to talk to you this morning upon the subject of fevers. There is perhaps no condition of disease in which the physician is called upon to act in which he has an opportunity to do so much as in the condition commonly known as fever. It has been said that there are three classes of patients: Those who cannot get well, no matter what you do; those that will get well, in spite of everything you do, and those who are helped to get well by what you do. Now the patient suffering from fever belongs to the last class if to any class at all. There is no morbid condition in which the physician can do so much--in which the physician has the opportunity for doing so much, and in which the remedial applications are so efficient for the relief of the patient and in which there are so efficient means--such admirable ~~means~~ and useful means for affording relief to the patient as in cases in which they are suffering from fever.

Fever is a symptom, and not a disease. So when we talk of a patient as having a fever, we never think of thefever being the disease, or as the only thing to be considered. The fever is only the symptom of the malady. There is always something else besides the fever--which is a matter always to be remembered--it is not only a fever, but something else. The fever is simply the evidence of something else, and this something else, whatever it is, must be discovered. In other words, the fever must have a cause, and we must discover this cause in order that we may give it, as well as the fever, attention.

Nevertheless, there are some cases in which the patient has a fever, in which we cannot discover what the cause is--we do not know exactly what the cause is--but in this case we have the satisfaction of knowing that we may possibly bring the patient to a successful issue and to a recovery by the treatment of his fever--the symptomatic treatment of his case. Symptomatic treatment in general is not a very satisfactory treatment, but in the case of fever it is generally comparatively satisfactory, for as a rule the thing that will benefit the fever, or lessen this symptom, will at the same time aid in the removal of the cause which has produced the fever, and it is a very comforting thought that the thing that will aid in the reduction of temperature and the lessening of the fever will at the same time aid in removing the cause of the fever; so that the symptomatic treatment alone my, in some cases, be entirely successful.

Now before proceeding further in the discussion of this question, let us consider briefly, what is a fever. In the first place we have to consider that the symptom of fever has to do with the heat making and heat regulating process s of the body . Let us recall what these are. There are three elements in the heat making and heat regulating processes of the body. First of all there are the thermogenic or thermogenetic tissues,. Every organ of the body and every tissue that works of course produces heat, but there uzx are special thermogenetic tissues in the body in the muscles, and to some slight extent in the liver.

Now the thermogenetic tissues found in the muscles are so called for the reason that they may be especially used for heat production, aside rom any other functional activity. We have heat produced in the liver while the liver is at work doing other things, but the same is true of the muscle when it is not at work--when it is not active--and they are called the thermogenetic tissues.

Now we have besides these a set of ganglia in the spinal cord, and the stimuli under which they act are automatically stimulating the thermogenetic tissues to activity--just as we have in the heart automatic centers which stimulate the heart to acticity, and just as we have automatic centers which ~~stimulate~~ control the respiration and stimulate the activity of the respiratory movements, just as there are automatic centers which stimulate the activity of the liver, centers which stimulate the activity~~xx~~ of the stomach ,-- so we have automatic centers in the spinal cord which stimulate and control the thermogenic tissues. Then there are in the brain more centers, which have the control of the automatic centers. We have a set of centers which stimulate the automatic centers to increased activity, or ~~xxxx~~ accelerating centers; and we have another set of centers which diminish the activity, or inhibitory centers. I think this way of looking at the thermogenetic apparatus in the body is the most reasonable and the most simple, of any view which I have seen advanced. It is the latest view of the subject, which you have already studied, I suppose, in the American Text-book, and it appeals to my good sense as being rational and reasonable. Thermogenetic tissues in the muscles, automatic centers in the cord, controlled by ~~xxxx~~ acceleratory and inhibitory centers in the brain.

Now a fever is a disturbance of the heat regulating centers; when a patient has a fever he is suffering from a disturbance of the heat regulating centers. There may be no disturbance of the thermogenetic tissues,--~~thextissuesxxxx~~ and there may be no disturbance of the automatic centers--they may be ready to operate in the usual way for they are under control, and only act as they are acted upon --they are under the control of the acceleratory centers and the inhibitory centers. Now in a fever these heat regulating centers in the brain are disturbed.

Thesex heat regulting centers are constantly being disturbed more or less a fall of one or two degrees of temperature, a little draft of air blowing upon the face--a blast of heat from a furnace, a hot breeze from a stove, a hot current of air, or any change of temperature with which the skin comes in contact is sufficient to bring into play these heat regulating centers and to stimulate into activity the inhibitory or the acceleratory center, as may be required.

Theseheat regulting centers may be disturbed in two, or rather three ways: By nervous impressions falling upon the skin or received in other ways, or by toxic substancesiin the blood, or by changing the temperature of the blood. In other words, by reflex influences, by changing the temperature of the blood, or by toxic substances in theblood..

(Dr. Paulson: Then there is reason to believe tht we may have such a thing as a nervous temperature--raising of temperature from mrxmmxdhysx txxinfixxxXxxx adisturbance of the nervus centers?) Yes .

Now there is another statement that I wish to mkxt make with reference to fever --that fever should not be looked upon, as it was formerly regarded, as an unmitigated evil. That is, I think, a matter of great importance for the young physician to remember. That fever may be doing him good. The very fact tha the patient has a fever is not an indication that we should make an attack upon him with allthe means that we possess for destroying that fever In such a fever the patient may have a temperature of 100 to 101 1-2, and othing can be done in the way of reducing his temperature; nothing needs to ne done in many cases. Why? Because the fever is in itself curative. Fever is an effort of nature to heal som thing, and the rise of temperature is in itself beneficial in certain cases.

Now we might consider how it might be beneficial. For instance, in diphtheria--you know that in diphtheria there is a production of toxins and this toxin causes a rise of temperature and gives rise to paralysis and to other disturbing symptoms. Now there is also produced, besides this toxin, another poisonous substance, called anti-toxin. Antátoxin is nature's antidote for toxin; nature produces a substance which neutralizes the toxin, or antitoxin. This substance may be taken from the blood, and is used as a remedy in diphtheria with perhaps somedegree of success in certain cases. Dr. Hare of Philadelphia says that it is most active when the body temperature is high, than when the body is at a lower temprature, And we can readily see--and he conjectures, and I think quite properly , that the raise of bodily temperature is one of the ways in which nature prepares this antitoxin--and one of the conditions for producing this antitoxin is an elevated temperature. So this ~~isxa~~ matter to be remembered and kept in mind.

Haig says "On the other hand, when under the reverse conditions the draught is bad, combustion is incom plete and the fires run low, the microbes get a firm hold, and are able to multiply and produce the disease. From this point of view the causation of fever is of extreme interest, for fever is accompanied by a general increase of combustion and metabábism, and, indeed, it looks very much as if it was a protective effort on the part of nature to stimulate the fires of life and burn out the invader, and it is interesting to note that Loewy and Richter found that artificially produced fever protected animals to some extent against microbic inoculation."

This explains how it is that patients suffering from one febrile disorder generally will not contract another. If a child has mumps, it will not get the measles; the child with ~~sxarks~~ small pox does not generally have diphthhria,--although diphtheria is a microbic malady, and often comes in complication, where diphtheria and scarlet fever germ previously present have developed.

Now the thought I want to place before you is, that a fever is not an unmitigated evil and a thing to be fought recklessly or without consideration. Still, we never would think of letting a patient alone and saying "Let the fever cure him," because the fever might consume him. The fever is a consuming fire which might destroy the disease, but might also destroy the patient. It might consume the cause of the disorder, but the patient might not be able to last until the dross was all consumed--the patient might be practically all dross, and it would consume it all.

The real cause of a fever is the resistance of the body to the causes of disease which are present in it. That is the real cause of fever--the resistance and vital reaction of the body against the disease conditions which are present. That is becoming developed more and more. This shows us the universal application of the statement that fever--that disease--is a remedial effort on the part of the body to heal itself. It is the activity of the acceleratory center -of the healing power--the curative power that is in man seeking to make him well--that is the real cause of this phenomena to which we attach the name Disease. I think this is becoming clearer and clearer every year. Twenty-five years ago when we were writing upon and talking this subject--when it was comparatively new in the world--it was not new, but it was scarcely ever regarded and talked about,--there were many dark and difficult and troublesome problems, to tell how some things were curative ; but as time went on and there were new developments in pathology and physiology, we saw more and more clearly all the time how true it is that there is within the body a divine power seeking to heal it physically as well as mentally and morally, and that very process of disease in which a person seems tobe suffering from the consequences of his sins is really an effort at healing, and of there is enough of the man to pass through that purifying process we will find him there after he gets through, but if he is nothing but dross when the fire gets through burning the man himself is burned.

I believe that is true of moral as well as physical things--that God is always trying to heal the man, and that all the unpleasant experiences we have in the world are to purify and heal us, whether mentally morally or physically, and if there is anything left in the man when this purifying prcess is completed--if the process can be completed and leave anything behind, that which is left behind will be pure gold and will be something that will develop throughout all eternity into all that is good and pure and beautiful,--and God will save any man that has any gold in him.

DR. PAULSON: In the Medical Bulletin the Editor likens it to boys persisting in breaking ice, and he says "as soon as they break the ice Nature mends it" so as soon as a man does things that will break him up, nature heals him. ~~Thx~~

DR. K. That is a very good illustration: We see the same thing in an abraded skin.

DURS: In fever, does the heat increase the activity of the white blood corpuscles, or does it destroy them and in that way get ridof the fever.

DR. K. Yes; and we have a good illustration of that in a local inflammation where there is an increase of the temperature; there is heat, redness and pain--those are the three great constituents of local inflammation. We find the white blood corpuscles in that region swarming, and exceedingly active migrating very rapidly outside of the vessels, and they are very actively engaged in phagocytosis, and everything else they are capable of.

Now the temperature is known to rise as gigh as fifteen degrees above the normal in some conditions of disease, and an even higher temperature has been noticed in some few cases just before death, but when the temperature rises over ten degrees, the patient very seldom recovers unlessthe elevation of temperature is due to some nervous disorder.

Now in fever the functions of the heat regulating centers are so greatly disturbed that influences which ix under normal conditions would be readily compen ated for create a very great disturbance in fever The heat regulating centers become very susceptible in cases of fever to disturbing influences; in other words the body is brought somewhat into the condition of a cold blooded animal, in fever. We know in the case of the cold blooded animal histempmrature is regulated by the temperature of the surrounding medium. Take for instance the temperature of the frog, and it is generally but little higher than that of the air or water by which it is surrounded, provided that the temperature of the air or water is not much different foom its ordinary tempe ature. For instance, if the temperature of the water is at freexing, the temperature of the frog in the water should be two or three degrees above fre freezing-- just a little above. Then if you raise the temperature considerably above the ordinary temperature in which the animal lives, then the temperature of the animal will be just a little below--but only a little. Whereas in man there is a wide difference which does not vary in that way. But in a condition of fever we find a different state of things. We find that the body id susceptible. The elevation of the temperature in the room will give us an elevqtion of the temperature of the patient, and applications fxx of measures for the reduction of the temperature are much more effective in the fever patient than in the healthy individual. That is a very important and practical thing to bememmbered. Ut used to give me trouble, until I learned that fact.

I said, "A boy goes in swimming in water at a temperature of 70", and he does not get his temperature lowered two or three degrees, and why should it lower the temperature of the fever patient? " And I did not have as much faith in water as I ought to have had, as a means of lowering temperature, because when I made experiments upon myself I could not see that there was any great modification of temperature either above or below normal --I mean by such applications as we use in treating the fever patient, because it is possible to reduce the temperature of the normal man by a severe application, or to raise the temperature. But in fever the patient is brought more nearly into the condition of the cold blooded animal, so that the heat regulating centers are more easily disturbed and influenced in one or the other direction. This must be remembered for two reasons--first, that we may have faith in those measures of treatment which might seem to be inefficient, which would not effect the tempratueeof the healthy individual, but that are effective ~~thexduxiixxx~~ in reducing the temperature in fever ; and we must remember also that since we find it possible in fever to lower the temperature too much, and lower the temperature more than it is safe and proper that it should be lowered, that it may result in damage being done. In fever, in other words, there is a disablement of the heat regulating centers ---a disablement and crippling of the heat regulating centers in such a manner that the generation and elimination of heat are not properly controlled. There is a marked loss of resistance because of this thermogenetic disturbance,--both of the centers which tend to depression of temprature, and those which produce an elevation of the temperature. In both ways there is a marked loss of the power of control.

Now see what takes place in the attempt to regulate the temperature of the body: We have the automatic thermogenetic centers in the spinal cord, we have thermogenic tissues and we hve heat regulating centers; and we have not only generation of heat, but we have elimination--we have two processes to be regulated. But we have two centers to do this work of regulation--the inhibitory and the acceleratory centers, acting upon the automatic centers of the cord, and these regulating centers do something more than control the automatic centers of the cord. The acceleratory centers--for example the heat acceleratory center, sends an stimulus to the automatic centers and causes them to produce more heat, and at the same time it acts upon other structures and functions of the body and causes them to conserve the heat and check heat elimination. These heat regulating centers in the brain are so small that it has been difficult to locate them, and yet they have control of the entire body in the most wonderful way. The heat regulating centers not only increase the heat production, but at the same time check the heat elimination from the body by the contraction of the surface vessels throughout the entire body; and if the exposure to cold is considerable, so that there is a very large loss of heat, a large tendency to vary from the normal standard, then all the muscles are set to work. Think what a tremendous control it has over the muscles; in shivering every muscle of the body works hard. I remember when I used to have the ague, thirty years or more ago--I remember how tired I used to be from shaking; after a few hours of shaking I felt as though I had been working hard all day, because every muscle had been working, and working hard. You not only get tired and thoroughly disgusted with the disease, but you get tired out from the exercise. Now this is a wonderful control that these centers have when they are able to control every blood vessel of the skin and every muscle of the body at the same time.

And so it is with the heat acceleratory centers in the br ain. They not only lessen the activity of the automatic centers of the cord, bu at the same time lessen heat e imination, cause dilitation of the bloo vessels of the s in, and stimulate every one of the perspiratory glands of the skin to activity. See what a control this is: These little ducts, the perspiratory glan s, if spread over a level surface would cover eleve thou and square f et, and if arranged end to end would form a chain several miles in length--and here this center has control over all this vast mechanism. Thus e have heat elimination increased at thesame time that heat production is desreased. It is important to rememb er this.

Now her is a inte esting fact which I hve already alluded to: That xx a warm temperatu e te ds far mo e to cause a rise of temperature with one in a febrile condition than when on is in health, because the condition of the patient is more like that of the cold blooded animal, Xaxx in warm water; its tempe ature will rise fifteen to twenty degrees high er than the normal. Take the temp rature of a frog and then put it in water that is forty d egrees warmer, and see how rap idly its temperature will rise. The same is true of all classes of cold blooded animals. The warm atmosphere tends far more xsxixxxsxxx in disease than in health to cause a rise of temperature both by increasing heat production and decreasing heat elimination.

Now how does the warm atmosphere decrease the heat elimination? By radiation. And how does it increase heat production? By adting as a vital stimulus. There is a re lex action by which the heat is sent to the surface of the body, thus ddereasèng the heat elimin tion and in creasing heat production.

QUES: Would not that hold true to a certain extent, and when we perspire have a tendency to decrease?

ANS. We were only speaking of heat production. The heat production might be increased and the heat elimination be increased out of proportion to it. This rests upon experimental facts. An atmospheric temperature of about 60" F., tends to increase heat production and at a temperature of 104 F. heat production is increased three times more than the normal. That means an increase in the bodily temperature. It is of the utmost importance to remember this in dealing with fever cases We often find nurses neglecting the temperature of the room, and allowing it to rise and the patient was accordingly having a temperature of three or four or five as the result of this increased heat production. Very often a child becomes hot and feverish simply because the temperature of the room is too high. Babies very often get into a febrile condition because of the abnormal temperature. You know that in a hot weather ~~atmosphere~~ babies are very apt to have a rise of temperature because of the continued high temperature around them, hence the importance of proper regultion of the temperature in fever cases. A cold atmosphere also increases heat production, but less than in health. That is, if the temperature falls below 60" it also has a tendency to produce heat-production. 60" then, is the neutral point as regards heat production. What is the neutral point for the skin? 92-6". The neutral point of the body, then is 92-6", but the neutral air is 60". That is the temperature we always prescribe for a fever patient. In England the temperature of a room is never allowed to get beyond 60", and in the hospitals it is never allowed to rise beyond that if it is possible to help it, and in the living rooms in England it is not allowed to rise above 60". In the bathrooms of Vienna the patients sit around after the bath with linen sheets wrapped around them, at a temperature of 60", and

I was surprised, myself, to find that I was not chilly. I had been through a process of soaking in the hot water tanks and showering with cold water, and vigorous rubbing, and no one seemed to be uncomfortable at all. They sat about with linen sheets wrapped about them, with a secore or two of men waiting for the barber , or the chiropodist, etc., and no one seemed to be uncomfortable. We simply had Chinese slippers o n our feet. But is over here in America that the rooms are kept so hot. In European countries they cannot afford to waste the fuel so. How is it in Turkey?

ANS. The bthrooms are very hot. They have no thermometers in the living rooms, ad the temperatu e is very irregular.

But it is in England where pains is taken to regulate the tempera-ture of the room, and those people make a great complaint about our hot rooms over here in America. Let us remember, then, that the neu-tral point of air is 60": A temperature below that increases heat pro-duction and a temperature above that produces heat production. Of course a dìfference of five or six degrees would not have very much effect. At a temperature of 104" the proportion is increased to three times the normal.

DR. PAULSON:--Just as soon as we get the bath rooms below 80", the patients complain about it. Is it because the people are used to these high temperatures? If we should put our bath rooms down to 70" or 65" I do not think we should be able to get the patients to take treat-ment that day.

ANS. The people of America are used to a higher temperature. But I do not think that our bathrooms should be above 75"--not above 76" . We have the patients continually complaining about taking cold in the bathroom. They do not take cold in the bathroom--they take cold after they come out of the bathroom. Now let us see the reasons:

When the temperature of the air reaches about 104 one begins to perspire. Now when the skin is warm and moist and perspiring, how much is heat elimination increased? To three times its normal amount. The temperature is maintained at the normal,--and that is one reason we know that it produces heat production to that amount, because the temperature would rapidly fall unless it was kept up. But experimentation shows us that it increases heat elimination to three times the normal amount, and of course heat production is kept up all the time. So while the elevation of temperature in a patient's room might produce increased heat production, this might be compensated for by increased heat elimination. But suppose we have a fever patient, whose skin does not perspire,--the skin is always dry and never moist-- then if we have heat production we have no compensating heat elimination, and here we must have a rise of temperature.

Exercise, either muscular or mental--even so slight exercise as sitting up in bed and conversing with a friend may in the case of a fever patient cause a very pronounced rise of temperature, and not only in the fever patient but in the convalescent from fever, and a person who has just recovered from a fever. I have known them to be up for half an hour, and walk across the room, and go back to bed and have a relapse. Sitting up in bed or talking may cause a decided rise of temperature in the fever patient. We think that this is such a slight exercise that it will not do any harm, but it is because of this lack of activity of the heat regulating centers. And although the body is at rest in bed there is usually a great activity of the thermogenetic tissues in connection with the muscles. The prominent feature in fever is increased heat production. For each degree C.,--1.8 F., elevation of temperature there is an increased heat production of 6%, according to Liebermeister. It is worth while to remember that: For every degree Centigrade the

the patient's temperature risesthere is an increased heat production, producing that,elevation of temperature, of 6%. I have prepared a table based upon this fact, in Farenheit degrees. Starting at 98, the normal temperature, at

100" the increase would be	4.6%.
101	8
102	11.3

In other words, for every degree Farenheit elevation of temperature there will be 3 1-3 % heatx increased of heat production above the normal When we get up to107" the increase of heat production is 27%--the patien is producing 27% more heat than he ought to.

DR. PAULSON: If there were 10% heat elimination this would be much greater?

ANS.Yes, under ordiary conditions of fever. In case of sweating fever the heat production is increased very much more than that. Heat dissipation is generally increased in fever, but in less proportion than the heat production,,so xsxmxxxhxxx that in this way we may have an elevation of temperature. It is quite important for us to know what fever is before we undertake to deal with it.

I thought I would give you something that was not given in Osler. I see that he doesn't say a word about what fever is so that you see that by simply studying the textbook you will simply learn by rote a few things that you ought to know., but that is not the way to practice medicine. You want to know the nature of the phenomena, so that you may be able to deal with it intelligently.

Now let us notice in how many ways we may have the temperature of the patient disturbed: In the first place we may have heat production increased, heat elimination remaining normal.
Second, we may have heat elimiation decreased, heat production remaining normal.
Third we may have the heat production and hat elimination both increased, but the heat production increased more than heat elimination.
Fourth, we may have heat production and heat elimination both decreased, but the heat elimination decreased more than the heat production.
These four methods will produce a rise of temperature. The rise of temperature is due simply to the disturbance of the balance between heat production and heat elimination. Then you see fever is simply due to relative conditions, not to absolute conditions, but the relative condition of the heat production and the heat elimination.

Now we may have heat production increased and hat elimination decreased, and we may also have heat elimination increased more than the heat production is increased, and that would cause a fall of temperature. We may have heat elimination idecreased and heat production increased, which would produce an exaggeration of the effects of increased hat production without elimination. We may have all of these combinations to produce a change of temperature, and we may have the converse of that. Increased heat production with decreased heat elimination will cause the greatest possible rise of temperature. We have that, occasionally, in fever--in a rise of temperature there is increased heat production and decrease of elimination.

Now it is not always easy to know from the general symptoms which of these symptoms prevail,, but there are methods by which we can find out, but which we will take up at another time. When the s in is red and moist heat elimination is increased three times its normal amount. In certain febrile conditions the riseof temperature is chiefly due to diminished heat dissipation or elimination.

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LECTURE TO MEDICAL STUDENTS. Oct . 31 '98.

F E V E RS.

J. H. Kellogg, M.D.

A study of this chart will make the subject clearer to you:
("HP"heat production, HE heat elimination.)

TEMPERATURE DECREASED.

HP – HE –
HP = HE +
HP –,+ HE –
HP + HE +.+
HP — HE +
HP – HE –

TEMPERATURE INCREASED.

HP + HE =
HP + HE —
HP = HE —
HP _ HE ,—
HP + HE + , —

QUS. If a patient's temperature had got down to 94-5", and if heat production were below normal and heat elimination were below normal, the temperature would remain the same, would it not?

ANS. The body establishes a certain standard, and maintains an equilibrium at that standard, and it might be 96-6"; while in a cold blooded animal there is a changing of the temperature caused by a change in the temperature of the air or water, which is changing all the time. A patient with a temperature of 102" or 1 00" seems to establish that standard--that is not a normal standard, however. In order to maintain that standard nature must keep up an increased heat production or must maintain a decreased heat elimination, because the surface of the body is adapted to the radiation of heat at such a rate that if the heat production is right for one part of the body, the skin will throw off heat under ordinary conditions at the same rate at which it is produced. So the lower standard must be an abnormal standard..

We have found out the different conditions under which we may have the temperature disturbed by both an elevation of temperature and a diminution of temperature. How in how many different ways may we have this disturbance of the normal equilibrium, produced? (In three ways.) State what they are.

MISS WHITE: We have nervous expression, toxins and a difference in the temperature of the blood..

DR. KELLOGG: How can we find whether a person has an elevation on temperature in consequence of increased heat production or in consequence of diminished heat elimination? We can generally ascertain that by the condition of the patient's skin. You remember we learned yesterday if a person's skin is red or moist heat elimination has increased to three times the normal. So whenever we find a patient's skin red and moist we know that there must be an increased rate of heat production, because it would be impossible for the body temperature to be kept at the normal point under such conditions. If we find the patient with a temperature above normal, and at the same time find his heat elimination increased 300%, we know as a matter of natural inference without further demonstration that there is an increased heat production of at least three times the normal amount. If his temperature is above normal and his elimination is increased, above the normal, and still his temperature is retained at the normal point or above it, we know that his heat production is keeping up with his heat elimination, otherwise his temperature would rapidly fall. This may be illustrated by a bottle of hot water. The intensity of the fire must be maintained equal to the intensity of the heat elimination. We know also by the objective symptoms which we observe in a patient--if we find his temperature above the normal we know that his heat production is increased,, and there must be increased heat elimination.

Now we will make a little computation and see what this means. Here is a case--in the evaporation of water from the surface of~~the body~~ an enormous amount of heat is absorbed because it is rendered latent . How many units of hea does it require to convert a pound of water into a pound of steam--how many heat units are rendered latent by boilin to steam? (700.) Over 900. Then if we had the amount of heat necessary to raise water up to the evaporating point, then we should find that there is still more latent heat, and we add the two, and it is practically a thou sand heat units--sometimes more and sometimes less, but practically a thousand heat units--pound-Farenheit units, because we have to deal with water in pounds. I always reduce it to kilograms and kilogram heat units in writing for a paper. Now here is the skin throwing off water all the time--about how much water is evaporated per hour, ordinarily? (A pound and a half a day.)- From an ounce to an ounce and a half per hour--averaging about an ounce. To what degree could that be increased in a profuse perspiration? (Three times.) more than that--it could be increased fifty to sixty times; it could be enormously increased. Now let us see what this amounts to--suppose it could be increased only to eight ounces in a fever patient sweating fairly, moderately--the result of the removal of eight ounces of water alone would be five hundred heat units--that is half a pound of water requires five hundred heat units to remove it in an hour. Now in the ca e case of a person weighing 160 pounds what would the decrease of tempera ture be in an hour--how many heat units would he lose per pound if he loses five hundred heat units in an hour? (Three heat units per pound.)

How much would his temperature be reduced then? (Three degrees.) Yes. Now suppose we consider the patient as a bottle of water. suppose this is a bottle of water, and the temperature of the water is 103F. Now we put a cloth around the bottle, applying heat, and making the water evaporate from that cloth at such a rate that if the bottle held 160 pounds of water it would lose five hundred heat units in an hour or in any length of time--how many heat units would that be, per pound? (Three.) Yes, because 160 is contained in five hundred about three times. Now if a pound of water in this bottle lost three heat units how much would the whole bottle of water lose--how much would the whole 160 pounds lose if each pound of water loses three ~~xxxxxxx~~ degrees? (Three.) Yes. The same thing is true of the patient weighing 160 pounds, provided there was no increase of heat production.

Suppose a patient has a temperature of 103" and we make him sweat at the rate of eight ounces an hour--that is moderate sweating--the evaporation of the water would remove from his body enough heat to reduce the whole temperature of his body three degrees in an hour--in other words the temperature would fall to 100 ". In an ague patient the temperature goes right down with wonderful rapidity,-- and this accounts for it-- there is sufficient power in sweating moderately to reduce the temperature at the rate of three degrees in an hour. In sweating his temperature would fall rapidly. Now what would prevent his temperature from getting too low? Increased heat production. So there is a good reason why when the patient takes a cold bath or makes a cold application to the skin there should be a reflex influence by which heat production is increased and heat elimination is diminished, otherwise we might refrigerate the patient so that his vital forces would be weakened and paralyzed. It is important to know the power that there is in refrigerative measures, and in simple sweating.

Now suppose the heat production in cases of this kind was just double the normal amount,--suppose the patient were making heat with twice the normal rapidity--how fast is that--how many heat units can one make in a minute at the ordinary rate? (About 600 calories.) The heat production is at such a rate as to raise the temperature of 7 1-2 pounds of water 1° per minute. Now let me tell you how to find this so you can always come back to the original effect--how many heat units are produced in twentyfour hours ordinarily? (Something like three million of calories.) It is pretty nearly three millions. How much would that be per hour? Dividing by twenty-four we have 116666 small calories. Now we will get this into pounds-Farenheit --it is 1.6 kilogram-calories. How many pounds does it take to make a kilogram? 2.2 pounds. (Blackboard calculation.) Dividing by nine-fifths we have 3.96. Then multiplying by 1.6 we have 6.3 . If we had used the 2,8000,000 it would have given us 7.5--for convenience we will call it 7 . The figures are not exact, but we will say that there are seven pounds of water evaporate in a minute-- seven pound-Farenheit heat units are produced by the body per minute. If that is the case how many can be produced in an hour? 420 . When we evaporate eight ounces of water, it produces how many heat units? 500 heat units. Now that 500 heat units had to be taken away from the body--now the body is making heat at the ordinary rate--it is going ahead at the ordinary rate, and that would be about how much? 420 heat units in an hour. How many heat units would we have left of the 500? 80. So the body has lost eighty heat units more. Now the weight of the body is 160 pounds, and we have eighty heat units lost from the 160 pounds, and the fall of one-half a degree in temperature. We will suppose that our heat elimination is doubled, so that the patient is evaporating sixteen ounces of water per hour-- it may be increased to forty or fifty times the ordinary amount--suppose a pound of water evaporated from the skin--

suppose it is a pound and a half--how many heat units would be lost? Three times as much--1500. This calculttion will help you in your professional work, and also in your work of teaching nurses. The normal heat elimination is about 420 heat units in an hour. Suppose heat production is doubled--we would have an increase of temperature because of the increase of heat production. If The heat elimination is normal and the heat production is normal what would that be? 840. Now we have caused a heat loss of fifteen hundred hat units in the same time in which eight hundred and forty heat units are produced--what would be the result? There would be 660 heat units gained. Now the patient weighs 160 pounds--we will divide to see how much he temperature would be lowered. Dividing 660 by 160 we have a fall of 4 1-8", so the temperature would be 98 7-8". This is very practical--it is a tangible thing, and something which you can estimate and masure.

I have been for some time trying to find a way by which we can ascertain more accurately as to what the condition of the patient is under different conditions of heat elimination and heat production. Of course we have heat production and heat elimination, and if we have a patient's temprature we only need to know one thing: If we can know whether the ptient has diminished hat elimination, from this factor we can get the other, knowing the temperature. Now if we find that a patient's temperature is normal--I will illustrate this. (Blackboard calculation.) Now we may say that heat elimihation and heat production are on the two ends of a teeter--here is the fulcrum or the balance. So long as these two are in perfect balance the body temperature is 98.5--so long as these two are balanced --if we find the heat production up, and the temperature of the body remaining the same, we know that heat elimination must be low(?). ~~If we find heat production up and the tem~~

Because, the temperature of the body represents the balance, you see; the body temprature tells us that there is a balance, and if it tells us that this balance is 98.6 that means that the scales are exactly balanced But we could not tell from the body temp rature alone whether heat production is increased or diminished, or whether heat elimination is increased or diminished--there is no possible means of telling that by taking the temperature. If the temperature is 98.6 it simply means that the balance is maintained. But we can say this--we can tell when the temperature is normal, and knowing that we know that if the heat production is normal that the heat elimin tion must be normal also--in other words we know that if HP is equal and the temperature is 98.6, HE will be equal also.. Now suppose we find the temperature 100"--if we find the temperature 100", and find that the patient is sweating, so that his heat elimination is increased, what shall we say, then, about HP? (That it is plus.) Yes So if we know the temprature of the body and cab ascertain the heat production or the hat elimination,--if we can ascertain the one we can ascertain the other--if we kno the heat elimination we can measure the heat production, because the human body is a physical body, like the sun, or like a teakettle, or anything else in which heat is being produced, and if we can measure the rate at which it is thrown off, we can tell how much the heat production ~~or heat elimination~~ is by knowing the body temperature.

One method which has occurred to me was to note the rate at which the thermometer reaches its maximum when applied to the skin; of course the hotter the skin, the more rapidly the thermometer would reach the maximum. Place the thermometer under the axilla and note the time when the mercury reaches the maximum--that is one way of application. The first thermometer that was ever used ~~wx~~ for determining the temperature was a most ingenious thing--but it was really the same as the thing that we are talking about. I did the same thing, but it simply indicated the rate of heat elimination. Just a hundred years ago now the doctors in New York city were interested in the ue of water in fevers, but thermometers were scarce and high priced in those days. An ingenious methodxacaxx of constructing a thermometer occurred to a docter in the backwoods of Maine where it is difficult to obtain them,. and you may find it useful for the same reason. You can easily make a thermometer if you can gt a piece of glass tubing of small caliber: Close one end. Nowxxxx warm it somewhat, and dip one end in a little fluid, and immediately take it out, and the result will be that as this cools off it will draw that little drop of fluid down into the tube. Now if you wish to know whether a patient has a fever, put this little tube under your own arm and notice the point to which this little column of water rises, and then put it under the patient's arm and see the point to which the column of water rises in his case and compare the results. This may be better than the complicated machine which I have here--however I will explain it. Here is a little device which is the same principle as the other. This consists of a bottle in which there is a little water in a tube; it is an air column- nothing more than that tube after all, and that tube is the best, nevertheless I will tell you about this. It is simply a little bottle with colored fluid in it and a tube dipping down into it. Here is a little chamber full of air, xndx this is a tube full of air, and it communicates with a very small chamber, into the top of which I breathe a very little--the less the better. Now when I take this in my hand you see it at once begins to rise; by heating the air the air displaces the water and causes the column of water to rise into the tube. Now this little chamber has a sort of definite known area, and contains a certain amount of air, and knowing the exact area of the skin and knowing how many heat units are being thrown off from that area of the skin, and knowing the maximum, we can find the local inflammation. (Marking zero-points.) See how delicate this is: I simply breathe into it, and it goes below very quickly--I blow hot and cold--what causes that to go below? (Evaporation.)

QUES. Why could you not have hot and cold to the spine by this means?

You could; I have had an arrangement for blowing hot and cold--first one and then the other--but it is not so convenient. Now I blow in, first slowly, and then I will blow hrd--first up and then down--what causes that? (The cool air; it draws in the air from the outside.) Yes, it brings a column of air from the outside which is not saturated with moisture; breath is moist and it makes an induction current. (Experimenting.) We must make several applications--the idea is to make an application to several places, and having ascertained the local temperature we are enabled to find the local inflammation in such cases as abscess forming in the thick muscles of the thigh or in cases of typhoid fever, inflammation of the bowels, peritonitis, etc,--it is a new thing. I only learned about this a few weeks ago when I was in Washington investigating to see if I could find something new in hydrotherapy. Just twenty years ago this winter I spent three months working in the laboratory and also spent several months in Boston and searched the Merchantile Library in Philadelphia and other places for these principles, and have been getting facts. I have found this interesting thing to which I have referred and I shall give an account of it in my work on Hydrotherapy.

LECTURES TO MEDICAL STUDENTS. (No.3.)

F E V E R S.

Suppose we analyze a little further the table showing the different relations between heat production and heat elimination which would be attended by a rise of temperature, and those in which it would be attended by a fall of temperature.

Producing Rise of Temperature.			Producing Fall of Temperature.	
2 HP +	HE =		HP —	HE =
3 HP +	HE —		HP —	HE +
1 HP + +	HE +	98.6"	HP — +	HE —
4 HP =	HE —		HP =	HE +
5 HP —	HE — +		HP +	HE + +

Now suppose heat elimination was increased and heat production remain normal, what would be the effect? A fall of temperature. So we could have but one case in which the heat production remains normal, in which we have a rise of temperature--by diminished heat elimination. It is possible to have heat elimination minus and heat production minus also,--that would be normal; but if heat elimination is decreased to a greater extent than the heat production is decreased, then there will be a rise of temperature. If heat elimination and production are diminished equally, the proportion is normal.

DR. PAULSON: That depends upon the first start:

Dr. K. We are starting with a normal temperature, and both are decreased at the same rate. The patient is then living on a lower level. When a man is fasting, what happens? The temperature falls a little below. What makes it drop? Because the heat production cannot keep up with the heat elimination, so nature establishes an economical level, and he lives on that plane until just a few hours before he dies, and then down it comes. It comes down because the whole thing is broken down --- he has burned his own body up. It is more difficult ~~to supply~~ for the body to supply fuel from itself than from the blood, consequently it cannot keep up with the extravagant expenditure ~~temperature of~~ 98.6, and nature establishes a lower level of one or two degrees below that, and keeps that up until a few hours before death, when it breaks down rapidly.

QUES. In that case, would it stay at that lower level, or would it continually go down?

DR. K. Suppose a patient's temperature is 98.6, and his heat production is diminished a little, and the elimination remains the same,--what happens to him? (There will be a fall of temperature.)

Well suppose the heat production is decreased and the heat elimination is decreased proportionately--would there be a fall of temperature? (No, but I was looking at the other end of the line, to see how he would come out.) Well, if he keeps right on this lower level, why not go right on living? Suppose a poor dyspeptic comes into the office--he is poor, and thin and pale and he is eating but very little food, yet his temperature is normal--sometimes it is subnormal in the morning. Here is a patient weighing 200, and we reduce his weight by working hard so that the production of heat is greatly increased--yet here, too, the temperature is normal. The principle that we are trying to consider is just ~~that~~ this,--that the body temperature is simply the balance between the heat elimination and heat production, and it is no measure of either heat production or heat elimination and we cannot tell anything about what the body is doing by taking the temperature.

We must know either the heat production or the heat elimination in addition to the body temperature, in order to find out the other. The body temperature is simply a balance established between these two things--heat production and heat elimination.

DR. PAULSON: The body makes about two and a half millions of heat units in twenty four hours. Now suppose it did not make as many as that--would the temperature still be normal all the way down?

DR. K. I think I see your point. It might be so under certain conditions , but the man would have tobe put in an atmosphere where the production and elimination would be equal--if his external surroundings are so adjusted that the heat production and the heat elimination are equal, the body temperature will remain the same. It is just the same as though a bottle of water was wrapped about with a cloth, so that the heat cannot escape any faster than it is generated, and a little candle will maintain the temperature of that bottle of water .

DR. ROSSITER: I would like to ask, If these conditions vary so in individuals, can we ly down an arbitrary rule and say that all persons shall live in the same degree of temperature? If in one eperson the heat production should be lower, would it not require a different temperature ?

DR. K. The only way in which we can establish a uniform temperature is to constantly change our clothes to suit the variations of the atmosphere, for it is necessary to adapt the clothing to the surrounding atmosphere. On a scientific basis we must consider the body exposed to an actual temperature, and ignore the clothes, but the clothing comes in, and we must consider the clothing a a factor as well as the air. Out in Arizona among the Yuman Indians it would not be nedessary to take the clothing into consideration, for they clothe chiefly in paint out there. Clothing comes in as a ~~distinct~~ disturbing factor, and I think is one of the great causes of disease in civilization. If we did not hve to wear clothes we should have no xxxx catarrh --we would not have catarrh of the various organs--the bronchial cattarh and all those pulmonary catarrhs. We get our unhealthy skins becauseof our clothing, and it seems to be next to impossible to have a healthy skin with clothing. We have been brought to that condition where the skin has lost the capacity to regulate itself . We want to consider that for a moment. It may seem to be a startling statement for me toxxxxx make, that clothes are unhealthy--that it is unhealthy to wear clothes. I will only call your attention to the delicate arrangement that is necessary for the adjustment of heat regulation, of which we get but a slight conception from these tables. This is absolutely necessary to maintain the normal temperature of the body, and in order that this shall take place, we have a wonderfully interesting and complicated mechanism--a complicated group of mechanisms-- brought together to control those functions. xNowxforxxxxxpxaxx This inhibitory thermogenic center which acts on the blood when the temperature has a tendency to rise--when the conditions of the body are such as to cause a rise of temperature the inhibitory center is brought into play, which is brought into activity by the temperature of the blood, nervous impressions, or by toxic substances in the blood; and when it is brought into action it controls this complicated mechamism. For instance, here is a person who has become warm--what is the thing we notice? Perspiration, a quickened pulse, dilitation of the blood vessels of the skin . The respiratory glands are numbered by the millions, and cover an area of about eleven thousand square feet.xxyxxxitxisxxxxhxa littlexbitxofxxxxxx xpxxkxthatxitx See what a controlling power this center has, yet it is such a little bit of a speck that it took a very long time to find it.

Why is the perspiration increased? (By increased oxidation.) That is one reason--and to take in more air to cool off the blood. The heart is working faster, and the lungs must keep up with the heart in order to relieve the congestion and purify theblood, which clogs in the two thousand square feet of lungs, and that blood that is spread all over them is cooled, partly by evaporation and partly by cntact with the cool air.

Now are there any other mechanisms brought into play? The spreading out of the blood upon the skin brings about evaporation and respiration of the skin. The kidneys are excited to activity as well as the liver, for the carrying off of the toxic substances in the blood. The thirst center is excited--we drink water to help cool the blood off. The whole body is aroused and excited, and all its functions are more or less influenced and disturbed by the rise of temperature of even .7 of a degree. A rise of temperature of .7" is enough to cause perspiration. Of course there are a great many variations between.1" and .7", and there are different degrees of perspiration before visible perspiration begins. There are a great many different degrees between invisible perspi ration and visible perspiration----a great many steps--there is a little increase a dna little more, and so on, until finally it becomes visible. So that we can see what a delicate arr angement there is there controlling this.

Now we want to consider something about the acceleratory center; and it is interesting to note what a mechanism this center controls. But there is one thing we should notice with regard to the inhibitory center, and that is that it controls the automatic thermogenic centers in the spine, which control the thermogenetic tissues, and thus they are able to diminish the amount of the combustion that is taking place in the thermogenetic tissues.

Now the acceleratory centers stimulate the automatic centers of thespine, and thus the thermogenetic tissues are stimulated to activity and the activity of the muscles is increased. Another thing the accelerator center does is to control the circulation. When cold is applied to the skin, what happens? It becomes pale. What happens when the skin becomes pale? Contraction of the capillaries Is there anythingelse? Radiation is decreased because there is less blood there. Now is there any other way in which the heat can get to the surface of the body, than through the blood? ("No.") suppose we have a hot water bottle wrapped up in a blanket--can the heat get through that? ("No.") Can the heat get from that bottle to the surface of the body in some way? ("Yes.") It works it way out throug the blanket, and so it is with the body,--the heat works through the tissue and membranes, mechanically, as we might say, just as it would pass throgh wood or iron.

Now what is the consequence of this contraction of the blood vessels, as regards the state of the skin? It becomes a poor conductor. The conducting power of the skin is wonderfully diminished by the lessening of its blood supply. The skin becomes tough and hard--have you ever noticed that when giving a bath? When the patient is perspiring the skin is soft and pliable, but on the application of cold water it becomes hard and glossy, like marble. That is an indication of a changd condition of the skin,--perspiration is decreased, evaporation is diminished, and the action of the kidneys is increased as a compensating means by which the condition of the blood may be maintained. So you see the mchanism by which the condition of the skin is regulted is a very extensive and nicely adjusted mechanism, and it is a very important mechanism, as well.

Now what do we do when we put on clothes? We assume an artificial skin, which has no nerves or bloodvessels, and which cannot be modified except by taking it off or putting it on so when living in a low temperature and there is a rise of three or four degrees of temperature or a lowering, there is no change in the skin, and in this way we protect the skin so tht there is no opportunity for it to exercise its functions The skin is in this way made one of the best non-conductors we can find, so that its functions are not called into activity. Then again, the skin deteriorates, just the same as the muscle deteriorates--it becomes weak and inactive,--and just so the skin becomes weak and inactive from lack of exercise.. Now you remember the Indian on the western plains, with his exposed body and limbs; On a cold wintry day a white man asked an Indian, if he wasn't cold . No, he wasn't cold. The Indian asked "Is white man's face cold?" "No" "Well, Indian all face." There is nomore reason why the legs of the Indian should be cold than that the face of the white man should be cold, and they were warm for the same reason--that they hd learnd to take care of themselves just the same as the face had--they hd the ability to take care of themselves, and the skin of the legs was as active as the skin of the face. Sometimes we see people with roses on their cheeks--not always, but sometimes we see them. One of my little Mexican boys said to me the other day, "I wish I had roses in my cheeks, like Helena;" and I felt quite sorry for the little fellow because he could not have them. Now the Indian does not have any roses that we can see, but his whole skin is in that active vascular condition --the skin of the limbs and arms, just as well as the skin of the face.

DR. PAULSON:--I would like to ask, concerning the comparitive vascularity, if nature has, throughout these successive generation s, developed a more extensive vascularity of the face than of any other part of the body.

DR. K. Yes . Wearing clothing has deteriorated the skin, but it is possible to regain its functions to a considerable degree, but not to so great an extent as in the face, because its anatomical structure is different. It is the result of changes taking place perhaps through degenerations--but you see a person by using his hands just as he does his face will get them just a strong to resist cold, and would not have to wear gloves and mitters any more than he would have to wear a mask for his face. I would be just as likely to freeze my face as my han s I have been compelled by my circumstances to be a sort of a hothouse plant. I was riding through a blizzard one day to see a patient-- the day was particularly severe, and I had my fur gloves on, and my fur collar around my neck, and I was pulling my head down further and further under the fur as I was more exposed to thecold, when I saw a man come riding along on top of a great big wagon load of wood, and I could hrdly believe my eyes when I saw tht he had no overcoat, nothing on his hands, nothing about his face or his ears,--and yet he seemed as happy as anybody needs to be, and I stopped and asked him to stop. I thought perhaps his hands were cold and I thought perhaps I would give him my gloves. I asked him if his ha nds were cold and he said "No, my hands are never cold--I never wore gloves in my life." "Do you not wear an overcoat?" "No, it is not healthy to wear an overcoat-- I know better." This man was living on the Indian plan as far as he could. I am not sure but that the English people are right about the matter, where they make their little ones run around with bare legs or little short stockungs. Yu see them go about in the coldest weather with legs as red as stewed lobsters. They were not blue, but they were red--those children blushed clear up to their knees--there were roses on their legs as well as on their faces because their limbs had acquired the vascularity of a healthy skin.

Now the healthy skin is one where we find this power of regulation. But when we put on the clothing txxtx it does not have this power of regulation--it has no nerves, and it cannot be regulted every second, and every minute , as the normal skin is, so that the skin is relaxed and weakened still more. warmth is comfortable. All the animals seek the sun--it is very comfortable to get into a warm corner --

it breeds indolence--and the tendency is to clothe one's self more and more warmly until the skin loses al l its powers, and the whole system is weakened and relaxed in consequence. In Mexico we see babies rolling about on the ground just as they were born--rolling around--getting into the mud and then running off on all fours, just like a monky Of cours/some of them die--and indeed a good many of them die. It is really a survival of the fittest. But by keeping the weak and feeble alive we are really making conditions which favor race deterioration--so that we cannot expect to be perfectly healthy as long as we remain in this wicked world. So long as man is no longer clothed in light, he must be clothed in some sort of an artific ial skin which he cannot control, and he has of necessity to live in an unnatural and abnormal state, and he cannot help it.

But here is one thing we can do--wear clothes to the slightest extent with comfort, and take exercise to keep warm. We won't save any money by this method, for what we save in the clothing we will sacrifice in food, for we will eat allthe more heartily, for that has a great deal to do with the bodily heat. You know when a farmer wants to keep his sheep cheaply he drives them in the barn, and does not let them have any exercise, and so he doesn't have to give them so much food. This is a good thing for the farmer, because he wants to get a big sheep or ox for the butcher. But on the other hand if he were raising oxen for hardihood and endurance, he would not let them stand in the barn and be idle: He would give them plenty of exercise, even though they did eat more food. I was down on a stock farm in Kentucky, one of the greatest stock farms in the country, where some of the best race horses in the country have been raised, which is owned by a Confederate Colonel. I was very much interested in looking over his farm to see that there was not a single barn door. The stables were arranged in long rows, in the form of a square, and they were absolutely open on the in side, so that the horses were never indoors. I asked him why he reared his horses in that way, for the temperature gets pretty low there sometimes--it gets down in the neighborhood of zero, and he said We raise those horses in that way so that they will have great powers of endurance and be hardy. A race horse must be possessed of greater powers of endurance and hardihood than that of any ordinary animal. The race horse must be possessed of two or three times the endurance of the average horse, and he must be trained to this by hard work. Then again, you know the ponies from the Western plains are possessed of great endurance: A man can ride one of those ponies a hundred miles a day for a week at a stretch, and they seem to think nothing of it., while twooor three days of that kind of riding would kill one of our horses. Why is this? It is because of their tremendous endurance. These horses are exposed and they often have to dig their grass or roots for food out of the frozen snow,--and they are hrdy. So by the very protection which we give ourselves we diminish our vital activity and vigor and make ourselves susceptible to disease.

So by the very comforts of life that we consider necessary we weaken our bodies and bring ourselves into the condition of hothouse plants and of coddled babies who have very little endurance. So one of the things we can do is to clothe as lightly as comfort will allow. Be careful that our rooms are not too warm. If the temperature be kept at 60", it will be far better than at 70 or 75. Another thing of paramount importance is to do works of supererogation. The savage does not need to take a bath every day, because he takes a cold air bath every day, and he scours the dirt off as he goes through the bushes by rubbing against the twigs and limbs. There is another thing that we have learned, and that is that it is not necessary to clean the middle ear. It is not necessary to have an ear spoon and to twist up the end of a towel and dig it into the ear--there has been a great deal of injury done in that way. I remember suffering a great deal of excruciating torture by my mother's investigating my ears to their extreme depths two or three times a day. It gave me many an earache, that I did not know how to account for. The reason for this is that there is an excretion in the ear that exfoliates and it comes from underneath, and when it peels off it carries all the dirt away with it. The cells become flattened and dry, and by and by they die upon the surface, and as these fall off they carry off everything that is on the surface with them. So that the currying and rubbing and grooming is all the body needs for cleanliness. Water is not an absolute necessity for cleanliness, because the body knows how to take care of itself. The natives of Africa rub themselves with oil. The stomach ordinarily keeps itself perfectly clean. There is not the smallest particle or fragment of food to be found after a meal in the ordinary stomach; it has the ability to care for itself. The same is true in the rectum; the very least little bit of fecal matter is expelled from the bowels--and so it is with the eye and the nostrils--the nose is kept absolutely clean. Nature is a splendid housekeeper, and keeps the whole bo dy clean and pure. But under the conditions in which we live this exfoliating process is interfered with by the wearing of clothing. When we wear shoes, you know if he doesn't clean his feet three orfour times a week what a terribly foul condition they get into. Our shoes are perfectly impervious and so these matters cannot escape . Some of us are wearing a felt shoe which partly obviates this. Dr. pearsons noticed it the other day, and pronounced it quite sensible. Now we see what a terrible condition the feet get into because of the impervious coverings which we wear over them--now the rest of the body gets into just the same condition, only not quite so bad, because of the evaporation , theattrition of air, and the contact of bodies which scours off the exfoliating epidermis. But we do not have that sufficiently because our clothing prevents it. We must ~~xxxx~~ do works of supererogation. In other words, we must take a daily bath--not simply for the purpose of cleanliness, but partly for the sake of the rubbing which accompanies the bath and for the vasomotor gymnastics which we give the skin by chilling it, for then there must come a reaction, and we give the skin the same sort of an experience that the Indian receives when he springs out of his smoky hut into the open air--but he doesn't shiver--there is a reaction and this reaction is maintained continually.

You have seen the patient go out from the room with the face pale, and Exercise for an hour, and come back with rosy cheeks-- that isreaction of the skin--it is a reaction in the face, and the face maintains that reaction. If one were a savage he could go out with the least clothing which modesty demanded and come back with his wholeskin rosy--with a rosiness of his whole body, and in a perfectly healthy condition.

(Description of Calorimeter.)

LECTURES TO MEDICAL STUDENTS. (No. 4.)

FEVERS.

I think we will take up this morning the conditions under which fevers occur. It is very important to know that a rise of temperature occurs under a great many different conditions each one of which may ordinarily be called a fever, and each of these different conditions require different applications of the remedial masures. Perhaps we might say that the simplest cause of a fever or disturbance of the bodily temperature is heat. We sometimes find a person who has been exposed to extreme heat of the sun, and whose temperature has suddenly risen, and he is suffering from an attack of sunstroke-- what is the condition of that person? There is but little elimination; the skin is usually hot and dry and red. Sometimes, however, the skin is pale and cold and clammy--it may be pale and dry instead of hot and dry. It is well to notice these conditions in which the applications would be different. You know with sunstroke there is always a rise of temperature. Now what is the reason? (It is due to disturbance of the heat regulating functions.) Now suppose a person should have his feet exposed to the sun, and should have a tremenduously strong sun-heat applied to them--would he have sunstroke? No. Suppose every part of his body, with the exception of his head, which was carefully packed in ice, was exposed to the powerful rays of the sun--would he have sunstroke? (No.) But suppose all the rest of his body was protected from the sun's heat but his head - would he be likely to have sunstroke? (Yes.) It seems then that sunstroke is largely, but not quite absosolutely, due to the effect of the direct rays of the sun upon the brain. Then a protection for the head against the sun's rays is the best protection against sunstroke, except a sober temperate life. Here in this room you see the sun's rays passing through this window on to the wall. I hold my hand on the wall in thesunshine, and it feels warm. Then I put my hand on the glass, and it feels cold. It is possible for the glass to be so cold on a cold day that a drop of water will freeze upon it, and yet the sun's rays are passing through and warming the wall beyond.* Here on the board where the sun has not been shining, and where it has been shining but passed away, it is cool, and the glass is cool, but where the rays strike the wall it is warm. What is the reason that the sun's rays pass through theglass without warming it? The glass is transparent to thesun's rays, or translucent. Now there is the same thing takes place when the sun's rays strike the scalp. You see when the rays pass through that they do not warm but that they onlywarm whenthey are interrupted. So the sun when it strikes the head does not have to stop and warm the hair and the scalp and the bone andthe duramater etc., but the sun's rays go right through into the brain cells just as they go through this glass, and the light is then converted into heat. The sunlight may shine into this room and pass right through the room, and not heat the room at all-- unless it strikes the walls, when it warms the just as it warms this blackboard. It is onlywhen these rays are resistedxxxxxxx of energy are resisted thatxthxx that they become heat. When an electric current passes through a wire, that wire is not heated, only so far as it offers resistance. Whenver a conducting body of any sort offers resistance to the passage of the electric current, then the electricity is converted into heat. So the sunlight passs through the hair and the scalp--

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of course there is some littleresistance there, and some little heat,--and then it passes into the brain cells and there the heat is formed and these centers are affected and disturbed by the direct action of the sun's rays. That is sunstroke. But we have also another form--heat-stroke--glass blowers and men exposed to very high temperatures are affected by the same condition.

Ordinarily these conditions are relieved by what means? (By clothing.) Well, sometimes the clothing is more of an encumbrance than a protection. (By perspiration.))By evaporation from the surface. The perspiration keeps the temperature down and cools him off . When in this condition he has a dry skin, consequently the temprature goesup, and the heat regulating centers are disturbed . The heat production goes on, and the heat is accumulating , and finally a temperature is reached tht may bedangerous to life.

So one cause of the rise of temperature of sunstroke is exposure of the hea to the heat of the sun.

(QUES.) Is there not another form of heat stroke?)

We mentioned that briefly when we spoke of the case where there is a pallor instead of a rednessof the skin. Under the influence of this abnormal temperature there is a toxin produced in the body which produces the peculiar phenomena which we hve recognized..

We ought also to remember that hot baths will also produce a rise of temperature, and that we may bring the patient almost into a condition of heat stroke by the wrong application of a hot bath--whether in a Turkish bath or in a sweating pack or in an electric light bath, or if a patient has a fever, xxdxxxxxx or is threatened with a fever, and we put him in a hot bath, or in a hot pack, and surrouded him by hot bags or packs--prodivded he doesn't sweat--and this is of especialy importance in the case of the fever patients, for I have kown of cases of fever where the doctors have employed the hot bth or Turkish bth to break up the fever and as the patient did not sweat, he was kept there for an hour or two to make him sweat, and the temprature reached alarming propostions. And we must remember that in these cases of fever whe e there is no sweating, and we place them in the hot bth, if the atient does not sweat very quickly the h at must be withdrawn, for the patient in the febrile state has already lost his power to respond to some degree, and the heat regulting ceners are already disturbed xx and have lost their contro over the cente s by which the tempr - ture of the body is re ulated, and now if w create a ve y great disturbance by the application of artific ial h at to the skin when the elimin tion is already unable to keep up with the heat elimixxxx production, you see we my do the patient a very great injury, by encouraging a rise of temp rature to a very dangerous degree. This is true of the Turkish bath, the electric light bath etc. , an this is particul ly true of the electric light bth, for I kow of no other bth in which the int rior of the body is so quickly heated a in the electric light bath.x We have known the temperature to rise from the normal to 103 1-2 degrees in te minutes. You see in the hot bath, the hot water bath especially, xxxxx ix it is practically impossible for th e ptient to eliminate h at, as he is surroun ed by a hot medium, and the only possible chance or elimination is throuh the lungs and the face which is exposed to the cooler temperature of the surrounding air. The body being completely immersed in the hot water, and in such a bath the temperature may rise very rapidly.

Dr. Paulson:--Often it i necessary to give a thorough-going hot treatmentx and often that means a prolonged hot treatment, and in these cases thatis an awful thing.

Dr. K. It is the danger of that which I am trying to impress upon the class now, especially in cases of fever. The idea is, if they can only make the patient sweat. We must bear in mind that the sweating function may be entirely beyond control. In the normal man, if you apply heat you can make him sweat, and themore heat you apply the more you can make him sweat. But in the fever patient whose skin is hot and dry, and whose temperature is already 103, the sweating mechanism is already disturbed, and he cannot sweat. If the sweating mechanism were active, he would already be sweating. So I have found it practically impossible, in my experience, to make a fever patient sweat by means of the application of heat. When the fever is at its height, and it is possible to make the patient sweat by the mere application of heat, he hs practically reached the turning point of his disease, and convalescence has already begun. You have probably noticed this already in casesin which you have nursed fever patients --how much more easily controlled the temperature was when a little perspiration appeared, and how the fever rapidly yielded to treatment. That is ome of the best possible signs in continued fever-you know your patient is on the road to recovery--unless it is the sweating of collapse, which sometimes occurs. The night sweat is the sweat of collapse; It is an evidence of exhaustion and weakness which comes along during his convalescence. There are some forms of fever in which the sweating is a common occurrence, as in intermittent fever (?) or remittent fever, but in the case of the continuous fever it shows that the height of the fever is past, and the patient is thoroughly relieved, but in the remittent fever it is only temporarily relieved. But we know in the continuous fever that the ~~xxxxxxxxxxxxxxxxxxxxx~~ fever has abated and the whole disease process is improved--not only for an hour or two, but until recovery is fully established.

Now another word upon this point: It is a dangerous thing to apply heat in cases of fever , and if you d o apply heat it must be watched with the greatest care, and this is especially true of the Turkish and electric light bath, the hot blanket pack, fomentations to the spine hot enema, and all kinds of hot applications. I remember of having had an experience of this kind myself when I was a boy--I had an attack of malarial fever and a dry pack was given me to break up the chill . An old lady recommended a "corn sweat," and so my mother gave it to me. A "corn sweat" consists of ears ofcorn boiled in hot water, wrapped up in clothes, and packed about thespine and limbs, and this was to be applied at the time of the chill was expected--that is where they get the idea of the dry pack for breaking up a chill. I was put into this corn xxxxx pack, and while I was there I fell asleep, and while I was asleep the chill was practically abated and the fever came on just the same, and I passed from sleep into delirium, and the difference was rot recognized as my mother found me sleeping quitely, and was called away ; but when she came back she found me making a desperate struggle to get out of that bed and to get out of the house. In my delirium I thought that I must make a desperate struggle for the mastery over that disease, and if I did not succeed in getting out of bed and getting away from that tyrant I should be an invalid and be sick all my life, but if I could escape from itxixwouldxbexallxrightxxxx but if I could escape from that tyrant that was dominating over me I would be all right,--and they had a great time, and had to call in the neighbors to subdue me. I have seenx several cases in which patients have been made delirious by keeping them in the dry pack too long waiting for the chill toxpxxxxxxxxxx to come, and the chill was mitigated to such a degree that it was not recognized, and the patient passed from the heat of the hot pack--into the heat of the fever, and so he adds the two orthree degrees of the hot pack to the two or three degrees of the fever, and so he has a very high temper ature. So you can readily see that these points have a very important bearing.

QUES.--What do you follow the hot pack with in these cases?

DR. K. That would depend upon the condition. If it were a condition in which we wanted to reduce the temperature, we would app ly cold. If sweating was desired, we would do anything, except to wrap him up.

QUES. I mean in cases where the application of heat produced a bad effect.

ANS. Then I would apply cold. . Now you will find that in many ca es where the patient has a fever, if the temperature is reduced slightly the sweating will begin. It is this heat which has paralyzed the sweating centers, and after a cold bath the sweati ng will often begin , and have a good effect. A hot application is always an indication for a cold applications, and if the hot application has not had a good effect apply the cold bath directly afterward, for the patient will be better prepared for it then.

DR. PAULSON: Shou ld not the statement be made that hot applications should not be made in fever cases except in the very briefest application? You do not mean to exclude hotapplications entirely, do you?

DR. K: We are going to take up the study of methods, and then we will study the effects of the hot baths, and how to use them. We understand that heat will raise the temperature and the fever produced by heat may be of very brief duration--as when one takes a hot bath the tempeature always rises a little,--or it may be of long duration. You will see a fever in chuldren in the su mer time. This fe ver may be due to the excessive rise of the temperature--or itmay be de to a heated room , and this is especially true in fever cases, where the rise of tempperature may often be attributed to the heat of the room. What is neutral air? (60") Then if we have a temperature of 80" in a sick-room , would not that have an appreciable effect upon the temperature of the patient? Yes, it would have a decided effect.

Another cause of rise of temperature is exercise. If a man runs for half an hour, he may have a rise of temperature of two or three degrees. Perhaps there is someine here who would like to make the experiment of running and note the effect on the temperature. I do not think it would have a bad effect if you all tried this experiment every day. It might be a good plan for you to take the calorimeter with you and take the temperature both before and after the exercise. While we are speaking on running, I might say a word in reference to how to run. There is one way in which you can run and get the greatest possible amount of work,, and then there is a way to run in which you get the greatest amount of progress without the work. The one is to raise the body when the step is taken, so as to gain space in which to put the foot forward, and the other is to keep close to the ground. If you have a long run to make, keep as close to the ground as possible, flexing the knees instead of raising the body in order to get space in which to move the foot forward--flex the rear knee. Then take the temperature when you first go out, and take it when you return, and then take it again ten or fifteen minutes after you return and see how long it will take you to regain the normal temperature.

Now the important practical bearing of this is that exercise will produce a rise of temprature.

There is another form of fever known as fatigue-fever, which is the result of violent exercise. Sometimes in soldiers who have been making a very long hard march, you will find almost a whole army stricken down with fatigue fever. ~~Gaax~~ This is the result of the production in the body of a specific toxic poison, the result of muscular activity. These poisons may be produced in such quantity as to make it possible to have a rise of temperature by taking the blood of an aimal that has been running and wearied, and injecting it into the veins of another animal. This experiment has been tried by ......, an Italian physiologist. He exercised some dogs until they were exhausted, and then injected some of the blood into a fresh dog, with the result that the fresh dog instantly became fatigued and showed all the signs of fatigue of the other dog--the lolling and running out of the tongue and the panting, and the other means by which the first dog exhibited fatigue were manifested in this dog.

Now these poisons may be produced in such a quantity as to make a fever of two or three degrees, and this may be continued for a number of days.

Then we have another form, known as secondary fatigue, which is the fatigue or exhaustion which one experiences,--not at the time of the exercise, but a day or two afterward.. We often find invalids coming here from a long distance who tell us that they do not feel as well after being here a day or two as when they started from home. They say "I felt very well the first day, but I did not feel so well on the second or third day. Invalids and old people, for this reason, do not know where to stop their work. They say "I think I can walk as far as I ever did--my head is just as clear as it ever was--and I think I am just as young as I ever was." And so they exercise, mentally physically and muscularly, and the consequence is that in a day or two they find themselves completely exhausted. This is one of the symptoms of old age--or secondary fatigue. A man comes to be forty or forty five years of age and then he begins to suffer from secondary fatigue. The the young man of from 15 to 25 will exercise himself to the very last degree of endurance, and as I have seen them in some of the competitive contests in some of the gymnasiums, they will fall down on the floor almost dead with exhaustion, yet in ten minutes they are on the trapeze again, performing with just as much vigor as before. But in the old man this is not true,--the old man and the invalid--the rheumatic the obese, the neurasthenic--all suffer from secondary fatigue. I say an old man,--one may be as old at thirty years of age as at sixty; it is his physiological condition which determines whether he is old or not young, not the calender or the gynecological record. ("A man is as old as his arteries.") A French author wrote that,--that a man is a old as his arteries, but there is a better way to express it--I think a man is as old ashis liver and his stomach. A man is as old ashis body in general. Old age depends upon the general condition of the body If a man's liver is worn out, he is an old man, because he has an old liver; if his stomach is worn out he is an old manbecause his stomach is xxxxxxxx old, and the whole bdy is as strong as his stomach. You know that the strength of a chain is the strength of its weakest point. Now suppose we have a great heavy chain here, but one of the links is worn down to a mere thread of iron. Now the lifting power of that chain is just the lifting power of that weak link. That is true physiologically. If there is no particular weakness in a man's body, then that old adage holds true, and he is as old as his arteries. But if a man's kiver is old--if he has lived a physiological life of eighty years, even if he is but thirty! that man iseighty years old.

Then we may have four conditions under which we may have fever from exercise: Let us consider them: Violent exercise will always raise the temperature and, by the way, that is what makes a man sweat. If a person exercises until the temperature of the blood is raised .7" then he perspires, and the perspiration tends to cool him off. If he keeps on exercising violently the amount of heat produced by muscular work will be so great that the heat elimination, although he is perspiring freely, will not be able to keep up with the heat production, and so the body temperature will rise until it gets to be two or three degrees above the normal.

So we may have heat production as the result of violent exercise. We my have heat production as the result of x prolonged violent exercise, resulting in a fever which lasts two or three days--fatigue fever ma last as long as that and may even last longer than that and be mistaken for typhoid of other fevers.

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Again, we may have a fever as the result of xxxxxxxxxx fatigue.
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When a horse has founder it is the resultof xxxxxxxx fatigue. (A horse is foundered when he is driven too hard or exercised too hrd, and drinks too much cold water when he is first put in the barn") When he is over-driven. Founder is xx a condition very similar to rheumatism, and it may be produced by overeating or anything which produces an excess of these poisons in the body may produce fever, but as the joints are used and irritated by exercise, it is more likely to be brought on by exercise than by any other means. So here we have three means of producing fever.

Now we may have an elevation of the temprature from an ordinary cak cold. Generally in acold we hve the temprature elevated one or two degrees, and sometimes more than that, and sometimes only a few tenths of a degree.. A cold is simply a checking of the natural eliminative processes of the body, causing an accumulation of waste matters,--excrementitious bodies--within the tissues. This acumulation of waste matters gives rise to an elevation of the temperature. There is always produced in the body substances which give rise to elevat,on o f the temperature. If we inject into the veins of a rabbit for instance ax a portion of the urine it will cause the temperature to rise, and there are other toxins which will cause it to fall. These are usually eliminate througt the kidneys. Tht is the reason why a person usually dies with a subnormal temperature. Now the idea has been advanced tht death is caused in these cases by excessive elimination; but it seems as thought it would be easy to protect him against that xxxxxxx by wrapping him up so that he wouldn't die. But that hardly accounts for the facts in the case. Bouchard says it is the action of those temperature lowering poisons carried off by the skin, which are retained in the body, and the kidneys cannot carry it off, and so the patient dies. There is also a poison which causes a rise of temperature eliminated throuh the kidneys. When a person takes cold and the action of the skin is checked and the eliminative activity is decreased, then we have a rise of temperature.

Then there is a chronic condition which will produce a rise of temperature. People with chronic rheumatism often hve a sudden rise of temperature with acute exascerbations from the reaction of the uric acid and other allied poisons with xanthine bodies and all the products of proteid wastes whih are retained in the b ody and gradually accumulte. Haig has called attention to the fact that while we ordinarily secrete six or eight grains of uric acid, by a mixed diet we may take in, in addition to what we normally have, more than the body orsinarily eliminates, so that the blood being more than saturated with the uric acid, which is a difficultly soluble substance, deposits some of the uric acid in the tissues, and so the poison will accumulatem and it will keep on accumulating in th sway and this accumulation of uric acid establishes a condition which is favorable to fe v r, so a person duffering from chronic uric acid poisoning or accumubation are usually very subject to such diseases as pleurisy, endocarditis, pericarditis, etc., inflammations of various sorts which are classified as muscular rheumatism, articular rheumatism, and doubtless neuritis in many cases is due to the same cause . And not only that, but he is brought into a condition where he is liable to all sorts of inflammatory conditions. So there are two conditions in which a person may have a rise of temperature--because of the retention of notmal poisons, of excrementitioud waste matters, commonly called leucomaines. First a common cold,--an acute condition; second, a rheumatic diathesis.

I might add another class to those spoken of--the rise of temperature occasion by the introduction of poisons into the body directly ,--not from infection, but introduced by the patients themselves--as from canned salmon; sometimes there is a ptomaine present which will cause a rise of temperature and the patient's temperature will very quickly rise after he has eaten the substances which contained it.

Now, the most common cause is infection, or some specific germ which is capable of manufacturing in the body the poison which has this effect upon the heat regulating centers,--to disturb them in such a way that the temprature will rise.

Of course there are poisons produced which will cause a fall of temperature, but the general tendency of these poisons is to produce a rise of the temperature. That is one of the indications of infection. If we find a patient has suddenly had a chill and an elevation of temperature, we feel sure that he has been infected in some way. It may be nothing but a sliver somewhere; the surgeon may have punctured himself in the hand, or it may be the prick of a pin or a needle --it may be something in the food we eat or in the water we drink or the attrition of the collar upon the back of the neck and the germs upon the back of the neck have been rubbed in and we have a kind of a boil. We do not always know just how the infection occurred, but still there is an infection. There are always present in the alimentary canal a large number of germs which are capable of producing this infection, and some of these germs are capable of withstanding ordinary disin- ~~xxxxx~~ fection. For instance the staphylococcus pyogenes aureus is there, which will live in pure bile. That particular germ--it is a pus-producing germ, one of the most virulent of pus producing germs, producing a yellowish pus will live in pure bile. You know pure bile will not decompose, it is a natural antiseptic and disinfectant, and it preserves the food while it is in the intestines so that it does not become infected, and it must be a very resisting kind of a germ that can live in that medium. Do you remember of another germ capable of living under the influence of bile, if not actually in pure bile? The bacilli coli communis, which is always present in the alimentary canal in multitudes-- there are millions of tehm constantly present there, and the only woner is that we can live at all under the constant presence of these virulent germs. But the fortunate thing is that this germ is not always virulent. This germ, if kept under the attenuative influence of fruit juices and of wholesome grains and proper preparations, its virulency is subdued, but it is only when fed with meats and meat juices and with other substances uponwhich it thrives that its virulency is revived. We have proven this by absolute experiments in our laboratory. It is fortunate that we do not find this germ present in the ~~xxxxxx xx~~ stomach. But recent observations have shown that the coli communis will sometimes get into the gstric juice, and when it does grow there it produces a toxic substance of great virulence--but the coli communis does not grow well in the stomach.

But we take thi germ in in a undance when we take in cow's milk . People living on cow's milk must have plenty of these bacilli in their stomachs, unless the gstric juice kills them, or they are passed along rapidly to the intestines.

But these germ are capable of pro cing infection, appendicitis, colitis, ent ritis, peritonitis, cellulitis, abscess of the liver, intestinal cattarh and pleurisy-- and even pneumonia has sometimes been traced to it, and it has even been found in the brain in meningitis, in suppurating cases; it has been found in multiple abscess in different parts of the body . The coli communis has the pow r to invade th tissues rapidly, and after death if an animal is not "drawn," and the intestines removed within a few hours aft er death, as has be n frequently ob served, the issues are found infect d, all through the body. All the tissues and muscles of the body are found to be infected by this ra idly growing bacillus, as it is only the vital resistan e of the tissues holding it back, so ft r death they pass through the tissues and we have inflammation set up in the healthy animal. The same is the case when there is obstruction of the intes- tine -when peritonitis occurs. Why is t his, when it doe s not occur under ordinary conditions? Becaus the circultion is destroyed, the tissues lose their power of resistance and congestions occur and the bacilli rapidly work their ay through the wall, and set up inflammation on the outside. You see then, how we havepperitonitis--we soon have we soomnhave an abscess formed on the outsi e. We have had a case of inflammation followinga case of laparotomy where the intestines have been pulled out a d manipulated and they have been exposed and sometimes congested--t is condition results in a loss of resistance of the tiss sue. I remember a case once on which we had a patient--I never shall forget that case-- xxdx inxgttixgxthex it was necessary to remove the intestines from the abdo minal cavity. It was a very large tumor, and an extremely dificult case, and a very fat patiant, and in getting the tumor out there was a pressure upon the intestines. We had to pull the intestines out, and we kept them hot by means if hot towels, and we noticed that their color was deepened considerably--they did not become black, but there was evidently a passive congestion because of the abnormal position of the intestins. I kept them wrapped in hot towels and did everything possible to keep them warm, and hastened through the operation as quickly as possible, and got the intestines back into the abdominal cavity. But I felt very anxious about the case, and the next day I was not surprised when I found the temperature raised to 102 or 103 degrees, and the next day the patient was dead. Hot applications were ~~xxxxxxx~~ applied and everything that was possiboe was done in order to promote the circulation, but the patient died, and the patient died in my opinion simply because the intestinal walls had lost their power to resist the microbes whih were already in the intestines and ready to pass through. We must bear in mind that our protection is due to the resistance of the tissues and that the tissues are continually fighting germs.

If we cannot find any other source of infection, we must not say that this is a nervous fever, or an ephemeral fever, or that there is no special cause for it. There is always a cause for the infection of the body, and the only wonder is that we do not hve a fever all the time. The only wonder is that we can live under the ordinary conditions.

But there is another point that I hope we will remember, and that is that there is a danger constantlynpresent with us which we can geatly and enormously increase by the neglect of a proper dietary--by a flesh dietary--by a diet of meat, and milk I may say, because this coli communis bacilli grows readily in milk. But by a diet of fruits grains and nuts and fruit juices and the natural products of the soil these germs are attenuated so that they cannot accomplish anything like the mischief which they otherwise might do.

I might say further that this germ, the bacilli coli communis, when it is readed under certain conditions is capable of producing cholera morbus, cholera infantum, and a fever which cannot be distinguished from typhoid fever readily, so that among the French physicians at the present time they recognize the bacillus coli communis fever just as they recognize the Eberth's bacilli fever, and they recognize that typhoid fever may be due to these germs and that sometimes these fevers are not due to Eberth's bacillus, but are due to the colon bacillus which is maddened, so to speak,--it is rendered more virulent and poisonous by the presence of Eberth's bacillus and the conditions which it sets up. When the intestine becomes inflamed then the little inflammation which arises gives the bacillus opportunity for growth and development and to take on a virulence which it did not have before. When Eberth's bacillus invades the intestines, where does it go to? (To the glands.) Can it be found at first in the discharges? (No.) We cannot find it until the eighth or ninth day. Why? Because when ulceration begins it is throwing off dead tissue. Here then are very pronounced symptoms--the patient has diarrhea, but there is no Eberth's bacilli to produce it. What causes it then? You see there are a lot of symptoms of this disease which cannot be readily traceable to Eberth's bacillus, but to the exaggerated virulence of the colon bacillus. Then it is easy to increase to increase these conditions by the use of milk. See what a physician we physicians have entered into by giving the patient a milk diet. Then, you say, why do you give it? Because it is better than beef tea, because a milk diet will starve out some germs. There are some thirty or forty different kinds of germs in the alimentary ... the bacilli coli communis, and a ceral, some of which are even worse than the bacilli coli communis, and some of these will be starved out on a milk diet. Another advantage of milk in this case is that it is digested in the intestine instead of in the stomach; so there is a better oportunity for the digestion of milk than of beef. and it is better to feed the patient on milk than on ham sandwiches , beef tea or beef broth.

But we are not confined to milk, we have an alternative which is in every way preferable, in well-boiled farinaceous gruels ; and this is the diet which Hippocrates gave to his patients , and this dietary is employed in germany at the present time. But many of the leading German physicians have something agreat deal better yet : Liebermeister and many other of the best German physicians use as a regulation diet for typhoid fever, fruit soup. Fruit soup is a German dish and not an American dish. The first idea of fruit soup that I ever had I received from a German woman--Sister Louise, who made some fruit soup at our house, and Mrs. Kellogg experimentdd upon them and now we have many kinds of fruit soups. It is a very interesting thing to me that these men hve found out by practical experience many things which we have found out in our laboratory by research, and it is still more surprising that we haven't found out many more things. So we find, as I have said, that we may have a rise of temper ature from infections. There are several forms of infection--there is so-called infectious fever and infectious maladies, as typhoid fever, cholera, typhus fever, and all the eruptive feversx, and we must include malarial fever among the rest. In all these fevers there is a specific germ--or a specific parasite of some kind which manufactures poisons which elevate the temperature in such diseases as pneumonia, scarlet fever, diphtheria, and in ordinary sore throat there is always present in the throat streptococci, cocci, etc., xx so that in taking cold they will take on virulence enough to paralyze so that they can prey upon them and grow upon them, the resistance of the tissues being lessened, and then they can get down into the kitxlaxx blood vessels and a riseoof temprature will follow and the patient has a fever.

These streptococci can be foundxd in the mouth all the time. A drop of saliva in a bottle of beef tea will produce germs that will kill a rabbit. Dr. Rsxtsrx Sternberg made this discovery about twenty years ago. While down at New Orleans during a great yellow fever epidemic sixteen or seventeen years ago his attention was called to this subject and he went home and went to experimenting, and in doing so he discovered that a drop of his saliva dropped in a bouillon [illegible] of beef-tea would produce germs which when injected into a rabbit would kill it. He was frightened, supposing his saliva was particularly toxic, but he afterwards discovered that the saliva of others was equally so. He thought that he had become so infected with the yellow fever germs that it had made his saliva poisonous. But when he experimented with others he found the same thing. He investigated further, and found that it was a usual thing for these toxic substances to be found in the mkxthx saliva. So they are always present with us. We also have local infections, as in boils etc.,--and in the felon we have one instance of local infection. Then we have surgical infection, in which the wound made by the surgeon becomes infected--and in all these conditions we have a rise of temperature. In all these different conditions the application of hydrotherapy must be varied more or less to suit each individual case. There are other things to be done besides the application of water and these we will take up later.

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LECTURE TO MEDICAL STUDENTS. (No. 5.)

F E V E R S .

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The man who can successfully treat fevers can cope with nearly all the acute maladies........

Now under what conditions would we find rise of temperature present? ("In a warm room, where the heat elimination is decreased and the heat production is increased. The heat elimination is decreased because the temperature of the room or the medium in which the body is placed keeps the heat from radiating out, while the heat production is increased by the poisons --and there are other ways.") Yes, that might be. It would be a very common thing in the case of fever if we should let the temperature of the room get too high. In the condition of fever the poisons of the system would not be eliminated, and there is an exaggerated heat production; at the same time heat elimination is diminished by too warm a room.

Now there is another condition in which we would have that present: (" Where the skin would refuse to eliminate as much heat as was produced.") Yes, but we want to consider the external conditions. Of course this would be true, but we could not examine the skin to know whether or not it was in this condition. ("In tropical climates.") Yes, or in hot weather, which would be the same thing.

Now let us see what would be the condition of the weather that would produce this: Would warmth alone produce it? ("No.") We never have sunstroke in Mexico, or in western Texas, in Arizona or in Southern California --(It is the humidity of the air.") Yes. We have sunstroke in Chicago and New York, where we have great bodies of water where the air is saturated with moisture--and why? Now suppose we have a man who is supposed to have sunstroke: if he had an elevation of temperature, what would be the condition we should find ? ("A dry warm skin, probably flushed, but no moisture." Red face and hot skin--there would be some increase of the elimination, but the heat production is increased more. How high can the temperature go? ("To 112-3") Now suppose we took this patient's temperature, and we found that he had no rise of temperature at all. He is lying here and is supposed to have a sunstroke, but there is no rise of temperature. What is the matter with him? I want to call your attention to this. The difference is this: There is a sunstroke in both cases, but they are not both technically called sunstroke nowadays, or, rather, the old term of "sunstroke " is xxxxxx divided into two parts; one is thermic fever, the other heat exhaustion--where the patient has no rise of temperature--but both are the effects of the sun, and the man may have either of them. For instance a man is working ~~himself~~ very hard, or exercising himself violently, and is at the same time exposed to great heat; he is liable to fall with heat exhaustion , and he will have a pale moist skin, and he may be in a state of collapse his temperature may even be subnormal. But a person who has thermic fever, or real sunstroke, will be in a very different condition, and he will have a rise of temperature. Twenty five years ago these conditions were not so clearly ~~daf~~ distinguished as now.

Then we have that condition called sunstroke, or thermic fever. Now suppose a person is in a very hot room or in a Turkish bath--what is the ~~dxffxxxxxxx~~ effect? ("To increase heat elimination.") Yes, a person is perspiring in a Turkish bath--and how about his temperature? His temperature goes up; his heat elimination is increased, butthis temperature is high, nevertheless--it is above the normal.

Now in that case is the elevation of the temperature due to increase of heat production, or to the heat of the bath ? We hardly know whether it is the heat of the bath that produces the rise of temperature, or whether it is an increased heat production. Suppose the temperature of the room rises to 80"--what is the tendency there? ("To increase the heat production. ") It would also increase heat elimination, would it not? But it is also necessary in increasing the heat elimination, to increase the heat production at the same time, otherwise if the heat elimination were increased without an increase of the heat production, there would be danger that the body temperature would be decreased too much, for that sudden change of temperature would leave the body in a state in which it would rapidly lose its heat and so the temperature would fall. So nature maintains this perfect balance--when one is increased they are both increased. That is an important fact--so that the balance may be kept all the time. It is just the same with the muscles; you see the same thing when I contract my biceps muscle the triceps muscle is not absolutely trnaquil--no, it is at work also; when I set the biceps at work the triceps muscle is at work also, in a sort of antagonism, but nevertheless that antagonism is necessary to maintain the balance. So in the very same way the conditions that tend to increase heat elimination at the same time increase heat produce heat production.

QUES. It seems to me that when there is so much heat from without, that there is not so much need of heat from within.

ANS. We will consider that for a moment. Here is a person perspiring freely: --When a person is perspiring freely, his elimination may amount to several times the normal amount. We will consider that at the present time the conditions are normal--heat production and heat elimination are exactly balanced. Now we will increase the heat elimination to three times the normal amount--and it may be increased more than that. We will suppose then that we have a rise of temprature, and that we have the heat elimination increased to three times the normal amount. Suppose at the same time the heat production was diminished--what would become of us? We would freeze up in a short time?

We will suppose that the heat production is at the rate of 7 heat units per minute, or 420 per hour--let us see how many that would be for the whole body. We will say that the man weighs 160 lbs, and that his temperature is in even numbers 100". We will multiply the weight by the heat production, and that will give us the number of hat units, or 160,000. Now we will say that this man is made to swеat profusely. Let us see how much of that will be eliminated by the skin if he is made to eliminate three times as much as he ordinarily does . But we may be made to eliminate sixty times as much by the skin as we ordinarily eliminate; we may eliminate an ounce in a minute instead of an ounce in an hour,--but that would run down the body in the form of water, and we could not call that evaporation, for we would have to stand the patient in the wind, or blow upon him with a blast strong enough so that this would be evaporated as fast as it appears. But we will say that it is increased five times what it normally is. That would be at the rate of 2100. Now his heat production is going on at the rate of 420--this is not increased at all. Or, we will say that it is diminished down to 200,--about one-half, or 200 heat units per hour. In other words, heat production is diminished one-half, heat elimination is increased five-fold. Suppose that we diminish the heat production at the same time that we increase the heat elimination. This is simply a little problem to clear up this question of heat .

regulation, and this little problem will help us to get at the bottom of it. This is an original investigation, if you please, and we may discover something interesting before we get through.

We will suppose, then, that the heat production is decreased one-half, or to 200 heat units per hour, and that the heat elimination is increased five-fold. We supposed to start with that they were just balanced, so that we were really producing 420 heat units, and eliminating the same number. Now we will increase this five-fold, or to 2100, and now let us see what will happen. The body would lose 1900 heat units per hour. Now we only have to divide 16000 by 1900 to see how quickly the temperature will go down to zero. If we lose each hour 1900 heat units more than we make, then we have to subtract from our stock of heat units. By dividing that by 1900 we find that it will take eight and one-half hours for the temperature of the body to be diminished to zero.

DR. PAULSON: When one is buried in the snow drifts, is not that what would happen--the heat elimination is increased and the heat production is diminished--isn't that what takes place, and they die?

DR. K. Yes. So it is necessary that the heat production shall be increased along with the heat elimination. The heat production is increased beyond the apparent necessity of the case. It is increased more than seems to be necessary. But is that the case? It is only increased out of proportion to the apparent necessity of the case.

What is heat? It is a natural vital stimulus. And when we apply a vital stimulus to the body we cannot single out a single part and increase the vigor of that alone, but the agent that is a vital stimulus to one thing is a vital stimulus to every living thing. Sunlight is a vital stimulus, and it stimulates every living thing that it comes into contact with. It comes into the body and stimulated both heat production and heat elimination. Then what is the effect of heat upon the thermal nerves of the skin? These nerves are practically set as sentinels in the skin, and when some of them feel the heat coming they communicate the fact to the great heat regulating centers, and the heat production is diminished. But there is also another influence brought to bear which diminishes the heat production, so that we have both these two things operating together.

Now if we put a man into a hot bath his temperature will rise. The heat of the bath will increase heat production. Take him away from the bath and the heat production is diminished. We have this to bear in mind when we have an increase of heat production and the patient's temperature had risen very high, just as in sunstroke. Let us see about that. Here is a case of sunstroke, and the man is exhausted under the influence of heat, and the skin is hot, and the elimination is increased more than the normal, but at the same time it is not increased in proportion to the increase of heat production; there is a great increase in the heat production. This whole subject is not so simple as it appears upon the surface, and a person has to keep a great number of physiological facts in mind in order to be ready to deal with any of these cases. You just think you have gotten nicely to the bottom of it when something new happens, and that makes it perennially interesting. It is one of the most interesting subjects in Physiology, and one of the most profound subjects, as well. We find new avenues of thought opening up before us all the time.

We might pass on to other instances here, but we shall hardly have time this morning.

Now what are the things to be done when we find a person with an elevation of temperature. This temperature may be reduced--what are the things to be done? ("Increase the heat elimination.") Suppose it is a case of fever--what is to be done? Put the patient to rest. Rest will accomplish more than anything else in the reduction of temperature, --and what is the reason for that? Because exercise will do more than anything else for a rise of temperature. Rest is simply the antithesis of work. If we find a patient going about with a temperature of 101 or 102, we say he must go to bed and take complete rest. Now let us see the reason why rest will diminish the temperature.

In the first place, these points will be brought up to you in the examinations, and these examinations will be at the bedside of the patient. You do not want to think about my examinations, but you will be brought to the bedside, and you will be staring vacantly at the wall; and if you do not know of your ignorance yourself your patient will find it out, and God will find it out,--God will know it if you have not fitted yourself for emergencies that may arise. You may be called to the bedside where you will have to apply every one of these principles. If you knew how glad I was to get hold of these principles, and how valuable they are to me, I am sure you would strive to get hold of every one of them. I believe they are all facts which will be of practical use to you.

I speak of this because I notice that there are many in the class who are not in the habit of giving good attention; they are making figures on the hands or something of that kind. You cannot think any too hard on this question. You cannot be salting things down in your minds and at the same time be tracing figures, because if your eyes are occupied by that figure even though you are listening with your ears, the next day that impression will have faded from your mind, and it will be gone. You cannot do two things at the same time and make an impression that will stay. You must concentrate your eyes and your ears and your whole soul, if you would make an impression that will stick. Then again, we have an opportunity to get something now, and if you do not get it now the chances are you will never get it. If we have an opportunity to-day, and we miss it, we cannot hope that that opportunity will come back to us again, forthat opportunity has gone into Eternity, and we never can accomplish what we aould have accomplished if we had embraced that opportunity. We must embrace each opportunity just as it comes along in order to make it a stepping stone to something else. If we do not do this we will find that when we come to step to the next stepping stone, that we cannot quite reach it. We find that by not stepping on each stepping stone as we can to them, that we cannot quite reach the next, and what we would reach is just a little beyond us. We must take these opportunities, these stepping stones, just as they come, otherwise we will find ourselves sinking in the mire because we have not prepared a foothold for ourselves. But you do not need to be scolded, you only need to be reminde to wake up.

Now let us begin again. we wanted to see what was the reason it was necessary to put the fever patient to rest. This is a thing that young physicians are very liable to overlook. They have a patient running around, with a rise of temperature and they never think that that exercise is undoing all that it is possible for them to do for him. That patient must be kept quite, and the only exception I know of is in some stages of tuberculosis, where there is sometimes a slight rising of the temperature, of say 101 or 102 degrees, when it is sometimes better to let the patient get out into the fresh air a little, but if the temperature is much above normal, it is better for the patient to be putto bed until the temperature falls ,- and I am not sure but it would be better in all cases to put the patient in bed and give him such exercise as he needs by means of passive exercise, --and it must be very gentle at that. I have sometimes noticed that a patient with a rise of temperature will be having Swedish movements, massage, and mechanical Swedish movements, and with a temperature of 101 or 102 this is a very detrimental thing. The patient must have absolute rest. Exercise increases heat production--and why is it? It causes heat production in the muscles because the thermogenic tissues are in the muscles. Then if we work those muscles with a nervous activity or a circulatory activity, it will stimulate those thermogenic tissues to abnormal activity.

That is the fundamental reason. Another reason is that exercising the muscles causes a stimulation of all the vital activities. It increases the activities of the whole body, and the whole body will be producing heat--not only through the thermogenic ~~muscles~~ tissues in the muscles, but every tissue in the body will be producing heat and that will tend to a riseof temperature.

Then there is another reason why the patient should go to bed: And that is that assimilation is decreased, disassimilation is increased . There is increased waste--increased oxidation. Here is a patient whose elimination is two or three times the normal. His heat production must be keeping up with thatelimiation, you see, and perhaps it is a little more than keep ing up, in order that there should be a rise of temperature. Thus you see at once that when a patient is eliminating heat three times as fast as he ought to that his body is being consumed three times as fast as it ought to be, and no if we make thatman work in addition to the energies consumed which is consuming about three -fourt of the energy, that will be added to the heat production , and the a patient will be wasting away very rapidly. We do not appreciate how rapid is this process of disintegration, and how much dependent we are upon assimilation and repair until we go without sleep for two or three weeks. Have any of you been without sleep for two or three days? If so, how did you feel? ("Sleepy and dull.") I once asked a small boy in Chicago who was chewing tobacco, why he didn't stop, and he said "Because I feel so bummy when I stop." I suppose this illustrates our feelings when we have been without sleep for a while--we feel "bummy." A man who has been without sleep for several days feels stupid; his mind seems to be almost effaced, and he cannot think, and he cannot walk straight, and his mental forces are almost paralysed, and by and by he will get into a condition where he will brave almost any peril for the sake of sleep. I remember when I was in the West an engineeron the train told me that he had gone to sleep and woke up and found that he had been asleep for fifteen minutes, and his fireman had been asleep, too; they went axtaspx to sleep at theirposts, and there that train had been dashing ahead for fifteen minutes, with the engi neer and fireman both asleep! The engineer said he had known of engineers going to asleep on their engines many times. But these men were partly excusable, for this was their second night out , and they simply hadto go to sleep--they couldn't help it. I have known of nurses going to sleep on duty, too, and the patient staying awake to watch them. (Dr. Paulson: I have known of cases where the patient was dying, at that.) But we make it a rule here that the nurses shall not be allowed to go without sleep--that is one of our rules, but it i not always regarded--for the fery reason that we know that it is not within human powers to resist the tendency to sleep unless there is some tremendous stimulus acting upon him to keep him awake. In olden times one of the punishments meted out to criminals was to make them go without sleep for a week; they had persons to goad them and keep them awake and force them to go without sleep. I have known doctors to fall asleep when riding horseback to visit their patients, and to fall from their horses. So you see that this demand for repair that is made by nature is a very imperative demand.

Now to study the condition of the fever patient: Thre is almost no repair. The assimilative powers of the body are greatly weakened; at any rate the dissolution of the body is taking place at two or three times the normal rate, and yet the power to repair is diminished. So how important it is that we give a patient as near absolute rest as possible in order to lessen as much as possible the disintegration of ~~tissues~~ the tissues. So rest is one of the things that is absolutely necessary for the fever patient.

("There is a time comes when you have been without sleep for two or three days when you feel brighter than before, and when you feel that you can stay awake for two or three nights longer, and that you can do almost anything.") Yes, that is true. And so we find with the fever patient that has not had rest for two or three nights; he is delerious and requires two or three nurses to hold him in bed, and yet of his voluntary action he would be scarcely able to lift his head from the pillow. It is a diseased condition. His brain becomes irritated, and he then begins to draw upon the store of energy intended to be used next year or the year after, and a man under these conditions is cutting off the other end of his life very rapidly..

DR. PAULSON : When they are in that condition and they go to slep and do not get but one hour's rest or so, it seems to "take the whole life out of them."

DR. K. I have heard persons who have not slept for some time say that if they were to sleep then that they could not do another thing. Now when a person gets into that condition he is inan abnormal condition, and it is very important that he gets rest at once. First of all I think he should take a neutral bath, and then go to bed for a couple of days until he gets rested.

But xm rest is especially important in fever--it is nature's remedy for fever,--for to-day a man may be vigrous and strong, and to-night he has a chill and a fever and to-morrow he is so weak that he can scarcely walk. The man who to-day could perhaps lift half a ton is taken with a chill and a fever, and to-morrow he probably could not walk half a mile. What is the matter with him? He has not lost all his energies, nor all his muscles. What is the matter with him? Nature has simply brought him into a condition where he will go to bed, bytaking away his disposition and his spontaneous ability to work. So it is important for us to recognize that suggestion of nature, and put the patient to bed.

And we must not only put him to bed physically, but we must put him to bed intellectually, as far as we can ; shut away from him all kinds of mental work and activity; do not let him read or let people talk to him or think about his business. It is very important that he shall be shut away from mental as well as physical activity.

Now another thing we must never forget is that the fever patient is far more susceptible to all of the temperature disturbing influences than is the man in a normal condition . This is fortunate on the one side, because it enables us to control his temperature by means which are not greatly effective in disturbing the temperature under normal conditions . For instance the hot baths would have very little effect upon the normal man, but with the man in a febrile condition they have a very marked effect.. When it is very important that we should protect the patient against sudden changes of temperature, from all disturbances, and against every kind of work or worry or annoyance of every kind. So we sometimes darken the room a little bit or put a towel over his eyes so that he will not see the figures upon the wallpaper and let them set him to studying. We get him into as nearly a vegetative state as possible. We tell the nurses not to talk to the patient; to speak softly; to step lightly, and we put the patient in a position where there will be just as little noise as possible.

All this seems simple, but it is ten chances to one that the first case you have you will forget nine tenths of these things. But you must remember that success all depends upon the number of agencies you ~~able to bring to bear~~ are able to bring to bear. And the reason one physician is successful in a case, and another is not successful in a case similar to it is because that one physician will concentrate a large number of helpful agencies in that case, while the other thinks of one thing and tries that, and then thinks of another thing, and tries that, and so on, and not a single thing helps the patient, because they are none of them able to do it alone. Now here is a big stone down here in a hole, and here are twenty men standing around wondering which can lift that stone. One of them says "I can do it," but he can't stir it; and another says he can lift it, but he fails to move it; so one by one they all try to lift it, but they cannot lift that stone because there is no single man there who is able to lift that stone alone. Now all of those twenty men could have taken hold of that stone and lifted it out of the hole with the greatest ease. So you must bring all the possible healing and curative agencies to bear at one time. Do not try to do it with a single remedy, but try them all together.

First, then, we have rest in bed. Second we have fasting, at the beginning. Why do we fast in these cases? If you take the temperature just after a dinner, it is higher than before--that is after the dinner is well settled. If a person has been taking a cold meal the temperature in the mouth may be a little lower just after it is eaten. Now why is the temperature higher after eating? Because all the processes of the body are quickened by digestion. So at first it is a proper thing to have our patient fast in order that we may get rid of all the rubbish that may come in with the food. At the first onset of the fever the patient has quite a store of glycogen in his liver and in his muscles, and if we are going to give him absolute rest he doesn't need very much food. Suppose you were going to bed to-night, to stay there until the day after to-morrow; you would not get very hungry. I presume many of you would not care to eat at all tomorrow. I do not think I should think of eating at all if I were to stay in bed and not work, because if a person sets to work and works hard, he needs to eat, but if he doesn't work he doesn't need so much food. So there is very little ability to work or to eat. Is the gastric juice secreted in normal quantity during fever? No, there is little if any. So then there is no ability to digest the proteids in the stomach. How about the saliva--is it abundant? No, the mouth is dry, and there is lack of ability to digest starches; and so we might go on through the whole digestive apparatus and find the same condition present. Thus nature indicates that there is no ability to digest food. There is no ability to assimilate it and digest it, so that if we were to eat it we would simply worry the body and increase the temperature with the fever of indigestion, so that we see that fasting is a good thing with the fever patient.

Dr. Paulson:--I notice that there is quite a tide setting in that direction among physicians.

DR. K. Yes. So we will have our patients fasting on fruit while absolutely abstaining from food. Some of you have tried this, and you know that it is a very pleasant way to fast; we find that fruit is a food that doesn't need very much digestion. We will take for instance a ripe peach; what has a ripe peach in it? (Lots of fruit sugar.) There is water, and that only needs to be absorbed; there is levulose, which requires only absorption; there are vegetable acids, and they do not require any digestion; there is no fat at all, and fat is one of the things that we cannot assimilate in a fever; fat would only feed the fever; we have almost no ability at all to digest fats; and there is only a very small proportion of proteids--so small that we may almost ignore them. But there are some dextrins. But we have acids--for what are they useful? For disinfectants, because they form a medium in the alimentary canal which arrests the action of the typhoid fever germs, because they will not live in fruit juices, so if we flood the alimentary canal with fruit acids we will do much to help the patient. The bacilli coli communis will not grow in fruit juices, either, so if we flood the alimentary canal with fruit juices this would be one of the best methods of checking this increasing virulence of the bacilli coli communis, which really does the greater part of the mischief in typhoid fever. It is in reality the bacilli coli communis that is excited and over developed. It is this germ in typhoid fever that makes the most of the trouble. The germs produce these toxic substances, and not only the bacilli coli communis, but streptococci, and the conditions of typhoid fever which are the worst are produced by other germs than the typhoid germ.

Then the dextrins, or grape sugars of the peaches and other fruits,--are they useful? It is just what we need to sustain the body. How is it in reference to the increase of heat production in ~~txxxxxx~~ fever--is it at the expense of the proteid substances in the body , or at the expense of the carbonaceous portions of the body? It is an increase of CO_2; there is a large increase in the CO_2 and also an increase in proteid oxidation, but this is due to the elevation of temperature, and as this is comparatively small when compared with the total increase~~x~~ I think the great loss in the body is of carbon and carbon compounds. So we can lessen that waste by supplying sugar that is all ready to be absorbed . Fruit is an ideal diet for fever, and the patient may be fasting from food, and at the same time be taking fruit .

Now how about a milk diet? Milk diet is better than a mixed diet, of potatoes and Boston baked beans and ham sandwiches, but it is as Bro. ~~Mayor~~ Jones says with reference to the city Government-- it is better than nothing at all, but it is not an ideal, by any means. Hippocrates had a better diet than that, consisting of barley gruel, strained; But the Germans have adopted the plan of giving the patients fruit soup , and I do not know of anything better that I could suggest . Fruit soup is really an ideal thing, because by the long cooking of the fruit all the nutritive elements are brought into solution and dissolved out, and are ready to be absorbed, and the woody substance and those rough and undigestible parts are eliminated, and then we have it in a perfectly sterile form, and the patient could take fruit soup when he could not take fruit in any other way . Now some person says he can't take grapes, because it gives him a terrible pain in the stomach; what is the matter? Why they wipe off the skins of the grapes with their lips, and the skins are covered with germs, which seem to select the grape for a nesting place, and for this reason they have fermentation of the stomach.

That is the reason we have fermentation in the wine. There is a heavy culture of these germs, capable of strating fermentation in yeast, etc., on the outside of the skin, so that the grapes have to be boiled in order to be rid of them. But if the fruits are coked, all the nutritive elements are ready for assimilation, and we cannot find anything better than fruit soup. But suppose a person takes fruit juice out of a bottle, and still he has trouble with his stomach. The juice has been boiled--what is the matter with it ? It cotains cane sugr. There is cane sugar in the bottled grape juice, and there is not the power of digesting it that there is in the healthy individual and consequently it readily ferments.

The hunger cure is an old fashioned cure for fever, perhaps a hundred years old, and has almost fallen into decay. The medical profession goes first in one way and then in another way. It is starvation one day, and then it is bleeding, and then it is feeding. We are now I think in the attenuated stage of the feeding era. Twenty-five years ago when I was a student of medicine, just getting through with my medical studies in New York, Dr. Austin Flint was advocating very strongly the supporting method in fever cases--. Up to within a few years of that time it had been customary to bleed the patients in fever; up to within ten or fifteen years it had been the custom to bleed and bleed the fever patient until the patient was almost in a state of collapse, until the temperature was brought down, and consequently most of the fever patients died because the vitality was gone and the very means by which it was necessary to fight the fever, the blood corpuscles, with their phagocytic action, were taken away, and the consuming power of the fever was in that way increased .

In London it was the custom to give the patients great quantities of alcohol--a pint a day was a very common dose. Whiskey was a very common remedy which Dr..Flint very strongly recommended and urged. The dose was one txx xxxxx to two ounces, and we must increase it to four o unce doses, and it was not uncommon for a patient to be given two pints a day. I remember how he used to insist on administering whiskey, and he used to smack his lips as though he enjoyed it a little himself. This was an almost universal remedy . In going into the London Hospitals tennyears later I foundthat milk had been substituted for the whiskey, and this was a very va luable change. The milk diet in typhoid fever is coming into vogue. It was a whiskey-and-milk diet, but now it is a milk diet, for it cost too much for the whiskey. In the poorhouse hospital they gave each patient a pint of two of whiskey a day, but this was very expensive, and the people began to revolt against such bills, and the hospitals began to vie with one another in cutting o ff expenses, and in order to cut off expenses they had to cut off the whiskey bill. A temperance hos pital was established in London, where they used no alcohol , and their patients got well faster than those of any other hospitalh, and this attracted the attention of the authorities to the fact, and so they left off the whiskey, and now in a great number of ho spitals it is left out entirely, except in the army, where Dr. Flint'sxson still advocates his father's theory of the use of w hiskey in typhoid fever--his influence is still dominant in the army. The army is very conserv tive. Certain things are supplied in the commisary, and cettain things are in the doctor's stock, and there are certain rules and regulations, and the doctor must walk wight in the heat en track: They have the same old officers in hte ar y for a score of years. One waits a whole generation for a change, and the man who has been waiting twenty years for a pro motion uses the same old things that he was taught twentyyears ago. For instance, pneumonia was treated by deluging the patient with whiskey in uuch quantities as to make him drunk all the time. The medicalt treatment in the army during this last war was something terrible.

Now that is the way this milk treatment came about, and it was a great improvement. But there is a better method, and that is to dispense with the milk. I am satisfied that milk is one of the things that makes the mouth so foul and causes diarrhea, by rotting in the intestines. The better method is to dispense with the milk and adopt the fruit dietary.

I think it is important to be well grounded in this, because when you go out you will find such a balance of authority in the other direction, that we must have a sound foundation on scientific fact in order to be able to uphold your position.

Ques: How did beef tea come in?

ANS.-- Well, beef broth was supposed to be strengthening, and it has been in use for the last two hundred years. Now I will tell you a fact, repulsive as it may seem; but two hundred years ago urine was used where beef tea is now used, and beef tea was its substitute. The urine of a young child was regularly prescribed and used, and beef tea is simply a more esthetic preparation, and is not more wholesome. Indeed, it is the very same thing. It is so absurd to think that the poisons of the body of a dead animal could ever have been conceived to be of value. I suppose it came about in this way, perhaps: People supposed that whiskey was the strength of the corn, because it was obtained from it by a process of extraction, and so they supposed that beef tea was an extract of the beef. This fallacy has been published so widely that the people have come to believe it. Take a package of Leibig's Extract of Beef, for example, and on the wrapper it reads "This pound package represents the nutritive value of forty pounds of the best beef.

and so the people have been deceived. But say here is a patient needs to be treated: If one can swallow forty pounds of beef at a mouthful or two, it is a very easy way of taking nourishment. It has been supposed, for example, that a teaspoonful of the beef extract put into a glass of water gave as much nourishment as a pound of beef, and the people have the idea that because the ox is strong --that by eating the strong man we get his strength -- that patients in order to be nourished had to have "strengthening" broths. And we read in the medical books that we should use beef tea, chicken broths, etc. These things give a person the impression of strength, just as with the use of alcohol--but he does not have any more strength than he had before.

Now we must give the patient rest, and fasting--but we have given the patient fruits, so it is not absolute fasting, but the ordinary articles of diet are withheld. This is for the first two or three days, and I would not hesitate to fast three or four days; if the patient was quite strong he might go a week without giving further food, but there is no harm in taking fruit juice or fruit soup from the beginning.

QUES. What about the cases where there is a sore mouth and the acids hurt the mouth?

ANS:--Take sweet fruits, such as raisins, prunes etc., and they may be stewed thoroughly and the whole nutrient value extracted, and that dissolved in the water may be taken; it should be taken well diluted. The patient can take the fruit juice in connection with the fluid that he drinks. Just think how much better this is than to take milk, which is such a good food for the germs.

....

LECTURE TO MEDICAL STUDENTS. (No. 6.)

F E V E R .

WE will now consider methods of subduing fever What is the first thing to do when we find that a patient has a fever? Rest. And why rest? To reduce the metabolism. And a reduction of metabolism will result in two things: First it will lessen heat production, and second it will lessen tissue waste and toxin production, and hat production comes in part from toxin production. Again, it will save the patient from wasting away; it will husband his resources. He is going on an expidition, so to speak, where he is cut off from his base of supplies, and he must economise his resources. His resources are all stored away in his body, and it is ofthe utmost importance that he should take care of his tissues.

Now another thing of importance, we found, is to fast. Is absolute fsting usef l in many cases? Yes. Now fasting is not nearly so serious a matter as manypeople think. I remember when I was a boy if a person should miss a meal once in a while that it was a terrible thing--to go all day without eating, and that it was a dangerous thing to do. I think that the majority of people who are not accustomed to fasting think that it is a positively dang rous thing to even lose a meal--and to lose two meals is a dreadful thing. When you are on board a train you sometimes hve occasion to see how people feel about missing a meal; when there has been an accident or a delay that leaves them out in the country,--there is a tremendous clamoring.

I had a letter from a lady yester day morning saying that she had eaten nothing for three weeks. She was suffering from chronic inactivity of the bowels and was taking that method of relieving it. She had tried it before, with excellent results. I remember one patient at the Sanitarium who was suffering from that cause, and about thirty years ago she went to a little water cure where they used to have their patients fast the first thing, and so she fasted three weeks the first thing she did, and she was well for ten years. There is a great deal of power on fasting, and at this water cure they used to make their patients fast for two to three weeks the first thing they did, and then there was no complaint over the bill of fare. They had sufficient appetite by that time to eat anything that they might have This was in Ohio. An English lady was in the cures of Vienna, and she wrote quite an account of the fasting cure. But it is not very much practiced at the present time.

Now what are we going to substitute for this absolute fasting? (Fruit diet.) Yes, a fruit diet is an agreeable way of fasting, and the best diet for a fever patient is stewed fruits, fruit soups, fruit juices,--and of them all I believe fruit soup is the best thing. The only objection I have against it is that cooked fruits are not quite as effective as the uncooked fruits in destroying germs.

QUES. Why is it that some people complain of headaches etc., if they lose one or two meals?

ANS.--Well, there are certain disturbances which come from fasting which we will have to take up at another time. But briefly I think that the main troubles come from an irritation in the stomach set up by the secretion of hydrochloric acid , and that hydrochloric acid having no food to dilute it, irritates the stomach. In some cases when hunger indicates that there is a necessity for food, the hydrochloric acid is poured out in advance of the swallowing of the food. This has not been understood until recently. Ther thre are case s in which the stomach secretes gstric juice all the time. This is a condition in which there is very likely to be an ulcer of the stomach pretty soon. But there are many cases in which the hydrochloric acid is poured out in the stomach in advance of the ~~fruit~~ food, and acts as an irritant to the unprotected stomach. Tat is a reason for that "all gone" feeling when a person has not eaten. Another reason is that as in chronic gastritis, the walls of the stomach fall together and there is an irritation of the surface which gives rise to this cond ition.

QUES. If the cooked foods are not as efficient as the uncooked juices, are there any means by which e can preserve the raw fruit?

ANS. Yes.. I am trying to devise means by which we my be able to preserve raw fruits, and I hope to be able to do it. I have one experiment under way now of about two pints of the fruit juice. It costs about $2 for t he pint and a half. It is made directly fro m the apples and put in a vacuum pan. It is vaporated down ti ll it is a great deal thicker than "molasses in January,"--it is like mush, and it is wonderfully delicious, and ha s all the natural flavor. It has been boiled it is true, at a temperature of 130 to 140, in a vacuum pan, so that it is thickened,--so that it will keep, I think. Now we can get fresh fruits nearly al the year and we can get lemons and oranges etc., all of the time. and you know lemon juice and orange juice are about the most efficient which we can give to reduce disease. InTurkey we can always get fresh fruits, and we can get the pomegrante, and oranges, lemons etc., from Palestine. It would be no cross at all to dine on pomegrantes.

We have rest in bed, fasting,--and what is the next matter of importance to be considered in relation to the fever patient? Regula - tion of the temperature of the room. We should have a l ow temperature, of about 60". Then again, if we get the temperaturex too low, we might have a disadvantage arising from that. I think I should make this remark with reference to the influence of the temperature: A temperature below 60" will increase heat production, as well as a temperature above 60". Of course between fifty and sixty degrees there is no appreciable difference, or between sixty and seventy. Between fifty eight and sixty eight is the negative area, or neutral zone.. Now when the temperature of the air in a room is elevated that increases heat production, for the reason that xx anything that will increase heat elimination will also increase heat production. Every condition of the body that will increase the heat elimination, will increase the heat production as well, and this is a necessity as a protection to the body, for otherwise, as we figured out on the blackboard, the body will lose so much heat that it will be brought into a dangerous condition.

But there is this point that I want to make clear to you that heat produvtion is ot increased unless the skin is cooled--unless the body is exposed. So we may have a patient in a room where the temprature is 40", provided the patient is kept warm, and not chilled, and we do not have any increase of the heat production unless there is a chilling of the surface. Then we have a signal by which we know when heat production begins, and that is the sensation of shivering . Now if the patient is not cooled by the cool air, he does not have increased heat production

Now what is the next thing? Just as soon as heat production begins heat elimination begins, under normal conditions. In fever the body has lost its power to regulate these functions, so in that case it is not so true. For instance when the skin is normal, when the temperature of the room rises that makes the person begin to perspire, and at the same time the temperature goes up--when the temperature goes up to 104 then how much is the elimination increased? Three times. So heat production must be increased right along with that elimination. But in the fever patient this is not true when the temperature of the room rises. His heat elimination would be diminished instead of being increased, because the skin is crippled. The skin is already hot and dry, and he cannot perspire. Now when the skin is warm and dry and red, how may the elimination be increased? How can the body increase the elimination, by itself? By perspiration. But suppose the skin is paralyzed so that it cannot perspire,--then what? It is helpless to do anything.

Now we will suppose that the temperature of the room is increased. We will not increase the heat elimination at all. The temperature of the room rises, and as the body is eliminating heat only as it can throw it off from the skin, into the air, and the temperature of the air is already above,--here is the temperature of the body at 104", and here is the temperature of the room in this case at 60". The body is giving off heat in the same way that a stove would give off heat, and it has not the power to moisten itself. The sweat glands are paralyzed and cannot act. Now in this way it is giving off heat at a certain rate. Now suppose we raise the temperature of the room to a higher degree. The heat elimination is diminished because it depends upon the difference between the temperature of the air and the temperature of the body, and then if we lessen this difference then we lessen the elimination. The difference between the temperature of the room, 60" and the temperature of the patient, 104", is 44", but if we raise the temperature of the room to 80" it is but 24", so that the elimination will be twice as rapid in the first case as in thesecond. Now if the elimination is still further diminished by raising the temperature of the room, then the temperature of the body must rise,--and we can even tell about how fast it will rise. We will say that the nurse has neglected this patient, and allowed the temperature of the room to go up to 85"; then the difference between the temperature of the patient and the temperature of the room would be only 19". Before , the temperature of the room was 60", and the difference was 44". Now with a patient with a temprature of 104", with a dry hot kkin, about how much do you imagine that that patient's temperature woul in all probability in crease? I gave you a rule sometime ago, by which you could know. What per cent does the heat production increase with every degree of rise of temprature? 3 1-3 %. Now this patient has a dry skin. If he was perspiring he would be throwing off hat at an enormous rate, but the skin is dry, and there is no perspiration at all. No let me ask you a question: When a person has a dry hot skin, and the sweat glands are absolutely paralyzed, is there any evaporation taking place? How can there be when there is no sweating? Osmosis is taking place. The skin is not like a rubber coat, impervious, and you know tht if you take a bladder and fill it with salt water and place it in a different medium, that osmosis takes place. The skin is porous. Independent of its sedreting powers it hxxxthexx is a porous covering, and water passes out by osmosis, so that there is some evaporation taking place even with this dry hot skin, and more than there would be with a dry cold skin, because we my have a dry cold skin, It is continually giving off more or less heat. So nature is doing all that she can to eliminate, but, probably due to some toxic substances, the sweat glands are paralyzed and they cannot flood the skin with water, and the perspiration is greatly lessened when if we had a temperature of 104 from exercise we would be perspiring vigorously.

Now how many degrees above the normal is this? We will call it 6. We will multiply that by 3 1-3 %--it is possible for the heat production to be increased twenty per cent. Now I think it is important to mention this point, because we might get the impression from finding the patient's temperature so high in fever that the tempxxxxx heat production was increased much more than it is. We find a person exercising and perspiring, without any elevation of temperature, and yet we find that that person's heat production is increased 3 1-3 per cent. above the normal, and we might mentionx imagine that a person suffering from fever has a geater rise. But we must mention here that the person suffering from a fever has no such rise of temperature as that. If he did it would waste him away and use him up in a very short time. Here is a man exercising and perspiring freely-- or, he is in a Turkish bath, and the perspiration is pouring right off. Suppose he stays there forty eight hours--what would his condition be? He would lose in weight very rapidly. And then suppose that he could take no food, and was wasting at that rate: His condition would simply be one of complete exhaustion in a very short time. Now suppose a man with a fever was being burned up as rapidly as by work. In work it is only the heat that is consuming him--it is only one-fifth work, and four fifths heat-- and he has a higher intensity of the fires of oxidation than in fever. Here is a person engaged in vigorous exercise: The amount of oxygen which he takes in and pours out may be increased to seven times the normal amount, and the amount of CO_2 that he throws offxxsmay be increased several times, and that is the action of the metabolism in the body. Now we have nothing of this sort in fever. We have an increase, but it is comparatively slight, of CO_2 in fever.

I originally had an idea that a person in a fever had an enormousły rapid consumption of the body. But there is no such very great xx increase of heat production, only in exceptional cases. If it were anything like the rapidity of the tissue consumption and oxiditation which takes place in vigorous exercise the patient would be consumed very much more rapidly. Now we know that if this patient perspires very so little, down goes his temperature. You all know that from your experience in nursing fever cases. And there is perhaps a double reason for that: One is that the condition of the patient which allows him to perspire is an improved condition, as well as the cooling off of the xaxx body by the fall in temperature.

Now we have twenty per cent increase of heat production, and the normal rate is 420 per minute. There is an easy way to remember the rate of heat production: How many degrees F. are require to make L"C. I.8" That represents the number of kilogram calories, centigrade, produced in a minute. To convert this into centigrade kilogram pounds multiply by the number of pounds to the kilogram, 2 1-5, or 11-5ths, and xx we multiply this by the heat units, 9-5ths,, and it equals the product,--four. Then all you have to do is to multiply whatever number you have by four, and it will give you the number.

Now we will go back to the original 2,700,000, which is the number for a day. Divide that by 24 and we have 112,500 per hour, and we can easily reduce that to minutes by dividing by 60, or 1870--that is gram calories. Divide that by 1,000, and we have kilogram calories. That gives us 1.8 kkilogram calories per minute. Now we will multiply that by 4, and that gives us FFarenheit pounds, and that gives us 7.2--we will call it 7, for convenience.

Now I am only going through these few problems to show you how easy xttxkait is to have a few hitching posts, so to speak, and to hang these other things on those "hitching posts ."

When a person's temperature is elevated .7 of a degree, it will cause perspiring, if he is in a normal condition. When a man is running his perspiratory activity is seven times what it is when he is lying horizontally in bed. Dr. Parke figured these things out.

The number of heat units per minute is 8.6. The heat elimination is such that the ptient's temperature is kept down to 104 when the temperature of the room is at 60. Now when the temperature of the room is at 85, we cannot say that the heat elimination is lessened one-half, because we do not know what it was in the first place. For instance, here is a weight--an unknown quantity; and here is another weight that weighs forty pounds more than the other . Now we will diminish the one or increase the other so that it weighs but twenty pounds more. But we cannot say that we have diminished the weight one-half, because we do not know what it was originally. Now it was previously twice as much but now it is only one fourth as much. But it is onl the difference between the two that is diminished. We know that the difference in the elimination between the temperatures of 60" and 86" is only about one-half, but we cannot say that the heat elimination is only one-half what it was, because we do not know what the standard is. We cannot say this, but we will make a guess at it. The temperature of the air at 60" is neutral, and when we get up to 104" it is increased three times--three and a half times. We will suppose it is increased by the heat of the air itself. So the temperature isinnreased by the fever conditions, and now we have added the influence of the air in addition, and it is increased fifty per cent, so we will add this 8.6 and 50%, or 12.5. This is approximately right. So at the rate of 12.9--is the heat elimination increasing? (No.) Have we a rise of temperature? (No.) It is constantly diminished. As long as the body does not perspire, the more it is diminished.

Now we will say that the heat production has been increased to pretty nearly double the original, yet the heat elimination is not increased at all. Now suppose that person is making 4.3 heat units more than before, and the heat elimination is not increased at all. The patient weighs 140, and makes 4.3 heat units per minutxx or 258 in an hour. Or, we will say that he weighs 129 pounds, and he has in the course of an hour accumulated 258 heat units, and that distributed through his whole body would be two to every pound, or two degrees for his whole body, so his temperature will rise two degrees, or to 106, provided the elimin-a tion remains the same--suppose there was no elimination, or it was decreased, it would rise faster than that. Suppose we put a man in a hot bath at the temper ature of his own body. How fast will the temperature rise? 1" in an hour, or two in an hour and a half. So with the temperature of the room at 95" it would not be unreasonable to suppos that his temperature would rise 1" in half an hour, and if the room were kept as warm as that for an hour it would raise 2" above the normal. These figures are not absolute, but are nearly correct. This is to impress you with the fact that the temperature of the room is to be kept down. Many institutions have adopted 60" as the best condition for living rooms, and the most vigorous people are in the countries where the temperature is maintained at xxxxxxxx approximately that figure. The body is protected by the clothing so that it doesn't chill, and in wintertime we have our stoves so that they keep us warm, and so we are able to maintain that temperature of 60" or 70".

DR. PAULSON: The Testimonies mentions that fact.

It is wonderful to notice how in Palestine and the Holy Land these conditions are arranged. (Diagram.) Suppose this is the sea level. Here we have a great mountain range, and Mt. Lebanon, which has snow caps nearly all the year around,--and then we have a descent coming down here --and here we hve a lake, far below the sea level-- thirteen to fifteen hundred feet below the sea level--the Dead Sea. Here is the Jordan flowing down i to that lake. So down here around the Dead Seawe have all sorts of tropical fruits growing, and on the top of Mount Lebanon we have the xx northern fruits, so that they have there in that region every kind of fruit that can be grown upon the face of the earth, in that little space. And here it is possible by slight adjustments of residence--living in tents and moving about-- we can have a uniform temperature--they could have a temperature of 60", or a little above or below, down here, and in summer they could go up here to the mountain, and that way could live a perfectly natural normal life.

Now have we any more questions to discuss? We have learned that in fever the consumption of the body is not so rapid as in work. That is one thing. Heat production is not so wonderfully increased . Now let me call your attention to this. If the heat production were so enormously increased, it would be impossible to control the fever at all; but this being true, it is possible to manipulate fevers by the right sort of measures.

QUES. I would like to ask if by putting water on the surface and letting it evaporate it would have the same effect as the evaporation of the perspiration.

DR. K. Yes. It reduces the temperature. As I intimated a little while ago, the temper ature falls when the patient begins to sweat, not simply because he sweats, but because he is able to sweat. The fact that he sweats is evidence that the morbid condition which makes it impossible for him to sweat, and which has paralyzed his sweat glands, is better, so that he can begin to sweat, somthat it is an evidence of improvement, as well as a means of improvement.

QUES. Would a cold air bath be good?

ANS. Splendid.

QUES. When he sweats is he not carrying out the toxins which produce the elevation of the temperature? That is true, but not as much as you would think. Dr. Bouchard says tht the elimination of poisons from the skin is comparatively insignificant as compared with the elimination ofthe kidneys. The skin is more of a heat regulator than an eliminator. It is more important as a means of ~~xxxx~~ regulation than of elimination. We made some experimments in our laboratory upon the toxic properties of the sweat, and found that it was almost impossible to kill a rabbit with it.

QUES. When the patient is in a condition where the skin is unhealthy and will not perform its functions, is not that an indication that the other eliminative organs are in the same condition?

ANS.--Yes, that means that every other organ of the body is unhealthy, because so long as the other organs of the body are healthy, that keeps the skinhealthy. A hide-bound horse is an unhealthy horse because the healthy horse keeps his hide loose . It is not the unhealthy skin that makes the unhealthy animal, but it is impossible to have a depraved and unhealthy skin when the body is perfectly healthy, because the body will heal the skin and keep it healthy.

Now we have rest, fasting, regulatien of the temperature of the room, and water drinking--which cools the body off and cleans it out. That isn an important thing. That is not a new remedy. I think the rule is a glass an hour. But, you say, he cannot drink so much. Well, take a sip sip at a time, and keep him sipping until he has taken as much as he ought to take. Or, a person gets into a condition in fever in which he will do automatically almost anything you tell him to, and you can have a glass of water and a tube, and he will keep drinking automatically when you tell himto. So it really depends upon the nurse more than anything else in the matter of water drinking.

QUES. What kind of water--cold or warm?

In a case of fever it would be best to give him cold water, for it is warmed quickly, and the patient has but little tendency to chill. But if the patient has a tendency to chill it is better not to give the cold water, because cold water precipitated into the stomach suddenly produces a tendency to chill, sometimes But if the patient's mouth is dry and his temples are throbbing, he will enjoy a little cold water, and a pint or two ofcold water will do him good.

WHAT DO YOU call cold water? Just a little below the temperature of the room. We have cold water, cool water, very cold water, tepid water, warm water, xx hot water and very hot water. Those are the different names used for the different degrees of water. I think that is about as well as we can express it in the English. In the French we could divide it a little bit more, because they have some different terms thayt we do not have for subdivision.

But a word further in reference to water drinking: It must be systematic. The amount depends very much upon the amount of fluids eaten, or the fruits or fruit juices or fluid food he takes. If a person is living upon fruit he doesn't need so much water.

Suppose he is delirous, and we cannot make him drink? Do not fight with him, but he may take it by enema. He may take large water enemas, taken slowly. He can take a large enema with the expectation that there will be quite a quantity left behind, or a small one with the possible for him to sweat, and which has paralyzed his sweat glands, is better, so that he can begin to sweat, somthat it is an evidence of improvement, as well as a means of improvement.

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QUES. Would you give a glass of fruit juice every hour? It may be combined with the water. If the patient doesn't like to take anything in the shape of food it may be well diluted and taken right along with the water. We remember that flooding the alimentary canal with fruit juices helps to lessen the growth of the bacilli coli communis, etc.

Now suppose the patient has a fever from an infected wound: Then what would you do? Suppose the patient has an injury, and fever in connection with it. We might have cold irrigation, or in case of surgical wounds becoming infected we must open up the wound and drain it and cleanse it. Disinfection and drainage are the two surgical means. When the patient has had an operation and has a fever, it is certain that there is pent-up pus somewhere, and we must find it out and drain it and wash it out.

Now our hour is just up, and we come to the most important means, Hydrotherapy. In the first place we have two measures to consider--just what is useful in reducing heat production, and those which are useful in increasing heat elimination. Measures which diminish heat production, and measures which increase heat elimination.

MEASURES TO DIMINISH HEAT PRODUCTION.

1. Graduated bath.
2. Tepid bath.
3. Cold friction bath.
4. Cold immersion.
5. Cold immersion followed by short hot bath.
6. Affusion.
7. Cooling pack.
8. Shower Pack.
9. Compress.
10. Evaporating sheet.
11. Cold sponges--cold, cool, or tepid.
12. Cold to head or abdomen--ice.
13. Cold enema.
14. Cold water drinking.
15. Cold air bath.

MEASURES TO INCREASE HEAT ELIMINATION.

1. Hot Bath Followed by Cold Bath.
2. Hot Blanket Pack.
3. Hot Evaporating Sheet.
4. Hot Sponging.
5. Fomentations to the spine.
6. Fomentations to the spine followed by Wet Sheet Pack.
7. Fomentation to the spine followed by Cold Enema.
8. Hot Blanket Pack followed by Cold Immersion.
9. Hot Blanket Pack followed by Graduated Bath.
10. Hot Blanket Pack followed by Cold Friction Bath or Affusion.

Now you will have your quiver full of arrows if you learn all thos e methods for controlling fevers, and how to use them, and you will be able to control any fever, as far as it can be controlled. I have put these nearly in their order in reference to usefulness, with the exception of the last, water drinking, which is useful all the way through. The cold air bath and the cold graduated bath at the other end give you an idea of the efficiency relatively,--but you may bring half a dozen of these things to bear at one time. You may use one thig as a main thing, and half a dozen other things as collateral means. T They are all useful . Now you must have these things so fi xed in your minds that they will come to you just as do the letters of the alphabet And you might say that we have here the whole armamentarium for fever.

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LECTURES TO MEDICAL STUDENTS. (No. 7.)

F E V E R S.

NOW this morning we are going to take up methods of reducing the temperature in cases in which the rise of temperature is due to increased heat production. We might have three cases in which we could have increased heat production, as follows:

HP ++   HE +
HP +   HE =
HP +   HE -

Now we will consider first the methods which would be applicable to this first condition, and in so doing you will notice that these methods would be applicable more or less in all cases of increased heat production.

First of all, as perhaps the most useful and the best of all methods that can be employed, especially in hospitals or in Sanitariums where we have all the needed facilities, we will say is the graduated bath. This graduated bath is given in a full bath tub, and is a full bath. The patient may be put in the tub with the water at a temperature one or two degrees below that of his own body, or at about the normal temperature of the body. You must remember that it is not to be much different from what the present temperature is. The idea of the graduated bath is to diminish reaction, and we might say first of all that in the application of remedies for the reduction of temperature in fever we must always aim to prevent reaction. Now why do we want to prevent reaction--or at least to prevent thermic reaction? Because thermic reaction would produce increase of heat production.

posed to the cold and has a temperature of 70", and we apply water at at temperature of 70" --would that produce a thermic reaction? (No.) Then suppose we apply water at a temperature of 40". (Yes.) Yes, that would produce a thermic reaction. We must have a temper ature which lowers the temper ature of the skin. There must be an application made which will lower the temperature of the skin below its normal temperature. Now suppose we apply hot water to the skin until we raise the temperature of the skin to 120" and then should apply cold water to the skin sufficient to bring its temperature down to 95". Would that produce a thermic rea action("Yes"--"No.") There is a difference hre and it is necessary to make that clear.. A thermic reaction is a protective reaction which protects the body from loosing too much heat. The circulatory reaction is a reaction which warms the skin, and tends to cool the interior of the body, but the thermic works in the opposite direction. For instance, under cold the blood vessels of the skin are contracted, and the heat of the body is raised. The circulatory reaction has the effect to dilate the vessels of the skin and thus cool, the body off. The circulatory reaction warms up the part which was chilled, but cools the body as a whole. Whereas the thermic reaction potects the body as a whole by increasing the heat production and raising the temperature of the blood. The thermic has a relation to the body as a whole, while the circulatory has a relation to the part to which the application has been made. So it is when you apply friction to a prt--but this is circulatory reaction, not thermic, for that affects the body as a whole. It is very important to distinguish clearly between these two reactions.

Now we can see that it is very important in fever that the thermic reaction should be suppressed, because the thermic reaction produces heat production--at any rate in ordinary cases of fever. Wherever we have a rise of temperature due to increased heat production, we want to suppress that heat production; so the best applications to make will be those which ~~xrmx~~ permit circulatory reaction while not encouraging thermic reaction.

Now in this case we always desire ~~txaxm~~ that there shall be a increased elimination if possible, because we want to lower the temperature of the body; so we would never think of giving an application to a person in ordinary fever cases which would tend to diminish the heat elimination, for when there is increased heat production with increased heat elimination we would never think of giving any kind of an application which would tend to lower the heat elimination, because there is increased heat production, and although there is an increased heat elimination it is not sufficient to keep up with the increased heat production enough to balance it. So we never think of giving an application to diminish heat elimination, because we want more heat elimination. There is increased elimination in this case, Case 1, but we need still more. We want if possible to emplyo such measures as will increase heat elimination without increasing heat production.

As a rule we avoid all measures which will produce what is ordinarily called a reaction. That is the ordinary rule, but we can make a distinction here and say we will avoid those measures which will produce a thermic reaction, and employ measures which will encourage circulatory reattion.

Now let us see: Suppose we start with a method which is coming to be quite generally used. It was proposed by Glenard some twenty years ago, but was in use longer ago than that. It has been advocated by Bouchard, and is now being used in this country--that is the graduated bath. The patient is put into a bath at a temperature about that of the body. Now suppoe the patient has a temperature of 104, and we put him into a bath at the same temperature as his body,--at a temperature of 104"--what effect would tht hve? Heat production ould go up and heat eliminatio would be stopped. Why? (Because it would stimulte the therm genic centers and consequently there would be a rise of temperature.) Yes, it would do that,--and what else beside stimulting heat production? There is no exchange of heat, but is body goes on producing hatall the time. Now the water is not capable of cooling the body off at all, and so what will be the natural consequence? (There will be a rise of temperxature.) His body would warm the water, and the temperature ofthe body would rise with the temperature of the water. The water would be heated, and by the body continuing to make heat the temperature of the water and the temperature of the body wouldrise together.

Now suppose we introduce the patient into the bath at a temperature of103, whe the temperature of the body id 104--one degree below the body temperature. Would that increase the temperature? That would increase the temperature because the body is throwing off heat do rapidly that it will raise the temperature of the bath, and both that and the temperature of the body will rise together.

Now suppose we put the ptient into the bth at a temperature of 103"--a temperature one degree below that of the skin, and lower the temperature of the bath, beginning with 103", and lower the temperature of the bath 1" every minute, what will be the effect upon the zero of the temperature sense of the skin? (The heat elimination would be increased as the temperature of the bath was lowered.) We were speaking of the zero of the temperature sense. (It would come down.) It will be diminished. No upon what does the thermic rea ction xxxx depend? (It is the reflex effect xx of applications to the surface.)

If the skin was at the zero point, and we should apply water at zero, there would be no reflex effect. Butsuppose the temperature of the skin was not at zero--suppose it was at forty, and we should apply ice to the skin, what would be the effect? It would cool the skin, because the temperature of the skin is above that of the ice. Th Then when the ice was withdrawn the skin would be warmed again--there would be a reaction, and the temperature would rise. That is the reason the lumberman rubs snow on his feet to warm them. His feet are not yet quite as cold as the snow, and there is a reaction and a rise of temperature as the result. It brings more blood there. After a while if his feet are not warm enough he will try it again, andtill the reaction is well established he can rub ice and snow on his feet, and thus warm his feet with snow.

DR. PAULSON: We used to cure chilblains in that way. What was xhax it that cured them?

DR. K. It is simply stimulating the vital processes . There is a relaxed condition, and the application of the snow set up a reflex action. The most essential thing in cases of chilblains is the hot and cold foot bath. This is a sovereign remedy. I froze my own feet when I was going to school--there was a big crack in the wall near where I had to sit, and so I froze my feet. The result was that I suffered with the chilblains for a good while, until I learned of the hot and cold footbath, and in three weeks I was free from them.

Now we will suppose that this patient'sskin has a temperature of 103" and the skin is not quite so hot as the temperature of the body, and we cab start at a temperature a little below that indicated by the thermometer--would there by a reaction? (No.) Why? (Because the bath is about the same temperature as the body.) Now suppose we lower the temperature of the bath at the rate of 1 or two degrees a minute--would there be a strong reaction? (No, I do not think there will be any reaction, because the zero of the temperature sensewill be steadily lowered, and there wil l be no great reaction.) You see the chamge is imperceptible; we do not lower the wat r from one degree to anot r degree at once, but we lt the wat r run in, and we lowerthe temperatu e of the bath ~~atxxx~~ at the rate of about 1-100th of a degree and so the gradation is imperceptible. Tht suppresses the eaction.

Now suppose we hve a patient with increased he at production and increased heat elimin ation. His skin would probably be hot and red. In that case there would be all the circulatory reaction that was desir d. We wou ld not expect th t there wouldbe any particular need of an increase in the circulatory activity. We do not need any reaction at all, because the skin is already throwing the heat off more rapidly than normal. What we want in this case is to stop the h at production. That is in the case in which there is both increased hat elimination a d production. We want to suppress the h at production. So we apply our b ath at a temperatureof 1 02-3, and we lower it at the rate of 1 degree per minute until we get it down to 85 degrees and then we can let the patient remain in the bath for some time, and by an by he will begin to get slightly chilly if you don't take good care of him. What would cause the patient to become chilly? (The temperature of the skin would be lowered below what it is normally and then there is no reaction because we go down so slow.) Now what really mak s the chilliness--we have not had any reflex action. We hve lower ed then temperature so slowly that there is no chance for a reaction--now what makes the man feel chilly? (It is simply the contact with the cold water.) We have not disturbed the skin. (I think it is the stimulation o of the thermogenetic centers in the muscles to warm up the body brcause the skin is alrea dy below the xxx normal temperature of the skin.) The reaction of the skin is due to the difference between the object it is brought in contact with and the temperature of the skin, and we have lowered it by such imperceptible degrees that we have got it lower than the temperature of the blood. Now when a person is in a normal condition how much do you have to lower the temperature of the blood be before he feels chilly? I do not know, and I do not think anyone else knows. It might be interesting to see if we could find out at what temperature of the blood one begins to feel chilly. Now I do not recall any authority upon this subject, and it will be an interesting thing to have a normal person take the bath and watch the temperature with a thermometer in the mouth and note at what point the sensation of chilliness begins.

I think we ought to note the facts upon which the sensation of chilliness begins depends: It depends upon the condition of the blood vessels of the skin. Suppose we take a patient's temperature in a hot bath at a temperature of 110. Did you ever notice a patient shivering in a hot bath? (Yes.) Why? There is no loss of heat, and thereiis no reflex affecting the thermogenetic centers to provoke an increase of heat production. If a patient id put into a hot bath at a temperature of 110 he will shiver . He will hve gooseflesh appearances, the same as though he were in a cold bath. What is the cause of tht. The phenomenon of shivering seems to depend upon the condition of the blood-vessels in relation to the nerves of the skin xxxx more than anything else. When they are contracted then we get the sensation of chilliness. It may be in the one case from excessive heat, or on the other hand from the effects of cold. When a patient has been in the gaduated bath for a long time the blood vessels of the skin will become contracted by the direct effect of the cold upon the blood vessels of the skin. And so the nerves of the skin will be robbed of their proper supply of blood, and then shivering will be produced. When a person is taking a bath of this kind, the moment shivering occurs--what does that signify? Nature rings a bell and says that something is going to happen--that increased heat production is beginning..

Now suppose we have a patient in the gaduated bath, steadily lowering the temprature, and the patient feels chilly?, and we think that the temperature is not lowered as much as it should be, and we want to prevent the occurrence of shivering--what would we do? We would rub him. Very hard? (No.) Simply peripheral friction. Would that friction be centrifugal or centripital ? Would it be in the direction of the veins, or in the opposite direction? Centripital would be in the direction of the veins and centrifugal towards the extremities. We want to empty the veins toward the heart because the blood in the veins has been there too long already and got cold, and the veins are relaxed , and so we will move the blood toward the heart. Now what would be the real effect of this friction-- a firm centripital friction towards the heart? How many think it would raise the temperature of the patient? Would it facilitate heat elimination? It will increase heat elimination because it brings more blood to the surface. It would facilitate the effects of the bath by bring more blood to the surface of the body by encouraging the circulation of theblood through the skin, and so we would increase the heat jelimination

DR. PAULSON. It seems to me that as soon as the temperature of the blood gets above that of the skin that shivering would begin.

DR. K. It does not seem based upon that for the reason that a hot bath will produce shivering as soon as a cold bath. A very hot bath will produce shivering and it seems to be a matter in which several things are involved--the lowering of the temperature of the blood and the contraction of the blood vessels of the skin. Here is a case for instance where a man has malarial fever. Did you ever have the ague? When you were shaking and shivering, were you thirsty? (I was thirsty, but I only wanted to drink a little bit.) Did you ever notice about the temperature at that time? (I took the temperature, and it was higher) The man had a chill, and the temperature was higher at the same time-- the man had a chill and a fever at the same time. How many think that when a man has a chill he has a fever at the same time? That makes me think of a patient who came into my office yesterday:"............it

goes up through the top of my head and then it makes me dizzy, and then I vomit." The dizziness upset his stomach and made xxxxx him vomit. . Now the chill is a phenomenon of the fever, but it is not the chill which makes the fever, but there is a reason for it, because of the contraction of the blood vessels of the skin drove the blood to

the interior of the body, and so naturally there was a rise of the temperature of the body. When you get a cold bath the contraction of the blood vessels of the skin raises the temperature internally xxxxxxxxxx , but the temperature begin to rise before the chill comes; we could find if we noticed carefully that his temprature began rising for an hour or two before; this is because of the toxins produced in the blood. The interesting thing is that this man was shivering although his temperature was rising all the while. A person has a chill, is shivering, hisxskx skin is pale, but the temperature of his blood is really above normal; so it is not the temperature of the blood that makes the chill, after all

You see this is a very interesting subject, there are so many dixferx

So when a patient tells us that he has had a chill, we always know that he has had a rise of temprature. If a man gives us the history od a chill, we feel absolutely certain that he had a fever aft rward; we say "Were you thirsty afterward?" And we find that he was gemrally thirsty. Maybe he had a pers iration afterwards unless there was what we call a nervous chill. So a chill is an almost universal evidence that there is a rise of temprature taking place.

Now let us botice about the gr aduated bth: We begin the gaduated bath at one or two degrees below the bodily temprature. We lower it 1 degree per minute until the temperature of the bath is about 85".

Keep the patient in the bath at 85 degrees as long as he ca be kept there without getting chilly ; we ought to take him out just a little before he begins shivering. Now we will postpone the time of tht shivering by gentle, firm friction towards the heart--centripital friction. This will bring the bloo d to the durface and p event the bloodvessels of the skin becoming empty and to such an extent that the skin is becoming chilled. It is the cooling of the skin and the contraction of the bloodvessels of the skin, and it may be that the lowering of the temperature has something to do with it , as well for you know that in fever nture sets a mark--she regulates the body just as the engineer sets his steam gauge, or his steam valve--his automatic blowoff, say, for twenty-five pounds pressure, and then when it gets up there or a trifle above it blows off. Now in fever nture seems to set a standard of bodily temperature at a higher p oint, and in this way she makes it unfavorable for the growth of germs which cause the fever. She does it as a remedial masure, and it has the effect of producing an antitoxin--a toxin which antagonizes the toxic substancesproduced in the body, and enables the vital processes to defend them elves against the encroachments of the g rms which are destroying the body. Now it may be that if we lower the bodily temperature a little below this higher mark which nature has set for this condition, that we will produce a chill just the same as lowering the temperature of the blood below the normal temprature under ordinary conditions which produce a chill. Now here is a patient who has a fever: We should not think that it is a happy thing if we are able to suddenly get that patient's temperature down to 98 degrees and keep it there, I imagine that it is really a better thing if the patient's temperature is maintained a little above the normal. So we need not feel happy because we can bring the temperature down to subnormal and keep it there. So you see how utterly destructive is the action of antipyretics which get the temperature down suddenly below the normal and keep itthere. If it doesn't get above 101 do not worry about it; when it goes up to 102 then you can begin to make application of measures to reduce the temperature; and if it rises above 102 you must be very energetic in your efforts. Ordinarily when you get a fever patient the temperature is about 104. , and we have means by which we can bring that temperature down to 101 or below; but if you keep it down to 101 1-2 you feel that the patient is doing well and you endeavor to keep the temperature at about that point.

So when we apply the graduated bath, if the patient has a temperature of 105, we apply the bath at 103, but rapidly lower it down. I want to say that we have no evidence that an extremely high temperature is better than a moderate one. we find that the body has become red, that the perspiratory glands are paralyzed; it is natural forhim to sweat, and what we try to do is to aid nature to do what under ordinary conditions she would do without any help. She wants to do it, but she is prevented from doing it by the crippled condition into which she is brought by disease.

(No. 8)

LECTURE TO MEDICAL STUDENTS, Nov. 14, 1898.

Fevers--Review.

J. H. Kellogg, M.D.

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You may each write upon the blackboard all you can remember in reference to heat elimination and heat production., as a review. I will also ask you a few questions for the same purpose : What are the advantages of the graduated bath? ("It stirs up the circulation.") Yes, it may stir the circulation either up or down,--what do we call this stirring up of the circulation? ("Reaction.) Circulatory reaction is the more scientific term. How many kinds of reaction are there? ("Thermic and circulatory.") May we have one without the other ? ("No.") What is the cause of circulatory reaction ? ("Disturbance of the vasomotor centers.") Why do we get it? ("Because we cool the skin.") What then would you say was the real cause of circulatory reaction when induced by thermic application? ("Raising or lowering the temperature of the skin.") Can we have a circulatory reaction as the result of raising the temperature of the skin ? ("Perhaps---") That is a very interesting point; it would bring more blood to the surface,--suppose I apply a hot fomentation to the skin and the skin is red--is that circulatory reaction ? ("No.") Isn't a red skin evidence of reaction ? ("Yes.") It is not reaction,--there is action--there is a difference between action and reaction. If we apply heat to the skin and it becomes red, what is that ? ("Action.") Can we have a reaction by the application of heat to the skin? ("It must be very hot.") If we make a very hot application to the skin may we have a reaction? ("Yes.")

What sort of reaction is it ? ("A circulatory reaction.") What is the the nature of the application ? ("A short hot application would be about the same as a short cold application.") I hope you will study this subject of reaction, as you will find it will help you to a better understanding of the whole subject.

Now there is reaction from heat, and there is reaction from cold. What we were talking about when we last met, was not reaction; it was a sort of pseudo-reaction. When heat is applied directly to the skin the result is not reaction,--it is action; the effect is due to the direct stimulus of heat. When a person shivers in consequence of the application of cold, is there an increase of heat production? ("No.") Suppose there was a goose-flesh appearance produced,--would that cause an increase of heat production? ("No.") No, there is really no increase of heat production then.. The effect of the action of cold is to diminish the circulation of blood in the skin; it blanches the skin and thickens it, making it a poor conductor, retaining the blood to increase heat production,--that is the action of cold. Now there is a reaction, in which the bloodvessels are dilated, heat production is increased, and heat elimination is also increased by a rush of blood to the skin, so we have action and reaction., so the difference between action and reaction is this : Action blanches the skin, and causes chilliness and congestion of the internal viscera. In reaction we have a reddening of the skin, dilation of the bloodvessels, increased heat-production and increased heat elimination; in the application of heat , we have dilation of the bloodvessels, etc. Then when we have cold applied to the skin skin it produces reaction, and when we have heat applied to the skin it produces dilation of the bloodvessels,--and we have redness of the skin in both cases,--the action of heat produces redness of the skin a and the reaction of cold produces redness of the skin. Now, if a person should come into that door, having had one hand in hot water and the other hand in cold water, could you tell which hand had been in hot water and which hand had been in cold water? (No.) You could not tell which hand had been made red by hot water, or which hand had been reddened by cold water,--how could you tell the difference? (By the relaxation of the vessels of the skin.) But could you really see that ? ("NO.") Who can tell us? ("If the water was hot, there would be a bluish tint.") One would be a dusky red, and the other would be a bright red ? ("Yes.") That is because the bloodvessels and arterioles are relaxed by hot water,--in one case it is venous blood, and in the other case it is arterial blood; there is a stasis of venous blood,--what causes that ? (The relaxation of the venoles.") The hot water acts more upon the venoles than upon the arterioles; it dilates the small veins, and that produces a stasis of blood, because there is not contraction which will send the blood along.

There was an interesting discovery made in 1781, and the fact discovered was ppublished by an English physician whose name I believe was Crawford; he observed that a cold application produced a brighter color in the blood did a hot application, and that when heat was applied, the difference in color was not as marked between the venous and the arterial blood as when cold is applied. Cold has the effect to accelerate the circulation and to increase oxidation; the same principle applies to the whole body,--but let us proceed.

Heat causes dilatation of the small veins of the skin, and a dusky redness in the color of the blood,--but you will have to look sharp to see the difference, when hot or cold water is applied,--try the experiment with your two hands--place one hand in cold water until relaxation takes place, and the other in hot water--youacan easily make the experiment.

Q. Is there not a compensatory action which takes place,--a contraction of the arterioles-- by a hot application ?

A. In a case of anaemia ,you might apply ~~heat at~~ a temperature of 118" to 122", and for congestion you might apply a temperature of 130° to 140°--in that case there is an interesting difference; it is important to understand the difference in the effects produced by different temperatures; a prolonged application of tem - perature at 118" to 122" will produce a mild congestion of the brain. Then if you apply extreme heat--130" to 140" --you will have ~~congestion~~ contraction of the bloodvessels of the brain. When we have heat relaxation, what takes place? We have first, contraction of the bloodvessels, ~~--we have a slight blanching of the skin--a goose-flesh appearance, a receding of the blood from the surface temporarily--now what follows all that ? Do we have increased heat production ? ("No.") What do we have ? ("A blanching of the skin and a contraction of the vessels.")~~

when we get the characteristic effect of heat; of course, to get the characteristic effect of cold, it must be entirely cold, and to get the characteristic effect of heat there must be intense heat; in the intermediate temperatures we get mixed effects which are sometimes confusing.. Now let us see the effect of heat,--we have first, contraction of the bloodvessels, a slight blanching of the skin and a goose-flesh appearance, a receding of blood to the surface temporarily,--and now what follows all that ? Do we have an increase of heat-production ? ("No.") What do we have ? ("A blanching of the skin and contraction of the bloodvessels. Do we have ~~heat-production~~ ~~he~~ increased heat-production after this hot application? ("No.") We have pallor of the bloodvessels and the effects are almost opposite to the effect of cold; so we have relaxation from heat also. This seems to be a neglected subject--the relaxing effect of heat--but it is a very practical subject; when one inspects it systematically we find there is an almost complete antithesis between the effects of heat and cold. We have a reaction from heat which is an atonic reaction, and we have a reaction from cold which is tonic; one is in the direction of increased activity, and the other is in the direction of diminished activity. The immediate effect of cold is a sedative effect; the later effect of cold is an excitant effect; if we have an opportunity to study packs, you will see how beautifully this is illustrated: The man is put in a cold pack and he shivers; his teeth chatter and he feels uncomfortable, and for a little time he thinks he would like to get out of there as quickly as possible, but pretty soon he feels rather comfortable, and little by little he gets to be warm, and then he gets uncomfortably warm and he is thirsty; a little later , this discomfort disappears with perspiration; beads of perspiration start out upon his face and he has a feeling of comfort and wellbeing; first there is a stage of sedation, in which the temperature is lowered; second, a stage of reaction, when the skin is being heated, and third, the eliminative stage. The re - action stage is excitant, and the eliminative stage or diaphoresis, is the excitant stage carried a little farther, the diaphoresis being due to the excitation of the glands of the skin. In the application of heat, unless the heat is renewed, there is a reversed condition-- put your hands in hot water and then expose them to the air--they are colder because the power to create heat is diminished by the hot application and hence the circulation is diminished. Suppose you put your hands in cold water--the effect of heat would be first excitant, then depressant. Now cold is just the reverse--first sedative and then excitant--in other words the primary effet of cold is sedative and the secondary effect is excitant, whereas the primary effect of heat is excitant and the secondary effect sedative. So we have a reaction from cold and a reaction from heat.

We began about the graduated bath but you must get these exceptions clear in your minds if you don't get anything else clear, and if you get a thorough comprehension of this apartof the subject you will get a better idea of it than you otherwise would. But this is the point we were after: Why do we use the graduated bath? And how can we get a circulatory reaction without a thermic reaction--what produces a circulatory reaction? Suppose we have a patient whose skin is at 100" and who is in a warm room: Suppose we make an application at 90", or give him a shower-bath--what would be the effect?

Would there be a reaction? ("Yes.") The temperature of the room should be about 60", when th the body temperature is 100", the temperature of the body rising one degree for every rise of 20" in the surrounding atmosphere. If a person is working in a hot room his temperature will rise unless he perspires freefly, --would there be a reaction? ("There would not.") Why not ? (Various answers.) What is the neutral temperature? ("94.") There would be a little reaction with a temperature at 92" which is ywo degrees below the neutral. Suppose we have a temperature of 80" instead,-- would we have a reaction? ("Yes.") Suppose the temperature of the skin is 80" and we apply water at 80" --would that produce a reaction ? ("No.") Suppose a person comes in shivering, and we apply eater to him at the temperature of the skin,--would there be a reaction? ("No. ") Here is some warm water, and here is some cold water, ~~and~~ when I put my hand in this water (experimenting) it feels cold...You see I can get a tonic effect upon one hand and an atonic effect upon the other. So the hands don't tell the same story. This water is at the neutral temperature. If I take a bath at that temperature will that produce thermic reaction? ("It will not.") Could I get a circulatory reaction with it ? ("Yes.") If, on the other hand, I should put this hand in ice-water, and then put it there I would get an atonic reaction would I not ? ("Yes.")

We see from this, that circulatory reaction is due to change of temperature--to an application which changes the temperature of the skin, and an atonic circulatory reaction is the result of ~~the~~ an application to the skin which lowers the temperature--we must lower the temperature of the skin in order to produce an atonic reaction.

Now what is thermic reaction? (Various answers.) It is an application which produces an elevation of the temperature of the body,--the total heat production of the body is increased. In order to have themic reaction we must have something done which affects the thermic centers of the ~~body~~ brain, and this may be accomplished reflexly, by changing the temperature of the blood or through some nervous influence or through toxic substances in the blood. Now what is the neutral temperature of the air? ("60°.") If the temperature of the air rises above that, does that produce thermic reaction ("Yes.") This is a sort of illy defined thermic reaction,--it is an the exterior acting upon the interior,--if the temperature is depressed much below 58" will that produce a rise of temperature? ("Yes.") What is the effect of ~~the application of~~ long continued cold ? ("To lessen heat production.") For this reason people who live in Arctic climates have a lower temperature than people who live in tropical climates or temperate climates.

Now in the graduated bath there are two things to be considered,-the circulatory reaction and the thermic reaction when you first begin to bathe: Suppose we should lower the temper very rapidly below the body temperature,--what would be very like to be the effect of that ? We would have circulatory reaction and also thermic reaction. Suppose, for instance, the patient's temperature is 102" and we put him in a bath at 85",--what would be the effect? (Heat-production.") ("It would vary according to the length of time the patient was kept in the bath.") What would be the sensation of the patient? ("He would be chilly.") What else? ("He would shiver.") Yes. Then what would happen?? ("Increased heat production.")

Then what we can objectively aim at is to suppress the shivering. If we have made the application so that the patient does not shiver, what can we say we have done ? ("Lowered his temperature.") Lowered his temperature without increasing the heat-production.-- and that is the thing we want to do, because there is too much heat-production already,--we steal away the heat of the patient--we steal the heat production from his body; the body does not know what is being done.; we lower the temperature and we suppress both kinds of reaction, the circulatory and the thermic. Now is there any advantage in suppressing the circulatory reaction in a bath of this kind ? ("No.") What is the condition, when we suppress circulatory reaction? ("Diminished heat elimination.") Do we want to diminish heat elimination ? ("No.") We do not wish to decrease heat elimination.

One of the effects of the cold bath is to cause contraction of the bloodvessels of the skin, thickening the skin by contracting the tissues, and lessening the conducting power of the skin and lessening the circulation of the skin, slowing the action of the heart through lessening of the circulation, and so heat elimination is decreased. This is one of nature's means of protecting her house, so have tto throw nature off her guard,or neutralize that influence in some way in these cases,--how would we do it ? ("By producing circulatory reaction.") Is there any other way by which circulatory reaction may be produced? ("By friction."() Will friction produce circulatory reaction ? ("Yes.") I will ask you to make a little experiment ,--put your pencil on the skin of your hand and hold it there for a moment--as you press the pencil down there is an area of pallor resulting from the pressure of the pencil. Now take up the pencil and watch that surface,--you see the pallor dis - appears,and a redness takes its place ; it is getting redder--the color is getting deeper and deeper; in five minutes the difference in color will be much more marked than it is now . Now there has been an action which has simply compressed the bloodvessels. Now pass the point of your pencil around this surface where it is a little red,--now you see there is quite a wide area of pallor ex- tending out around the point of the pencil. That seems to be a pres- sure which is greater than would naturally be produced,--is it not probable that by this pressure you are stimulating the sympathetic ganglia and are thus exciting the vessels beyond the point of the pencil , and thus causing contraction of the bloodvessels. Now we have not been using great pressure upon the tissues, and yet there is an area of pallor, so there is an action which stirs the visceral ganglia of the sympathetic and the vasomotor centers... Then we have a reaction,--the bloodvessels are first contracted and afterwards dilated. Now friction is nothing but pressure,--by friction you press on different parts, and pretty soon you have a redness of the skin.

There is another thing which will produce reaction,--what is that? ("Percussion.") Percussion of the surface will produce a reaction very quickly; there is first a contraction of the vessels, but you will very soon see that there is a reaction. Now see how quickly you can get a reaction (Percussion.) You can get a reaction very quickly by percussing the cheek,--you can get a very fine blush pretty soon.

Then let us notice that we have not only a reaction from cold,but a circulatory reaction which can be produced by percussion or friction

Now we have the graduated bath for the purpose of lowering the patient's temperature. Now we have increased heat production and heat elimination already; we desire to decrease the heat production,--and, if possible, to do what else ? To increase heat elimination.; we certainly would not care to decrease heat elimination. Now when we put the patient in a cold bath there is increased heat elimination in one way and decreased heat elimination in another way,--then what should be done ? ("Rubbing, or friction."). So if we gradually lower the temperature, we by that means suppress the reaction from the cold, do we not ? ("Yes.") Yes, because we imperceptibly lower the temperature of the skin so that the skin does not recognize the shock,--there is not that pronounced difference between the temperature of the water and that of the skin so as to produce a strong circulatory reaction--that can be produced in another way--and how ? ("By friction.") Yes,--by rubbing the hands up towards the shoulders; in that way we can increase the circulation of the skin, and thus do what ? ("Increase heat elimination.") ("We could do that in a neutral bath.") Yes. We will consider that next.

I thought it worth while to spend this length of time in explaining the graduated bath, because if we understand this, we can understand other baths quickly. ("When would you commence rubbing the patient ?") How fast can we lower the temperature? ("One degree a minute.") When will the patient begin to feel chilly? ("When the bath gets below the body temperature.") Then when you get the temperature down below the normal temperature you begin to rub the patient? ("Yes.") Suppose the temperature is 101" to 103", would you begin to rub the patient then? ("No.") We would begin friction when the temperature is about 95", commencing gently and gradually increasing the ~~friction~~ vigor of the friction,as the temperature falls,so as to have no shivering; in that way we can keep the shivering off for a long time .

Q. Do you mean to say that when the patient feels cold his heat production is increased ?

A. Yes,--unless the cold has been applied too long. But we we were speaking of a healthy man,--is that what you mean ? ("Yes. ") If we find that a man is cold when he ought to be warm, he is sick.

Now we will examine these lists which you have placed upon the blackboard,--the graduated bath is at the head of the list, because it is the best, and the tepid bath is the next best. The cold friction bath is the next best, and then the cold immersion bath with the friction left out, the graduated bath and then the tepid bath, and the cold friction bath--the graduated bath without the lowering of temperature.--it is the graduated bath in part.(Explaining lists.) It is the cold bath and the friction added. The cold ~~bath~~ immersion is the friction (?) bath with the friction left off. The affusion bath is the only addition applicational application in which we have a volume of water come in contact with the patient. The first six cases is when ~~the~~ a body of water is applied to the patient.

In arranging your facts you will find it of great advantage if you will put them in order; it will not then be very difficult to remember them. I have noted these facts down and read them over, but I have put each one in relation to the others. I acquired the habit of doing that when I was a small boy, and it has been a great help to me, because when my facts are all arranged in a string, I just get hold of the end of the string and the rest of the string comes along easily. Just get into the habit of tying your facts in a string, so that when you pull the string for one thing, all the rest comes in order .

LECTURES TO MEDICAL STUDENTS, 11-21-98.

No 9

J.H.Kellogg, M. D.

Baths, Temperatures, etc.

(Recapitulation.) We will begin the bath at a temperature a little below that of the body,--perhaps five or ten degrees below the temperature of the body, thermic reaction being induced by a temperature which is below that of the skin,- -what is the temperature of the neutral bath ? ("92" - 96".) Now notice the temperatures on the blackboard which we will call cool, cold, etc.--we will start with "very cold." What is the temperature ? ("32° - 65°."). Cold? ("55"- 65".) Cool? (" "65"- 80".) Tepid ? ("80"- 95".") Warm or neutral ? ("92"- 98".") Hot? (" 98"-104".") Very hot? ("104" and upward.") Water is much cooler than air,--this is a point to which I wish to call your attention. Somewhere between these limits which we have named there would be no thermic reaction produced. We must be careful and not lower the temperature of the patient too rapidly; it should be lowered gradually,--about one degree a minute. If we start at 95" and lower the temperature one degree a minute for thirty minutes, what is the temperature? ("65".) When the patient begins to shiver we should keep the temperature right down.

Now suppose we consider the physiological effect of ~~rubbing~~ friction, which comes in with this bath (the graduated bath?) If you will try the experiment of tapping the skin you will notice that it becomes ~~very~~ pale when you percuss gently; a light tapping causes a contraction of the bloodvessels and makes the skin pale at that point while hard percussion will dilate the bloodvessels and make the skin red. Try the experiment. (Students try experiments .)

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Now friction has the very same effect as percussion, only not so vigorous; the natural effect will be the acceleration of the blood-current and an increase of the heart-pressure and consequent slowed pulse and slowed respiration,--and what would be the natural result? ("Decreased heat-production.") The thermometer shows a slight rise of temperature under these condition, because the superficial vessels , and the bloodvessels contract; the first thing noticed is a slight rise of temperature. I will illustrate this,--this is the curve of thermic reaction (blackboard diagram.) When you apply cold to the surface there is a contraction of the vessels, and the effect of that is a lessening of the elimination of heat. There is at first a slight rise of temperature, but as the blood comes to the surface, cooling off begins and the reaction occurs,--here is the curve of reaction. (Blackboard.) there is heat production and then there is reaction. As I have said, moderate friction of the surface has the effect to cause, first, a contraction of the bloodvessels, and directly afterwards it causes a dilatation of the bloodvessels,-- I might also say here, that the elimination of heat is diminished by a diminution of the rate of respiration. With moderate friction we have first a very short contraction of the bloodvessels followed by a ~~dilatation~~ marked dilatation of the bloodvessels which continues for some time; there is at first a slowed heart-pulse,and afterwards a quickened heart-pulse. When the bloodvessels dilate,the pulse is increased; the same is true with the respiration--at first slow, afterwards increased. Moderate friction has the same effect as does gentle percussion, as I have said..

Very violent friction has only a secondary effect; there is doubtless a little contraction of the vessels, but it is not observed; the bloodvessels being dilated,there is increased circulation of the skin, there is increased heat-production in the case of animals upon whom experiments have been tried, the temperature falls and the animal falls into a state of collapse. These experiments have been made chiefly upon rabbits, and it is very interesting to notice the almost parallell effects of friction and percussion. Percussion produces the same effect as friction, only it is a more violent measure.

Let us see what the effect of the application of this principle would be in the graduated bath. Suppose we put a patient in a graduated bath and rub him in a sort of light, desultory way,--I have seen patients rubbed in that way in the graduated bath,--what would be the effect? (It would antagonize reaction.) We want dilatation of the surface vessels, and this would antagonize that. When we take the patient out of the cold bath how should we rub him? ("Vigorously.) . Yes, but he must not be rubbed too long and too vigorously; you may do this,, and if you do, the patient will have a secondary chill and be injured; and if we apply too light friction we may antagonize reaction, so this, as well as violent friction would be wrong I have seen patients rubbed in such a weak, inefficient way that the patient was worse off after the friction than he would have been if he had not been rubbed at all. This is not simply because the effect of the light rubbing,--it is not only inefficient but it is actively pernicious, because it contracts the bloodvessels when we want a dilatation of the bloodvessels. These experiments were worked out some years ago by--

Q. In giving friction after removing a patient from a cold bath should the friction be given until a reaction sets in ?

A. We will come to thet. Now we have a graduated bath, and with this we will combine--what ? ("Friction.") Let us see what are the essential elements of the graduated bath: The temperature is is somewhere in the neutral zone,--not because that is a few degrees below the temperature of the body, but because it is approximately the neutral temperature,--we use this temperature, not because the temperature of the body is about that of the body in fever--not because we want, approximately the tepperature of fever, but because we want, approximately the normal temperature of the body. Now we wish to increase the tepperature of the body one degree,--how will we do it ? ("By friction.") We will rub the patient, and thus encourage ~~ther~~ circulatory reaction without thermic reaction. Now by using the bath in this way, we can lower the temperature gradually. We get circulatory reaction when the temperature of the skin goes up so that the temperature of the bath is below that of the skin. So we encourage circulatory reaction by what sort of rubbing? ("Moderate rubbing.") In what direction should it be? (""It should be centripetal friction.") And we ought to give special attention to the limbs, in rubbing the patient,--we ~~pay special~~ should pay especial attention to the legs, arms and chest and back of the patient,--wherever we have a mass of muscles; wherever there is a mass of flesh we can squeeze the muscles and the flesh overlying the bones; we cannot do much in the way of moving the blood along by pressure upon the abdominal wall, but we can do much by the other procedure. There is a question in reference to rubbing the patient after the bath,--as to whether it would be beneficial; that would depend upon the condition of the patient after the bath. Suppose he is shivering,--we may stop the shivering by covering the patient with clothing, or by bringing more blood to the surface--provided he has not lost so much heat that he needs heat production; if so, we may suspend (rubbing) for a moment, so as to give nature a chance to catch up and stop the shivering; if we should take the patient from the bath we might rub him so as to stop this effect. When we have decided that a patient has had a bath as long as he should have it, ought we to continue the bath? ("No,sir.") Rubbing has the effect to stimulate heat production, because it is mechanical work; the pressure upon the muscles and the stimulus of friction may produce heat production as well as heat elimination, and we may overdo the application;so, as I said, it depends very much upon the condition of the patient. After we have left the patient in the bath as long as we think we should, shall we put him in bed and cover him, giving him a slight ~~reaction~~ rubbing so as to cause him to react well,--wouldn't that be as well as to continue the bath ? That depends: If we desired to continue the refrigerating action a little longer, we might take him from the bath uncovered and wet and cool him off by evaporation. But the question is , whether we want to stop this refrigerating action: If we do, we cover up the patient and let him react; if he shivers and wants to go to bed, we cover him up and let the reaction occur. Now wouldn't the patient eliminate more heat if you allowed the reaction to occur than if you allowed the skin to remain cold ? ("Yes.") Suppose here is a patient to whom we apply a cold bath, and the temperature rises, we will say to ~~XXXXXXXX~~ 99.4°. Now the thing that quickly follows is, that the temperature goes down below and is normal, because the bloodvessels are contracted and the skin is cooled,--when the bloodvessels are dilated the skin is being cooled off, the blood is being cooled and the temperature is lowered. That is the condition of a patient when coming from an ordinary ~~bath~~ cold bath . Suppose the bloodvessels remained contracted,--what would be the effect? ("They would remain contracted.") and the heat production would be increased.") Yes, and the temperature would then rise; we want the bloodvessels of the skin relaxed and the skin warmed up; when the patient has been in the bath so long that he cannot react any longer we take him out of the bath so as to allow the skin to warm up,--so as to allow circulatory reaction to take place so that the skin may be cool for some time afterwards. Then, if the cold bath has had the proper effect we let the temperature come up immediately after taking the patient out of the bath, and the temperature will fall for some time afterwards. But suppose the temperature comes up just as soon as the patient comes out of the bath,--we conclude either that the man had not been properly managed, or that he had not been kept in the bath long enough. Now if we take the patient from the bath and rub him vigorously we might in so doing increase the effect of the bath beyond the point desired; or, if we take the patient from the bath and expose him to the air without rubbing him, the bloodvessels are contracted and there would not be a proper reaction, and the cooling effect would not continue.. But we want reaction to occur soon,and the skin to become warm,--after a patient has been taken out of the bath and put in bed under proper conditions, does a cool skin mean increased or diminished heat elimination? (Diminished heat elimination.") Then the patient must remain in bed so as to allow a reaction to occur----

Q. Suppose we apply friction through the blanket,--in that case the patient would get the benefit of the friction without exposure . Would that be well?

A. It is not the friction that cools the patient off; it is the dilatation of the bloodvessels in contact with the air; if the patient is covered up well there will not be much heat elimination.

Q. You said it was better to wrap the patient up so as to give the patient a good chance to get a reaction?

A. I meant to say that we allow the patient to be wrapped up for a moment so as to encourage reaction,--and we might also rub him so as to encourage reaction,--or we might combine both together,--the question is, whether we should continue the bath by exposing the patient and rubbing him. Friction would of course warm up the skin, but we might continue the friction so long as to produce an excessive effect, first, by too much dilatation of the surface vessels , ~~and second,~~ if the friction were too long continued and vigorous; and second, by increasing the heat production by too much disturbance of the patient. We should consider this,--that a fever patient is very easily disturbed; that the temperature will rise by a little work, or if the patient sits up in bed, or if he is talking with frinds--suh things as these excite the fever patient , so too much friction is also undesirable for the same reason. Friction as well as all other things which disturb ~~heat production in a fever patient~~ the heat-regulating processes in a fever patient will disturb the heat production in that patient very much more than would be the case in a ~~healthy~~ person in ordinary health. So that I think we might say,as a rule, that the fever patient should not be rubbed much outside of the bath; we might rub his limbs a little ,but not gigorously; we might rub them with a firm pressure, but not so as to agitate the patient too much; we must not agitate the patient.

Now let us consider the tepid bath : The temperature of the tepid bath would be what ? ("88° - 92°") We may put the patient in a bath with a temperature anywhere from 85° - 92°, and with this bath we may combine the effects of the ~~cold~~ graduated bath,--but we are now talking about the tepid bath; the patient would feel cold at first, but he would quickly warm up . We would then have in the tepid bath something of the effect of the graduated bath; we wouldn't have so strong a tendency to thermic reaction, and if we continued the bath for a time, we would get an excellent effect. We have noticed in some of our cases, for instance in one ~~of Dr.~~ case in Marinette, and in one of Dr. Hunter's cases.

DR. PAULSON: In Dr. Hunter's patient the lowered temperature did not have much effect.

DR. KELLOGG: It depends upon the patient,--the condition of the patient is changing all the time. In this case the patient had been sick and exhausted, and the nervous system was extremely ~~irritable~~ susceptible and greatly agitated..

DR. WINEGAR: She was in a very nervous condition.

DR. KELLOGG: Yes, and when a patient is very nervous and irritable it is not only the intellectual faculties which are disturbed, but the whole body is in that condition, and so the reflexes are more excited, and the tepid bath is better adapted to such persons than the cold bath. In Dr. Hunter's case I found that a bath at the temperature of 92° would lower the temperature of the body more than a bath at a lower temperature would. There was a case of this kind in Marinette; the nurse in that case reported to me that a lowered temperature did not affect his patient much, and I suggested the tepid bath instead of the cold bath.

The next bath that we will consider is Brandt's cold bath, in which the patient is put in a bath at a temperature of 64° - 68°. There are advantages in this cold bath,--there is no doubt about that; it has the effect to enormously increase the toxicity of the urine; it increases it six times the normal amount in pneumonia. One of the effects of the cold bath is to excite the kidneys, and its effect upon the kidneys and the metabolism of the body is to increase the toxicity of the urine sixfold. The method of the Brandt bath is to put the patient into a bath at a temperature of 62° - 64°, and then a pailful of water at a much lower temperature is poured over him--say a temperature of 45° - 50°. Suppose you were going into the sea to swim,--what would you do first? ("Wet your head.") And it is better to wet your chest also; so if you were going to give your patient a cold bath you would wet his face and head and chest. Why do you do that ? ("It isn't so hard on him."). And why not? Because it warms up the nervous system,--and then what ? ("It produces a reaction in that part of the body.") If you plunge into the water head-foremost the effect is not so bad as it is to go in feet-foremost, for in that case there is a contrae tion of the bloodvessels of the lower part of the body, and there is n no protection to the upper part of the body, so that the bloodvessels of the brain ~~etc.~~ would become congested. But if we apply cold to the back of the head and neck the reaction in the brain would cause a contraction of the bloodvessels so as to tone up and protect that part of the body. When the patient is lying in the cold bath, if cold water is applied the brain would dangerously exposed to congestion. In order to obviate that difficulty, Brandt has his patient sit up in the bath once every five minutes during the bath and pours a pail of water over him at a temperature of $45^{\circ} - 50^{\circ}$, the effect of this is to protect the head and chest.

Another thing which is important in the administration of this cold bath,--and that is, the shoulders must be kept under water., otherwise you might cause excitement of the lungs and pneumonia. Cold Water must be poured on the patient at the beginning and every five minutes during the bath. . The patient must sit up in the bath and have water poured over him at the beginning of the bath and at the end of every five minutes, and the shoulders must be carefully kept under water,--and the bath should be properly administered. Brand't requires that the patient shall be kept in the bath until he shivers well; that he must shiver so hard that he shivers for fifteen minutes after he is put in bed, so as to make a profound impression upon him; and that when the temperature gets up to 102° the bath should be administered. Brandt has found that this method reduced typhoid fever 14%- 16%, and it is universally admitted that by the use of this bath typhoid fever can be reduced one half. Dr. Wilson of Philadelphia has been using the cold bath there for 10 or 12 years, and, although his colleagues laugh at him for using cold water in these cases, he says that he is satisfied that it cuts typhoid fever right in two in the middle.

Q. After three or four successive pours, don't your patient arrive at such a stage that pouring has no effect?

A. It is ~~of~~ a temporary ~~duration~~ contraction; it antagonizes the strong contraction of the skin which follows very hot or very cold applications; there is a relation between the internal and external areas,--

Q. How long is this bath to continue?

A. Fifteen to twenty minutes, and repeated every two or three hours, or until the temperature rises to 102°. There as been some discussion as to whether this mode of bathing is advantageous. The belief has been expressed by some that rubbing the patient during the bath increases the heat production to such a degree that, although the effect at the moment is greater, it is less durable. Winternits has shown that by rubbing, the heat elimination is increased more than 30%; ~~that~~ heat elimination is greatly increased by vigorous friction,--it may be doubled.. I think the balance of opinion is in favor of friction in the cold bath. Here we have four baths,--let us see which one of them is preferable: We have the cold friction bath which stimulates heat and thermic reaction by two methods,--first, by extreme cold, and second by vigorous friction which is required to prevent shivering, so as to keep the patient comfortable in the bath. The Brandt bath has the same advantages, but in an extremely low temperature there is danger of internal congestion; when cold water is poured over the head every few minutes there is danger of cerebral congestion. The tepid bath is very useful, and so we put it second in the list; it is well adapted to very nervous patients, and patients who have been sick and weak from typhoid fever; it is particularly active in these cases and in cases in which the skin reacts quickly to the action of cold . In the graduated bath we have the advantages of all these baths combined; we can start the tepid bath at the temperature of the body, and we can stop anywhere,--we can manage the tepid bath exactly--we can carry it down until it becomes a cold bath or a Brandt bath; By the use of this bath we can avoid the intense stimulation of the skin which is likely to produwe internal congestion, so we don't require the cold pail pour when we haven't reached the condition rendering that necessary. We can also have, in the tepid bath , the temperature of the co ld friction bath, we can have all the different kinds of baths in the graduated bath, so the graduated bath is the king of them all.

LECTURE TO MEDICAL STUDENTS. (No. 10.)

FEVERS.

Before taking up the methods of treating fevers, let me call your attention to the fact that in all cases in which there is an increased heat production we must have an increased heat elimination. Let us consider the following table:

HP	HE
++	+
+	=
+	−
=	−
−	−+
?	?
?	?

Here is a case in which we have excessive heat production: How are we going to treat it? We want to increase the heat elimin ation. Here is a case in which the heat production is increased, and the heat elimination is less, although it is normal, and here the necessity for increasing the heat elimination is still greater. In the next case in which the heat production is increased and the heat elimination is diminished, there is a still greater need for increasing the elimination. So we see in all cases in which there is a rise of temperature due to increased heat production, or in which increased heat production is present, there must be an increase of heat elimination.

Now we have cases in which the heat production is normal, but in which the heat elimination is diminished, and there it is just as plain as in these other cases that we must have a rise of temperature, and we must have an increase of heat elimination in order to establish the normal relationships. Here is a case in which we have a diminu tion of the heat production, but we also hve a greater diminution of the heat elimination, so in this case also we have a rise of temperature.

Now may we have such a thing as anxi increase of heat production, with ut having any rise of temperature? (Yes.) There would have to be a diminished rate of increased heat elimination in order to produce such a state of things. Now in this case where we have a dimin^ution of the elimination with an increaseof h at production, would we want a cold bath? (No.) Now we can establish the normal by increasing the rate of elimination, can we not? (Yes.) Well, what do you think would be a wise thing to do? We want to make the patient live a little more actively. Now shall we attack that patient with all the means at our disposal for increasing the elimination, and apply them as vigorously as we can? If we did, what might be the resuly? (A subnormal temperatur)

This patient is producing how many heat calories in a minute? (7) Suppose this was diminished to 5.

What is the normal heat elimination per minute? (7) In this case we will suppose that the rate of elimination is four instead of seven.

Now what would be the effect of that relation--five produced , and only four eliminated? There is one calorie left in the body. We have here heat production lessened, ~~but~~ and heat elimination lessened, but lessened more than the heat production. Would this be a subnormal temperature? Heat production is diminished , but elimination is diminished more. Would not that cause a rise of temperature?.

Now we must keep these different conditions in our minds, and the reasons why we supply these different classes of remedies.

Now there are two general classes of remedies; those for cases in which the chief cause of the rise of temperature is increased heat production, and the other, for those in which the chief cause is decreased heat elimination.

Now let us see in which of these cases these conditions are present . In this case we would have heat elimination increased and heat production uincreased, and there must be measures applied which will greatly increase the heat elimination, and that would at the same time decrease the heat production. Here are other cases in this table in which the nevessity for this is still greater , unless it be in the first case, where we already have an increase of elimination. In the other cases in which there is a raise of the temperature there is no increase in the elimination, xxx except, as I said, in the first class, in which there is an increase of elimination, and this is the class found in cases of fever in which there is an increase of heat production and a hot dry xx red skin, and there is a rise of temperature.. In all these other cases there is simply a normal or a diminished heat elimination. So you see that there is quite a large class of cases,--four--in which there is no increase of elimination. Now what is the condition which we will find present? We will divide these classes into two classes, one in one class and four in the other, and then in all these other case in which there is a rise of temperature there is a condition which is not present in the first casep--there is noiincrease of the heat elimination. Now in these conditions what is the indication present--in all these cases save in the first? To produce, if possible, circulatory reaction.

We have two kinds of reaction, thermic and circulatory. We need the circulatory reaction in this second class of cases; we want more blood brought to the surface of the skin; the blood distributes the heat and we must have more blood to the skin, and so we must have a greater surface circulat ion.. Now sometimes with circulatory reaction we have thermic reaction also. Now do you desire thermic reaction for instance in this case in which there is an increase of heat production andnormal heat elimination--would thermic reaction , or an increase of the heat production, be of any benefit? No, it would be most undesirable. Take the third class of cases, in which there is increased heat production with diminished heat elimination--would it be desirable here? (No.) We need simply to increase the heat elimination, and to suppress the heat production. Take the fourth case, in which the heat production is normal,--would it be desirable in this case to have a thermic reaction, or increase of h at production here? It is not especially desirableiin this case, but still if we increase the elimination sufficiently it might do no particular harm, because nature is trying to keep up a normal temperature, and it is kept down so that the heat elimination might not overbalance it.....Now take the last class of cases,--would the thermic reaction be undesirable in this class of cases? No, it might be beneficial. It might be well if in this case there should be an increase of the heat production, or thermic reaction.

Now we are reiterating these subjects in so many different ways, and endeavoring to pry into every little corner of the subject so that when you go out from here you will be better prepared to treat fevers tha anybody on earth , and there is no reason why you should not be better prepared than anyone else on earth if you study these subjects thoroughly, for I do not think there is anyone else has ever studied it thoroughly in this way, so far as I can ascertain. I do not know that anyone hasxxx ever undertaken to marshall the whole ~~xxxxxxxxxx~~ battalion of hydrotherapeutic xx procedures with which to subdue and combat fever. They only use a portion of them. One man uses Brandt's bath, another the enema, affusion, or wet sheet packs, but I do not know of anyone who has ever before undertake to employ the whole of these different procedures of hydr otherapy, and to apply the whole gamut of hydrotherapy against this morbid condition.

QUES. I would like to know what would be the condition of the skin in that last condition.

ANS. Well, let us consider first, what would be the condition: Fix first, dry, second, hot. In the first class we have a hot dry skin-- we have a little moiture, but only a little. Again, we my have a cold skin --there might simply be a deficiency of the circuàtion and the skin would be white and cold. The body might be warm and the legs by cold. We might find a patient complaining of feeling chilly when the skin is hot. In the class where we find heat production normal and heat elimination diminished, there we might find the skin cold, but we would not be likely to find a very profuse elimination by sweating, --sweating would greatly increase the elimination, which in this case is diminished, and the flesh is perhaps quite cold. It is in the condition of a man having a chill, when the surface is cold, but the interior is warm and his temperature may be up to 102-3.. We must remember that paleness of the skin does not always mean an increased elimination, but that it has not been heated as much as normally. . If the skin be warm it will be cooled by contact with the air. A hot bottle will throw off more heat than a cold bottle. Here is a ho t stove: it is throwing off heat much more rapidly than a cold stove would. The redhot stove represents elimination increased, and the cold stove elimination decreased. Now we might have a state in which the fire might be very hot, but be covered with ashes-- there m may be plenty of red hot coals in there, but they are covered up with the ashes and smothered, and the stove itself feels cold to the thuch. That represents heat production normal, but heat elimination diminished The heat is there , but it is retained. The stove surrounded by a non-conductor does not throw off heat, but the internal temperature would rise.

In the fifth state mentioned we have the same thing, the skin cold, and the ptient in a state of collapse. Here is a condition of chill; that would be a condition of collapse.

QUES. I would like to ask if we can have a pathological condition, with a profuse perspiration--a wet, moist skin., with rise of temperature

ANS. We could have a cold clammy skin, with moisture standing on it, with a rise of temperature--the temperature 104, and the skin cold and clammy--a clammy perspiration. What was the diagnosis of that patients condition respecting the heat-regulating functions? (Heat elimination was increased, bout to a less degree.) There is a rise of temperature and a cold clammy skin.. That perspiration on the skin is producing some elimination, and is cooling the body off to some degree. There must be a great deal of heat production.

A cold skin would indicate a decrease of elimination and the moist skin would indicate an increase of elimination. In that case we must make a sort of a balance between the increased moisture and the pallor and coldness of the skin. A red warm moist skin indicates heat elimination three times the normal but a pale, cold, moist skin is a different thing. Suppose we have a pail of water on the stove, and there is no fire in the stove: One would not ~~spmpx~~ suppose that the water would boil away very rapidly . So if the skin is not hot evaporation is not taking place. Here is a ptient comes into a Russian bath and if he should come right out at once his body would be covered with moisture. What does that indicate? (That ~~is~~ he is perspiring profusely. The water condenses upon his body because his body is colder than the surrounding air.

In that case there would be no evaporation from the skin when the skin was colder than the surrounding air. Now we see a person who is just dying, and in whom the temperature has gone down to subnormal, and we see him perspiring very freely. This is a condition difficult to explain The patient is in a state of collapse, and the skin is covered with moisture, beads of sweat standing out all over him--but that patient is not dispersing heat in that case.

And we must remember that the patient will be chilled by the evaporation of the moisture to some degree, and we mu t cover the patient up so that the skin will not be liable to chill. I find it necessary to brig this matter up continually. You will inquire what are the relations of heat production to heat elimination hre, and what are the necessary measures. You must remember this thing, that the thing that is needed all the time when we need increased elimination of heat, is to increase the activity of the skin. Now the question is, how can we increase the heat elimination--what physiological change must be brought about in order to produce increased h at elimination. The skin is hot add dry. (By the application of a cold medium.) By bringing a cold medium in contact with the skin, because here is the skin, and the blood is going throu h it very rapidly. Now if the patient is in contact with cold water or air or something else that is cold, it will have the effect to cool it off more rapidly. Suppose the patient is covered up with a big feather bed, ad they used to treat smallpox patients-- they used to smother them with a big feather bed. And, too, that is the way in which they used to treat the measles. There was a lesson taught the medical profession about a hundred years ago, with regard to the effect of water in lowering the temperature. A man who was suffering qith smallpox ran away from his attendant and got into a pond of waterm and went in clear up to his neck. He threatened to kill anybody who should come in there after him, and so he stayed there for several hours. Everyone suppee of course that all hope was lost for him, and that he would die , but he made a very rapid recovery. The water seemed to have a beneficial effect, his fever disappeared, and he made a very rapid recovery. That taught a lesson to the medical profes ion that was of service to them. Thus same thing happened in another case, where a man sprang out of the window. Thy made a rush to rescue him, for they thought that he would certainly die, for they thought that the chill would "strike in," but he made a brilliant recovery. The treatment of fever cases has entirely changed within the lst yundred years: A hundred years ago the fever atient was virtually doomed to die, because he cuold not have any water to drink--or only a few sips--and none upon his skin, and he was simply doomed toburn up with fever. It was a terrible tyranny that the doctors exercised over their patients in compelling them to resist all the atural instincts of the body.

Now let us recite some of these measures whi h can be employed in cases in which there is a well developed heat elimination--in which there is an increase of heat production and increased heat elimination. First, there is the g aduated bath, second the tepid bath, third, the cold bath with friction .

Now as we have a few minutes left to us, I think it can be profitably employed in learning how to distinguish between these classes of - cases. In the first we hve a hot dry skin. Now what is there that we can do to increase the elimination in that kind of a case? In the first place there are two masures: We can apply a cooler medium to the skin, or we can induce perspiration. Now can we ordinarily produce perspiration readily in this class of cases? No indeed wecannot. If we could it would be a beautiful thing. We are not always able to make him perspi re, but we ca cool the skin. Now if we cool the skin the blood will heat it right up again, and as soon as it does we can cool it off again, the blood will warm it up again, and so we can keep cooling it off as fast as the blood warms it yp, and if it is warmed up three times as fast as usual , we can cool it off thre times as fast as usual. Now if the evaporation of a pound of water will lower the temperature, it is just the same whether it is sweat or wh ther it is water; it is just the same whther nature puts itoon from beneath, or whther we put it on from the outside. we do not all appreciate the power that there is in cold water. Now suppose xxx we moisten the skin, or apply a sort of a wet skin over it, and then we fan him so that the water will evapcrate. suppose a man falls into the water on a warm summer day, and he sits around under the trees in his w t clothes,--doesn't he soon become chilly? He will get chilly and take cold. so we see how much power there is in evaporation from the skin. Then if we cannot make the atient perspire we can cool the skin by contact with cold water, and we can make the effect still greater by evaporating it from the skin. And this is p actically the best thing we can do, lthough there a e some other things, however. Now in class one, where there is an increase of both heat production and elimination, we must still more increase the heat elimination, and with the hot dry skin which is present, the thing is to bring it in contact with a coller media, so a s to increase the efa poration from the skin. Then is there anything els that we can do? Now if we can do anything which will assist in lowering the heat production, which has been increased, tht will help still further. There are those two things that we can do, diminish the heat production, and increase the heat elimination--and wht is th re in Hydrotherapy by which we can do that? (Apply cold applications.)) Cold applications increase the heat production. ..ery cold air and water increase the heat production. But if the e is anything that we can do to lessen the heat production in conjunction with the effect of increasing the elimination, that would be a happy combination. Drinking water has the ef-

temperature
fect on the whole to increase the xxxxxxxxxxxxxxxxxand cold water to diminish the t emperature. (Make a short application of the hot bath.) That is right, that would have a tendency to decreasethe heat production. The ap plication of a hot bath after a cold bath would have the effect to diminish the heat production. Then there is another way; suppose we pack the head in ice--at the base of the brain --and cause a continuous application of xx cold to the back of the xxxkxxxxxxxxxx head and around the neck. what is the e fect of applying cold along the course of an artery? (It contracts the artery--the peripheral end.) Then if we apply ice clear around the neck, how many arteries will it cross? four, two vertebral and two carotid. Then by so doing we would make an application of cold to four large arteries and ho many more are there that supply the brain? (No more.) Then those four large arteries supply the br ain . Then if we make an application in such a way as to lessen the thxxxxxxxxxxxxxxxxxxxxxxxxxxxx xxxxxxxxxxxx circulation of bl ood to the brain, would not that have the effect of lessening the activity of the thermogenetic centers? (Yes.) Then that would have a tendency to decreasex the heat production, because the heat accelatory centers which stimulate heat production would be lessened in their activity, and that would lessen the activity of the heat production, so by this mode of application we would have lowered the temperature to some degree.. Now suppose we cover the head itself with an icecap--that would also have the effect to olower the temperature . Now by applying heat to the priphery of the skin, would we have a reflex effect upon the thermogenetic acceleratory centers of the brain, and cause a lessened activity of the thermogenetic ceners of the cord? If we apply cold to the head we

may affect the centers directly, and lssen the heat production, and through them the activity of the heat production. So we may apply ice to the back of the head and around the neck.

There are two ways, or rather two things, to be done: we must xxxxxxxxxxxxxxxxxxxxxxxxxxxxxx lessen the heat production and we must increase the hat xxx elimination. This latter can be done in three ways: By cold water, by cold air, and by evaporation. Then we may decrease the heat production by a short hot application to the skin--and it ought to be quite hot for that purpose--and by prolonged cold applications to the head.

Now you see what a beautiful balance there is in this work: Cxxxxx Heat is the converse of cold. Cold has a secondary effect which is exciting and stimulating, and heat has a secondary effect which is sedative. So that there is a balance all the way through.

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QUES. Suppose we get hold of a patient who will not take these treatments--how are we going to convince them that they are good for them?

ANS. I have met a case like that--I think it was the first case I ever had. It was an obstetrical case which I had attended, and they thought that I was quite a wonderful doctor. When the baby was about two weeks old I was called in again, and I found that the baby was very dirty, and needed a bath, and so I said to the mother "This baby needs a bath every morning." The baby had a grandmother there, which was a great misfortune for the baby, and the old grandmother came around just as I was describing how to give the bath, axxxxxxx in the dish-pan, etc., and she said "Doctor, do you propose to put that baby into water, and give that baby a bath? It will kill it! Don't you do anything of the sort. It will kill it, sure." I said "You haven't heard the whole prescription: You must fill the dishpan half-full of water, and then you must go around to the distillery and get a a pint of alcohol,, and you must put a whole teaspoonful into the bath-you must be sure to put a whole teaspoonful into the bth." And the grandmother said that this wwould be all right, and she apologized very profusely for having interrupted me. The alcohol was for the old lady and not for thebaby, and was something in the nature of an after-thought. Sometimes in giving a spongebath we will have to add a little salt, say a teaspoonful to a gallon of water, and you can administer a "salt " sponge bth when the ordinary sponge bth could not be. Sometimes you may recommend the steeping of some harmless herb in the water, or something of that kind,but you must never leave a case of that kind until you give them the true principle before you get through. In order to get yourself a foothold you may have to yield to their prejudices a little,--that is a better way to put it-- but do not sacr ifice the principle, because the principle is that which is doing the work. But if you were to state "Very well, if you do not want to take the bath, I will give you some medicine that would be sacrificing the principle. But by using a little "tact" we save the principle, and it will do its work, and by and by we can bring it out and explain its effect, and explain the whole thing. About twenty years ago we had a case around on Kalamazoo Street--a very severe case of inflammation of the bladder, and the lady had the proper treatment, and made an excellent recovery,, but the Sanitarium didn't get the credit for it. She had been improving right along, but one day after she had been sich about a week her son came and said "My mother is getting no better, and we have send to our old doctor in Jackson, (a Homeopathic) for some medicine, and she wants to know if you will let her take it." There were about forty powders, which were to be taken one at a time,--and I said I will take the them and examine them." So I took them home with me that night and examined them, and made up my mind what they were,--and I did a very foolish thing, I put them all in a pile , and I swallowed one half, and I gave Dr. Winegar the other half, and she took them the next morning in her coffee. We took it for granted that this physiciab was was a real Homeopath--and a real Homeo. is a rara avis nowadays--he is a scarce bird at the present time--but we didn't suffer any ill effects from our twenty powddrs. Then I filled the papers with white sugar which resembled the powders very closely, and delivered them the next morning, and she took those forty powders , and began to get better right away. When she got well she refused to pay our bill, because it was the medicine that had affected the cure. Finally I confessed the fraud, and then they felt worse than they had before, and they said that now they wouldn't pay the bill anyway, because we had deceived them., but I am glad to say that the good lady lived long enough to pay the bill, and to get established on sound principles.

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LECTURES TO MEDICAL STUDENTS. (No .11.)

FEVERS.

I might say that they are having very interesting times in the Chicago medical missions and dispensary, and the work for the medical students as increased five-fold over what it was last winter. (Referring to mission-work.)

Hydrotherapy is one of the most interesting things in the world to me, because it is such a practical thing, and so convenient. We always have water with us. Now with regard to the method of treating fevers. First we had in mind that we would give the patient a graduated bath if we had the conveniences, but a tepid bath would answer the purpose if the temperature was properly adapted to the conditions. Then there is the cold affusion bath that Winternitz has shown us is capable of lowering the temperature very rapidly--thirty per cent more rapidly than the cold bath. Then we have the cold bath with friction: What sort of friction? (Vigorous friction.) We might keep the patient in the cold bath so long that even though we rubbed him he might be too greatly depressed.

Now did we mention any precaution with reference to the shoulders? Yes, in the cold bath the shoulders must be kept under the water.

Then again, we have the simple cold bath, which is an excellent means of reducing the temperature. Now would you expect to reduce the temperature by a cold bath of two or three minutes? No, it must be a prolonged application. And why? So that the tendency to reaction shall be overcome We must gradually subdue and overcome it.

Now I want to mention the fact that this principle of graduation is by some practitioners introduced into the use of the cold bth. They are beginning it with the temperature of the bath at about 85, and then the next bath a little cooler, and the next a little cooler, and so on, lowering the temperature of the bath each time four or five degrees. This principle of graduation may be employed in a great many different ways.

Another method is affusion, and in this the patient sits in the tub, and pails of water at about the temperature of the room are poured over him. Here, again, the principle of graduation may be employed , using the first pail of water at a temperature of about 90--what is the temperature of tepid water? (From 80 to 92 degrees.) 80 is a rather cool tepid, and 92 is rather warm tepid, so about 85 for moderate tepid. It may be either cool or warm tepid--there is quite a little magin for graduation.

Now the patient sits in the bth-tub and the water is poured over his shoulders., and his neck. A good plan is to pour the water first over one shoulder and then the other, and let the stream divide. Of course the water falls from the shoulders to the limbs. The plug is pulled out of the bath tub and the water runs out as fast as it is poured in. Now how many pails of water shallwwe use? Shall we use one every five minutes ? You see in this wy we want to get the effect of a bath in a bath-tub, even if we haven't got a tub, by pouring the water over the patient with a pail. That is the way Currie practiced it. Well, there must be eight or ten pails of water. It must not be dashed upon the patient, but poured rather slowly, and just so that the water is continually in contact with the body, and poured just fast enough to keep up the refrigerant effect. If poured rapidly then the cold water is lying against cold water, and the patient does not get the benefit, but by going slowly a larger portion of the water is brought in contact with the skin. So there are eight or ten pails of water employed, and this is continued until the patient begins to shiver. When the patient gets into a condition where is a start towards shivering it means a lowered blood temperature, and when you have lowered the temperature of the blood, then it is a question how much longer it should be continued. It might be continued so that the patient has a chill, and a depression.

Another application is that of the sponge-bath. In this either the whole surface of the body may be exposed, or only a portion, and the patient is rubbed with asponge. Should the sponge be wet or dry? The sponge must be very wet, because we want to bring as much water into contact with the body as possible, and leave as much water on the surface of the body as possible after the sponge is removed.; ; we want to leave a film or layer of water upon the skin. Now if the sponge were very dry then there would be but a thin layer of water left on the skin, and it would be quickly warmed, but with the very wet sponge it leaves a thicker layer, and it takes longer for the body to heat it.

QUES. If shivering begins after a bath, what is the better way to warm him? --By friction, warm application s, bath-e or wouldn't you warm him at all?

ANS. What do you think about that? (Friction.)What reason would you give for that? (Because of the increased circulation.) The friction qould produce circulatory reaction. Would you administer moderate friction? (No, vigorous.) Now if vigorous friction is applied what would be the effect if you agitate the patient--if you stir him up too much? What is the tendency? (To increase the tendxxxx tempera-ture.) If a person has a fever, or after he has a fever, if he sits up in bed, or talks, or takes any exercise at all, that tends to an increased heat production. But then there is some advantage in a hot application --what is the reflex effect of the hot application? Don't you have a thermic reaction? What is the result of thermic reaction? A rise of temperature, then a fall, then a rise, up to or slightly above, the normal. Now when we apply heat let ussee the effect: The heat elimination ceases. There will be, then, a little increase of the temperature; but then we will, a little afterward, have a xixx fall of temperature--why? Because the heat production is diminished and heat elimination increased. So in this case we will expect to have almost the same effect as in the other. So hot and cold applications, provided the conditions are proper, are both capable of producing a fall of temperature. ("I thought if a person had a chill it would be nec-essary to bring the temperature up without the application of any heat at all.) Yes, that is a point . We don't the patient to actually warm up, we want him to cool off; but we want the skin warm.

Now suppose we make a short hot application to the skin--what would be the effect? If we had a hot blanket pack it would warm the patient up. But suppose this is just simply a hot evaporating sheet, or a very short application of heat, as sprinkling the body with hot water--what would be the effect of that? As long as the skin is cold there will be an increase of heat productiön going on. It would be increasing right along. Now suppose we apply heat transiently: That would hbe an atonic reaction. You see we have a tonic, and an atonic, reaction. We have a tonic reaction from cold, and an atonic reaction from heat.. Cold produces a tonic thermic reaction and ax tonic circulatory reaction.

With the application of heat there is a lowered heat production and lessened activity of the circulation and an atonic effect is the result. So with a cold application; an immediate fall of temperature, and the temperature will then slowly return to the normal; whereas with the hot application it will return more rapidly.

Now we have one more general application to consider, and that is the cold bath followed by a short hot application. This cold bath may be the graduated bath, the tepid bath, the cold affusion bath, or the cold sponge bath--any form of cold bath, but it must be immediately followed by a dash of hot water.

The sponge bath may be either cold, cool, or tepid. We then have five forms of cold application, and either of these may be followed by a short hot application, either a spray bath or sprinkling the body with hot water. The effect of this is to render the loss of temperature more enduring. You have lowered the temperature with the cold bath--how much would you expect to lower it? (Two to three degrees) That will sometimes occur, but it is extraordinary. If you get a degree, or even a few tenths of a dgree, do not de discouraged. It depends upon the stage of the disease. If thetemperature is 103-4, then if you get it down six or eight tenths of a degree you may feel satisfied. But if the temperature is at 104, then you must bring it down to 102.

Now suppose you put the patient into the bath, and he resists the bath--his temperature resists the influences of the bath, and you cannot get the temperature down, and he shivers so that you don't dare keep him in any longer--what are you going to do? This often happens in the early stage of typhoid fever, and then is when doctors get discouraged with the use of water. They will say, I have kept the patient in the bath for half an hour, and his temperature is 103. Now suppose you give him friction, and the temperature is stil l persistent. We

We must see that the temperature is brought down to 102. It is utter nonsense for a person's temperature to be allowed to run up to 104-- it is destructive. The patient is going to have hemorrhages and a terrible collapse when the temperature finally does come down, and he ay die. Now what do we want to do? Here is a patient witha temperature of 102 1-2 after a bath with friction. Now if you put him in a hot bath the temper ature thax will go up steadily. ((But it will come down again.) A short hot bath xx x after a cold bath is one of the ways in which it may be subdued. The principalleffect is not so much to lowerthe temperature more, but to render the effects of the cold bath more permanent. That is the point I want to emphasize. It is simply to check the tendency to heat production bay a cold bath. It is simply to stop that tendency, that the hot bath is employed. It must be short, just long enough to give the impression of heat, and we would not expect that that would increase the heat elimination very much. It helps the circulatory reaction to some degree, while it checks the thermic reaction. By helping the circulatory reaction it assists in cooling off the body, while at the same time the thermic reaction is suppressed.

Now what did Dr. Weiss, the German, do, but put his patient into a tepid bath , at 85 to 92 degrees, and he keeps him there for ten to fifteen hours, until his temperature comes down to normal. He just keeps him there until his temperature becomes normal. And then when it goes up to 101, he puts him back again,--and the patient won't shiver very much, either. The thermic reaction is not induced very much, and thecirculatory reaction is maintained.

Now we must not insist that the patient's temperature shall come down to normal. But put him in a bath tub and give him a long tepid bath, and keep him there and he will be comfortable. But you must remember th is, that the neutral point is raised in fever. The neutral point is raised about as much as the temperature of the patient is above the normal. So that the bath at 85 degrees would have amjx much greater effect in reducing the temperature of the fever patient than in the normal man.

Now let us see about that: You say a te perature of 85 degrees is warm. When we go in to take a sea bath, the temperature is never more than 70 to 75 degrees, and how do you expect that tht temperature is going to lower the temperature of the fever atient?
It lowers your temperature if you stay in it a long time; it is the vigorous exercise of swimming that keeps up thesupply of heat, oso that the heat eli ination, alt ough great, is not sufficientx to bring down the temperature. But the fev r patient is quitt. You go into the sea bath, and instead of making vigorous movementsm simply lie down quietly in the water, and see how quickly you will be chilled. Go into the swimming bahh, at the temperature of 75 degrees, and unless you exercise you soon become chilly..so with the tepid bath in the case of the fever patient. But, you must not expect to get great results short of two or three hours.

You can make your patient very comfortable in that bath; put into that bath tub a blanket saturated with the water, and a rubber bag filled with cold water, and you can make the patient just as comfortable as though he were in bed.

Now if you find t e patient becoming chilly at 85 degrees, you may raise the temperature up as high sometimes as 92, and still get an excellent refrigerant effect, only the ba ath must be stillmore prolonged. We must not forget that. I wish you could go from here to a fever ward, and see the practical application of these thingsx principles, and see how beautifully they will work in all your daily experiences.

Now we have besides this series of baths, the cold pack. And what is this?. It is simply a pack applied with the water at heeordinary room temperature , and as soon as the sheet begins to get warm , that is, in four or five ~~xxxxxxx~~ minutes, remove and apply it again, and so continue until the patient's temperature has been sufficiently reduced. By being inductrious and applying the pack assidiously we can obtain refrigerating effects, and lower the temperature, as well this way as in any other. It is almost an affusion. I might say that this ~~xxxxxxx~~ is to be kept up for one to two hours, and continually changing for a cooler pack. Two or three changes are not sufficient. How long should it remain there? (Till it be ins to get warm.)) And not till it begins to get warm, but just until it threatens to get warm. Now if it is left on until it gets warm, then the reaction has occurred and you have done harm instead of good, for that is the very thing you do not want to do. So just as soon as it begins to get arm, or threatens to get warm,--as soon as it has lost its coldness and the temperature of the skin is approached, it must be re oved and a colder one substituted.

Another method is the cooling wet sheet pack, which is simply a large compress for the entire body, and is managed in the same way.. Now should we wring the sheet very wet, or very dry? (Very ~~dxxx~~ wet.) Why? So that there may be more water to be warmed up by the skin, and so that it will approach more nearly to the effect of a full bath. Now it would be a good plan to use a double sheet, so that it would hold more water, would it not?. And we might employ two packs for the sake of convenience. It is an inconvenience for the patient to stand up for the pack to be renewed,. In stead of that we might have two compresses. We might have a sheet folded into three thicknesses, and have another sheet folded in the same way,, and the patient lies on his side, and the

the sheet is laid there, the patient rolls over on it, and another sheet is put above him, and they are tucked around him, and we have the effect of the wet sheet pack.. In this you must take paons to tuck the sheet down around the arms and legs carefully. You would not simply do the legs up in a mass, but tuck the edges around the legs and ankles. Would you cover the feet? No, we would leave the feet out when we apply the sheet for cooling effects. And why? We leave the feet out because they comprise large vasomotor areas, and the contraction is so great--the internal effect is so great, that the feet get chilled and do not readily warm, and have to be rubbed, and so we have to leave them outside, and then the natural heat of the reaction of the whole body sends the blood to them and they are kept warm. But i it is many times hrd to get the feet warm in these cases. we might apply a hot bag to the feet, but sometimes this has a peculiar effect that we must keep in mind; it poduces athermic or atonic reaction, and a sedative effect. Now did you ever notice that when you had a hot bag in bed with you at your feet, that you got chilly around your shoulders? Have you ever noticed that when you come in from outdoors and your feet are a little cold, but your body is warm and comfortable, and you warm your feet at the register or stove, that you begin shivering around your shoulders? This is simply the xtaxkaxeffaxkaxaf kasxxxx effect of the atonic influence of heat. And there is tdk danger of producing this atonic effect in other portions of the body and interfering with the effects of the cold that you wish to get.. It Bbibgings all the vasomotor and the heat making centers into play, and if we apply cold to a large vasomotor area, as the feet, the effect would be to antagonize the reaction. (We might apply a warm bag.) Yes, it might be applied at about blood heat, or about 92-8 degrees.

Now in order to warm the feet the best way is, if you happen to be in a family where you can obtain it, is a large flat bag filled with oatmeal, cornmeal, or egen sand,, have it slightly moistened, and warmed to ju t about blood temperature. Then there is no loss of heat, no ~~thaxm~~ atonic reaction,, and the feet are kept simply in thenormal condition. But it is best not to wet the feet.

It is not always necessary for the compress to be applied to the limbs. Often around the trunk is all that is necessary.. It is often n cessary to employ this measure in connection with other measures, especially around the abdomen, where there is such an amount of heat.

Then we have the shower pack, and in that the wrappings are removed and water is poured over the patient from a sprinkling pot, or poured out of the hand.

Just twenty-six years ago I was called upon to treat an epidemic of typhoid fever that broke out among our students and in the town At that time we had one or two medical students, and no train d nurses.

We adopted th t plan,, and we had the patients put in a wet sheet pack, and then the sheet was opened, and water was poured all over the body and until the sheet was saturated, and then we closed it up again. We had about sixty-five cases in all and not a single patient died. The students tood by and assisted, and hour after hour we looked after them, and opened these wet sheets, and had the water poured on and sprinkled on, and we had no trouble with them at all. But now we have a sort of hydrophobia--there is a dread of water--they are afraid of it, and mortality is increasing because of it. It is a sign of deterioratio

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LECTURE TO MEDICAL STUDENTS. (No. 12.)

F E V E R S.

Let us enumerate the measures we have so far considered: First the graduated bath, the tepid bath, cold affusion bath, cold bath followed by friction, cooling wet sheet pack, (etc.) In applying the cooling pack, would you apply the sheet wet or dry? (Pretty wet.) And how would we intensify the effect? (By doubling the sheet.) The shower pack consists in simply pouring water over the patient. It is a very convenient bath for a private place or a home, and is a bath that may be used almost anywhere. It is wonderfully convenient. It is only necessary to have a cot. Cover the cot with oilcloth, and raise one end by means of blocks. Have a pail at the lower end to receive the water, and by the aid of a pail of water you can shower the patient nicely. This is sometimes called the Keeley cot, for the reason that a physician by that name first used it in this way.

Now another cooling application is the compress. This is simply a small pack. You my have two compresses--a divided pack, or you may just have your compress around the trunk. The important thing is to keep the trunk cool in fevers. The most of the mischief is wrought in the center of the body. How often should we change the compress?--Once inevery fifteen minutes ? I have seen a nurse who had a fever patient asleep. He would make an application, and then he would go to sleep, and when the patient got so delirious and hilarious that he made a disturbance, the nurse would wake up and apply another compress That will hardly do. It must be assiduously applied, and attended to closely--and as soon as it gets hot, change it? No, you do not want to wait for the reaction to occur. The compress must be attended to very faithfully, otherwise you will have rise of heat production, with very little increase of the elimination.

Now is there anything more? The cool pack, the shower pack, the compress--how about the cooling evaporating sheet? Let us see how much we can accomplish by this: Suppose we take the sheet and wring it out of cold water, and we take up into it say two pounds of water. Do we wring the sheet very dry? (No, very wet.) Well, that would depend somewhat upon the susceptibility of the patient. You would use it is in a case in which you would not put the patient into a very cold bath, although we can make a very severe application if we like. But we will suppose that the cool evaporating sheet contains two pounds of water How how may heat units would be used if we were toevaporate it all? How many can you get into a pound of water? (1000) somthing over nin hundred, but we will call it a thousand. How many heat units are required to convert a pound of water from the boiling point into steam Something over 900. So you see a thousand heat units will be used in the evaporation of a pound of water.. So in the evaporation of a pound of water we take a thousand heat units away from the patient. Now suppose the patient weighs 150 pounds. Dividing we get seven--what The number of degrees of temperature per pound. And if we subtract seve for every pound of the patient's weight, how much have we lowered the patient's temperature? We have lowered 7° to the pound, but the temerature has also been rising, and we do not know how much that would be.. Now we will suppose that the patient is making heat twice as fast as he ought; suppose you have a patient with a hot dry skin, and a temperature at 104°. What is your estimate as to the increasing heat production? Suppose the patient has a moist, warm skin: What is the amount of heat elimination? Three times the normal. Now with a dry skin, would it be lossing heat as rapidly as with a moist skin ? No, because there is evaporation from the moist skin more readily than from a dry skin. We would hardly expect to lose more than half that quantity of heat. Now how do we know anything about the heat production. Now when the body temperature has raised to 104°↓ the rate of heat elimination is not so very much greater than at 100°, but when it goes up to tht point and remains there, we know that heat production and heat elimination are balanced., We know that the hot dry skin cannot eliminate so rapidly as the hot moist skin, so that the heat production cannot be three times as geat as normal. Nww how much is the ordinary increase for every degree of temperature--for every degree of elevation of temperature, how much is heat production increased? 3 1-3 %. Heat production may be increased as much as 25% to 30%.

We will say that we have a scale-beam here, and now it is exactly balanced. How much weight would we have to put into this side in order to sink the balance? Very little. Then here is the body; heat elimination and heat production are exactly balanced. Here we have increased heat production. A raise of 1° in temperature means increased heat production of 3 1-3%, or about 1-30th more than usual. Don't you see that it takes but a very little tax increase of the heat production to increase the temperature, because it is such a delicate blance. The rise of temperature simply means that heat elimination is not keeping up with heat production, and only a little increase of the heat production above the elimination is sufficient to raise the temperature. I think it is important to get this in mind, so that when you have fever to deal with you do not feel that you have such a terrible maldy. It may be simply a little decrease in the elimination.

Now let us suppose that the temperature of the patient is 104, and that 98 is normal. Now if we add 1 to that and make it 99, what would be the increase of heat production there? (3 1-3 %) Now suppose we add another and another--four more--what would that be? Practically twenty per cent. The heat production is increased twenty per cent or nearly one fifth above normal. The normal is what? (7) And one-sixth would be about 1.6, so that would be eight and six-tenths per minute. Now suppose we brought this patient's temperature down in an hour; suppose in the course of an hour we had reduced the temperature that much; the patient's heat production was 8.6 per minute. What is the next step in this problem? . His temperature is at 104, and I want to find out what his temperature would be if we applied the evaporating sheet for an hour and had evaporated a pound of water. That is a practical question. It is by the working out of Such problems as these that we get at the real principle, and see what we are really doing when we are treating our patients, and that is the thing we want to accomplish. Now what do we want to do next?

(Find out how much heat it makes in an hour.) That is right, if it makes 8.6 in a minute, what will it make in an hour? We will multiply by sixty, giving 516 in an hour. Now how many have we removed?

Dr. P. He is eliminating some of his heat, so it is 516 plus 7.

ANS. We have wrapped him up so that all the elimination takes place in the sheet,--we keep all the heat that escapes from his body. We take it all in this case , just as we do in a bath tub. Well, what do we want to do next, then? Find the difference. 1052 is the number of heat units carried off in the evaporation of the water--of a pound of water, so we will subtract this 516, and that leaves 536 heat units that is, 536 more heat units have been substracted than have been produced. Now we want to ascertain how much the temperature will be lowered. Divide by the weight, 150, gives us 3.5, or the amount the temperature has been reduced in one hour.

Now I wonder if we can demonstrate this in any way. Here you have the pail of water and the sheet: Put the sheet in the water and weigh the whole, then after applying the sheet in such a way as not to lose any of the water, weigh the pail again, and see how much has been taken. At the end of half an hour put the sheet back in the pail and weigh the whole thing again. that would be the simplest way to do it. Then take the patient's temperature both before and after the application. It would be difficult to get at he exact weight of the patient, but we can get at it very closely. This is very practical and tangible, and is a measure that we can apply with confidence. When we get hydrotherapy upon a scientific basis, it is a very practical thing. Some of you will have to train nurses sometime and it will increase their faith enormously in the methods which they are using to see that they have such power. Suppose on the other hand that you put ten drops of aconite in a glass of water and say to the nurse, "Give a teaspoonful every fifteen minutes" --it is rather difficult to explain to the nurse the basxxxxx principle upon which that infinitesimal dose is going to bring that patient's temperature down. Id there any scientific or physiological basis upon which we can base a demonstration of the loss of heat units by any such method? There is not. It is all based upon empiricism, and there is no foundation for it. The only way it can act is gy depressing the vital powers of the patient--by putting the man to sleep by knocking him in the head. The blood vessels are paralyzed, the heart is affected, and the vital powers are depressed; the heart is weakened, and doesn't pump the blood around to the skin as fast as it did before, and the patient is therefore not so able to contend with the enemy, the disease , as well as before, and whatever effect the drug produces is only by de - pressing the vital powers, and is not by increasing the vitality and resisting power of the patient's body. So much for the evaporating sheet.

What will we consider no w? Thaxx Sponging. This is something that is not generally practiced in a manner to make it amount to any- thing. The fever patient is sponged, not for the purpose of carry - ing of some of the heat in the sponge, but for the purpose of moisten- ing the surface so that evaporation will take place. It is really on the principle of the evaporating sheet. The patient's skin is hot and dry, and elimination may be increaed by the application of mois- ture to the skin. If the patient could only perppire the elimin- ation would be greatly increased, but as he cannot perspire, we must moisten the skin for him. It is of no consequence whether the water is hot or cold, or warm, but it is the time, which is the principle in- volved. The application of cold to the surface may excite reflex- es which would increase heat production, and I have seen nurses spong- ing the p tient in a way that would certainly tend to increase the heat production rather than to diminish it. Suppose for instance that we apply a cold s onge-bath, deliberately sponging the head and the back and the legs and the arms,--just enough to keep the thermogen- etic centers in the spine stimulated and active, and to keep the pa- tient's temperature going up. But if you are going to sponge the patient, it must be done in good earnest, so that the whole surface will be evaporating at once, and the whole surface of the body should be moistened at once, as nearly as possible--the sponge used must be a good large one, and be very wet. I think you can readily see the importance of that. Then, as the skin becomes dry, it must be renewed. How much good do you suppose will come to a patient from a sponging once in half an hour? What a ridiculous, thing it is to sponge a patient once in a half hour or an hour. I have known physicians to say Yes, I have tried hydrotherapeutic treatment, I ordered a sponge bath three times a day, regularly--I told the nurse to be very particular about it." That would have just about enough effect to keep the temperature raising, otherwise it would not amount to anything at all. It would not amount to anything at all in the way of a reduction of the temperature.

QUES. Would it not be a good thing to give an alcohol sponge--in that case will the alcohol assist in the evaporation?

ANS., Yes, or a vinegar sponge--being a temperance doctor I think the vinegar sponge would be preferable. There is no harm to use something to promote the evaporation of the water., but there ar other ways, that are just as useful, as for instance, by fanning There are times when a little something added to the water helps the patient's friends and the people in the neighborhood, wonderfully. It is a good thing to add vinegar sometimes, it is a cleansing agent to some extent, and is entirely wholesome. I think we might just as well do without the use of the alcohol at all, for it really does not aid so much in the evaporation of the water--or rather, we can get the effects we want just as well without it. It is very easy, too, to apply the same method of observation that we were talking about, with the sponge. Weigh the water with the sponge in it, then take the sponge out and squeeze it just so that it will not drip, and apply it to the patient's body, and in the course of an hour you can tell how much water has evaporated. If the sponge bath is properly managed, you can apply almost as much water as with the sheet.. It must be appled all over the body so that the whole surface is moistened. Now, would you cover tthe ptient up very warmly after the sponge-bath? ((No.) The sponge bth is often applied with the idea that it is the temper ature of the water appled tht lo ers the temperature, but this is not true, it is the evaporation. . It really does not make so much difference whether the water is cold or tepid, but if cold water, and it makest the patient shiver, that infeases the heat production, and then it i better to employ tepid water. Bu suppose that the patient8s skin is so hot and dry that it takes a very protracted and prolonged sheet, then cold water is the thing to apply. You see how the impressions made upon the patient's themselves are a physiological guide of the utmost importance in the application of water. When a patient takes a cold bath, and it makes him shiver, of course it will increase the heat production, but it is a thing to be looked forward to with pleasure, then it is goi g to help him. So we must follow the patient's own instincts. The instincts are God's signboards, which show us the way to act.

Cullin said that he would drive natu e out of the sickroom as he would a squalling cat, but we don't do that, we recognize the fact that nature in the sickroom is God in the sickroom, pointing the finger in the right direction.

QUES. At once time in caring for a case of typhoid fever, I was recommended to emplyy an alcohol rub--it was alcohol diluted a very little--only a little water added to the alcohol.

ANS. It is hard to get rid of the idea that strong drink is strengthening. It is one of the greatest of mistakes. People imagine that if they eat an ox, because the ox is strong it will strengthen them. We might expextxx just as well expect to make a patient st ong by having a strong wind blowing on him. The patient is not going to be strengthenеb by applying alcohol. We dosometimes put a teaspoonful of alcohol in a large quantity of water, from the hardness of the people's hearts, but we do not often have to do that if we will only take the pains to explain the facts. I had a gentleman come to me the other day who had a sister in the ward, and he insisted that his sister should have either some chicken brother or somebeef tea, but he preferred chicken broth. I asked him if he had ever noticed the peculiar color and appearance of beef tea--I asked him if he had ever noticed what they resemble, and I explained matters to him for a few minutes, and it was not very long before he said "Well, Doctor, I think I will leave the case with you." The fact is, there is enough to be said on these things, and they make a great impression, if stated in the right way.

Now let us see what applications of water we have: We might begin with the cold applications . There are, the graduated bath, thefrictioh cold bath, the Brandt bath, and cold affusion. We have allthese cold applications, and they may all be followed by a cold application afterward, so that makes six, and then we mave the cool bth, the shower pack, the compress, the evaporating sheet, and the sponge bath. That gives us eleven applications.

Now we willconsider cold to the abdomen: In the first place, w why do we apply coldto the abdomen? What are the three great vascular areas of the body? The skin, the muscles, and the portal circulation.

The skin has a very important visceral circulation; you know what an enormous amount of fluid can be poured into the skin, as in dropsy. Then here are the musvlles, and the portal circulation--does that contain the coldest blood in the body? (The hottest .) Here the great viscera are the most active, and here metabolic changes are taking place, and catabolic and anabolic changes, and the spleen and the liver and the other viscera are here; so by the application of a com press over the front of the trunk here, we might pe haps succeed in lowering the temperatur e when the tendency to increased heat production was not too great. It would be an ixxxxxxxxx extreme case in which we could not obtain control by this means. Now what kind of a case would that be in which this should be employed? It would be toward the end of the fever--it would not be the first week of typhoid fever, but toward the end, the second or third week, when we put him in a cold bath and we find that the temperature goes down quick, and we need some more moderate means. Another indication for this measure s when the extremities are inclined to be cold, and when you put the patient in a bath his arms and legs are cold, and you have hard work to get them warmed again, and so we will make the cold application where the heat is the greatest, and leave the feet and limbs dry.

Now another kind of cold application is suggested, cold water drinking . Now let us see when we must use cold water drinking in order to get any effect. Suppose we apply cold water to the surface of the body--it is evaporated. Now if we apply it to the interior of the body--is it evaporated? No, we cannot hope to get that continuous gain from the conversion of sensible heat to latent heat. XBut suppose the patient drinks a pint of water,--what is the temperature of the patient is 104, in the interior of the body it is probably 105. We will say that the patient weighs 105, and that the water has gained 25 heat units. Then how much will have been abstracted fromthe heat of the body? About 3°. Then if you are going to lower the patient's temperature by water drinking, he would have to drink a considerable amount of water. How much would he have to drink to lower the temperature 1°, provided there was no heat production? About 6 glasses. We do not have to wait for it to evaporate in order to lower the temperature. When the patient swallows three pints of water--that would be about six glasses--now how long would it take to swallow six glasses of water? It would take at least a half hour for a patient to swallow that. It is a pretty hard thing to do, if the patient doesn't happen to want to drink, and won't drink,--he may be thirsty, and take just a little, and then he doesn't want to drink any more, and then you would hardly expect to get six glasses down him in half an hour. Well, how much would that be? If he takes the three pints, or six glasses, that lowers the temperature 1° in half an hour.

Nowlet us see how much heat he has been making in this time: How many heat units are produced here. How does this case differ from the previous case? There was elimination. In this case heat elimination is taking place independent of the water, and it is not interfering with the elimination. There is a exact balance between heat production and heat elimination. . The elimination is keeping the external temperature ddown to 104°. Now that elimination is taking place the same as usual, and we make the patient drink some six glasses in half an hour-- that would be just so much elimination added to what is already taking place. So if we lower the temperature

.... heat units for every pound, in the course of half an hour we hve lowered the temperature 1°, provided the water taken into the stomach does not have the effect to accelerate heat production, and it may do that a little. . S o we have simple the balance between the heat loss and the diminution and or increase of heat production by the reflexes from the mucous membrane of the stomach.

QUES. I think that would increase the heat elimination, by sweating.

ANS. That would be true, but if he was in a condition where he couldn't sweat, he couldn't get the benefit of that, but it may have some benefit in promoting osmosis of through the skin, but water-drinking is a serviceable means of reducing the temperature. Dr. Beverly Robinson(?) systematized the plan; he advised the drinking of six or seven hundred litres a day. A litre is 1,000 c.c.--it is nearly 2 1-2; it is supposed to weigh 1 kilogram, or 2 1-2 pounds. Seven kilograms would be how many glasses of water? About 31. , and how many in an hour? That would be about 1 1-2 in an hour. He maintained that this method of water drinking was the most efficient of all methods of lowering the temperature. In an old book I found written by Dr. John Hancock, about 1723, he maintained that water drinkig was the best means of lowering the temperature in fever, and he combated it very successfully; he was opposed by all the leading physicians of the day, but he held up to the rational position he hd taken very vigorously; it was a very spicy and interesting controversy. Water-drinking is really coming to be quite fashionable among those who are treating fever.

Now water may be taken throuh the bowels, and this is really a more efficient method. We can introduce it through the rectum. Suppose we introduce two quarts, or four pounds, of water at a temperature of say 80° ; we have four pounds of water. The temperature of the patient at 105. The water remains in the body ten minutes, and in that time its temperature is raised to 100°,--from 80° to 100°--that would be twenty degrees per pound, four pounds would be 80°. That water would be replaced ny other water, whch would be retained in the same way, and so on for an hour , until you have introduced six, and then you multiply this 80° by 6, and we 480°,--heat units abstract d in the course of an hour. Now at the same time heat elimination is taking place by the skin just the same. We have added to the heat elimination 480 heat units more, and so we m ay have a patient weighing 150 pounds, and if we hve an increase of heat xxxx production and diminished heat elimination, just as they were before, we ought to lower the temperature of the patient 3°, so that you see we have here a powerful means of reducing the temperature. I have found it a most efficient means in cases of erysipelas, with a temperature of 105° gto 106°,with a temperature absolutely uncontrollable, by many other means, and I hve found that this would absolutely control the temperature,xxxxxxx We have to have a tube about three or four fe et in length, in addition to the ordiary tube used in connection with the fountain syringe. This is connected to the ordiary tube, and the fountain is held two or three feet above the level. The water ixxxxxxxxxxxx passed slowly in at first, so as to avoid producing violent peristaltic movements to force the water out; if necessary a napkin is placed over the rectum to assist in retaining the water,. Then the txxxxxxx end of the tube is lowered, but the tube is left in position, so that the patient will not have to be disturbed, and the end is then lowered to a vessel at the side of the bed, and the water allowed to pass out, and the tube is connected with the fountain again, and the water is allowed to pass in and out as before.

It is also a good thing to graduate it, starting say at 90°, and keep turning cold water in with each successive enema, and with each enema a little lower temperature may be used, until you get down to 70°, and in that way you can intensify the results without any very serious disturbing results.

This will not do if the various applications produce shivering.

I will just add this word with reference to the local measures: We have the cold application over the heart: This lowers the temperature by slowing the heart, diminishing the rate of vascular excitement and secondly by cooling the blood.

Now we have also cold applications to the head; lowering the temperature by depressing the thermogenic centers, cold applications to the spine also has the effect of depressing the thermogenic centers, and it also has the effect of dilating the peripheral vessels.

One other measure which is useful for local, application, is cool or cold irrigation. Wrap the part with a cloth, then let the water run upon this cloth, so as to keep it perfectly saturated.

Then again we have what we might call cold application by proxy: If you have a wound, and it is open sothat you do not wish to immerse it in the water, you can put the other hand in, and it will lower the temperature to some degree. The right hand placed in water will lower the temperature of the left hand, and so we can treat the opposite side of the body if we cannot treat the affected side. But this is not a very effective method, as the change of temperature is very slight. I think it would have a greater influence upon an inflamed condition than when one is in the ordinary state of health.

....

FEVERS.

If we have a contraction of the bloodvessels from the application of cold to the outside, what is the condition inside? The same thing. Suppose a person should have a hot bath, and immediately afterward should have a cold shower, a cold douche, or cold water poured upon him, , and he should faint away, what would be the cause of it? (The contraction of the blood vessels of the brain.) That sometimes happens. We should remember that. Suppose a person faints away in a hot bath, what is the cause of that? Dilatation of the surface vessels, so that there is too much blood drawn into the cutaneous vessels, and there is not enough to supply the brain. We might have this condition aggravated. We might have a peren taken out of a hot bath ad have some cold water applied to him, and he might faint worse yet. A person will fain from the sdden application of heat and the sudden withdrawal of the blood--there may be a contraction of the bloodvessels and the person is anemic and faits away. There are some people that are so susceptible to the influence of water, that placing the foot in very hot water will cause them to have severe headachs, etc.

QUES. Why would this not happen in the electric light bath, when the tendency of the blood will be to go to the cutaneous circulation. It seems to me it would be to increase the flow of blood from the head.

ANS. Let us see about that: The body is a very complicated machine, and we mu t look at the various ~~xxxx~~ influences exerted when a person is in the hot bath. What is the first effect? It excites the heart. There is a very strong action of the heart, and if the blood vessels of the skin are contracted, and the heart is beating vigorously, the probability is that the internal organs will get the most blood, and the blood will be congested and then will be crowded into the head. Now we apply water to the head,--would you apply ice? The best way is to simply wet the hair and scalp, allowing the evaporation to cool the head sufficiently. We want moderate applications, because very soon the acton will cease and be reversed, and then we want the effect of moderate cold. Is this to be long-continued? No, long continued and intense cold will cause a contraction. We apply a moderate warm application, at a temperature of 100 or 105°--what would be the effect of that? (Dilatation.) If we apply very hot, as 140° for example, what would be the effect? (Contraction ofthe blood vessels.) A very intense application exhausts the blood vessels very quickly--that is the reason xxkxxxx a subsequent congestion of the blood vessels is produced; they become exhausted, and there is a dilatation.

Now let us see: A short application of intense cold makes a contraction. A prolonged application of moderate cold, or cool, will cause contraction. Moderate heat will cause congestion and relaxation. Very intense heat will cause contraction, so that at the two extremes we have contraction. We will make a table of these effects:

Very hot application	Brief, sudden contraction. (Must be short and hot)
Warm or hot,	Dilatation and moderate congestion.
Cool and tepid	Contraction.
Very cold	Brief contraction.

Now if you had a patient who had fainted away, would you apply an extremely hot application to his head? No, it should be a moderate application. Too hot an application might do the patient harm. ~~This means~~ simply hot, or warm. Then would you get ~~the~~ benefit ~~of~~ by an application of cold to the head and face? Yes. If we take a little water and sprinkle it in his face, and we get an instantaneous reaction. Do you think it would be good to wrap a cloth wrung out in ice water around his head? No. We just get a brief impression of cold , and it will be immediatly followed by reaction.

There is just this suggestion that we ought to keep in mind, that the thing that happens to the skin, happens to the mucous membrane. There are (blackboard) two scale-pans, and a pair of balances, and they are perfectly level. When you touch one the other feels that touch, and the first movement is in the same direction, and then xxxxxxxxxx subsequently there is a reaction. For instance, we can make a cold application to the skin, and th blood vessels may contract, while the internal organs are dilated--what takes place? Blood is driven from the interior.

But we want to consider what we would do in cases of fever, or in cases of elevation of temperature,, in which we want ax reduction of temperature, but in which it is necessary to have an increase of heat elimination in oder to do so: Let us see in what cases that would be. We might write down all the cases ib qhich we would have an elevation of temperature :

HP	HE
++	+
+	-
-	-
-	-+

Now we have to consider this first case, and possibly the second. In the case we have been talking about there has been increase of both production and elimination, and now we want to decrease the production, and increase the elimination. Now what forces have been brought to bear to diminish the heat production, in all the measures we have been describing? (Cold application.) Does not that increase the heat production? There are two things that diminish heat production (The application of heat after a cold bath.) How would you apply this? (By sprinkling the face with hot water.) The other method is a long-continued application of cold. We must remember, then, that a long continued application of cold diminishes heat production, and a temporary application of heat after abath diminishes heat production also. So then you see that the more we emphasize these two things, the more we will diminish the heat production..

Now on the other hand, there is the heat elimination: We have been endeavoring to increase that. In what ways will these measures increase the heat elimination? First, by abstracting heat from the body, the same as from a lump of iron--by conduction, byevaporation, and by radiation. Now how by radiation? In what ways do these act directly upon the elimination? The water absorbs heat and renders it latent. How many heat units are rendered latent in the absorption of a pound of water? A little more or less tha a thousand.

We are to have a report from our investigating committee with regard to the effects of the treatments.

REPORT. No data with regard to evaporating sheet.

Water enema:

Body temperature, rectum,	102.3
Cold enema,	80
Time,	35 minutes.
Number of treatments,	3
Average tem., water injected	86°.
Amount of water , quarts,	3
Temperature 1 hour after,	100.7

Now let us see how many heat units were lost: We will call this 6 pounds, and there was 6^{o}, so how many h at units will that be? 36, calories, or heat units. The patient weighed about 130. 36 divided by 130 equals .28, 102.3 minus.28 equals 102 .02. A little less than one third of a degree. Now was that treatment efficient? The practical results were all right. I have seen a glass of cold water lower a patient's temperature for more than half an hour, so that it would be subnormal in the mouth. The effect of the moderate cold application to the rectum lasted longer.

REPORT OF GRADUATED BATH.

Body temperature		102.3
Temperature of bath		94
Began at		4;40 o'clock
Ice on head and constant friction.		
Tem. at	4.40	94
" "	4.42	92
" "	4.45	88
" "	4.50	86--patient began to feel chilly.

Tem. of patient, 102.3.

The patient began to feel chilly at 88, but was kept in until 86.

DR. K. When I was in to see this patient the nurse complained that her limbs were cold. The power of calorification is not sufficient to keep up heat for the whole surface, and nature confines the heat to the trunk. Nature consequently wrings the alarm beel of danger when the temperature begins to fall a very little. . Now what sort of a bath would you use? That bath was a total failure, the enema didn't amount

to very much, and the result was that thw patient's temperature was just about where it was at the beginning.

There is a case in w ich the e is something radically wrong, the patient was shivering, the heat production was increased, an the temperature was kept up., unless the bath was kept up long enough so that the eliritation set up by the bath would over balance the heat production, but this bath was for only ten minutes, so tht there was no chance for that. Now what would you suggest? (Give her a tepid bath for a long time.) Give a bath at 94, and lt the atient stay in for a long time, say half an hour, so that the heat may be slowly removed, an even lower ing of the temperature, if not 1° perminute. The patient was not able to co-operate with that amount of cooling off. (It was about 1° in five minutes.) The main thing then was to suppress heat production. Suppose the patient has a temperature of 105°, with water at 98°; the temperature would lower to 85 in five minutes, that would be about 13°. That would be 13 times 5, equal 65°, beginning with a temperature four or five below the temperature of the body. Then you can lower the temperature quite rapidly to 95, and I am sure you will find it quite helpful.

Now with reference to the enema, what should be done in order to make it more effective? The temperature might perhaps be raised. We might have gone right on with it. We might have gone right on for an hour.

Bouchard says to lower the temperature 1° in ten minutes, He suggested started at 36° below the temperature of the body. The ffat i , that the temperature at which the bath begins must be determined by the temperature of the atient himself. If the patient had a hot skin, we might begin at a lower point. I think in this case it might be well to begin at a point near the temperature of the body, in order to suppress the heat production. What is the lowest point named by Bouchard? Never lower than 86. We cannot make an absolute rule, for each case must be adapted to the individual himself. A number of French authorities adopted the plan of beginning the temperature at 10° below the temperature of the body. Brandt begins at 68°, or 30° below the normal. I think they are all right. I think that it would be wrong to lay down an arbitrary rule, xx for you see how difficult it is for one to judge the patient's condition by his own condition. xRxtixntxxaxexmmntixnaixy We find a case right on the border line, and you hardly know to which of these classes it belongs, when there is an increase of heat elimination, and diminished heat production.

So by beginning near the temperature of the body, we can adapt the bath to the condition of the patient . The graduated bath will be able to take the patient in, no matter what the condition is. I might say hxxmxx that there is a little bit of a chip, and I cam hardly see it distinctly,--I am nearsighted, and I can hardly make out what it is, but I put my hands on both sides of it, and then I know I will gather it in. So with the graduated bath, by beginning the bth at a temperatu e near that of the body, we cantake the case in wherever it is little by little, but you will be sure to reach it pretty soon. But if the patient begins to shiver, we ought to take the patient out right away--just as soon as the patient begins to shiver, take him out. So the graduated bath is the best in the early stages of typhoid fever, and the tepid bath in the later stages, that is, the graduated bath ought to stop at the tepid temperature. Graduate it down as a tepid bath. It may stop at 82, or at any point you like.

QUES. Bouchard says he gives it seven or eight times, and keeps the ptient in for a day.

ANS. Yes. I think I mentioned the other day that tepid baths may be used sometimes as many as 15 hours by Weiss, the German authority, and there is no doubt but good results may be obtained in that way thato would not be obtained in any other way.

QUES. In this case where the patient complained of coldnesss in the feet and lower limbs, would the tepid bath be indicated--would it not be abstracting heat?

ANS. H e suggested beginni g with a xaxyxhighxtempxratxrex temperature near that of the body.

QUES. I was wodering about the cooli g compress.

ANS. Suppose we take this class of cases up next. There are two general classes in fever patients, the so-called adynamic and the dynamic When patients have a hot flushed skin, flushed skin, high temperature,-- what do we call that? That is the adynamic state. You have not as yet learned these terms. There is the sthenic and the asthenic conditioms. In one condition the forces of ature seem to be very active; the febrile condition seems to be very active, the patient's pulse is full, or beating rapidly, and the patient has plenty of strength. Thexxxisxxthe The other is the adynamic state, and the features are pinched the hands and feet are cold, and in this condition we are liable to have the patient fall into a comatose state, and serious nervous disturbances are likely to follow. These conditions correspond very closely to the two conditions we have bee talking about in which there is a diminution of heat elimination and an increase in the heat production, or some of these other conditions which we were discussing.. When there is a flushed skin and a vigorous pulse, there is usually a good circulation, the hands and feet are warm, and the patient is eliminating heat at more than the normal rate, but in the adynamic state, in which the patient seems to be in a collapse, as in the second or

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Now we might prepare the skin for acold application, and also prepare the nervous system for a cold application. What is the primary effect of heat? A stimulant. Then if we apply heat to the surface we will stir up the nerve cen ers, and ex cite them to activity, and prepare them to perform their ordinary functions,,we will excite the heart to increased vigor, excite the nerve centers and bring them into a condition in which they are better able to throw off energy. That hot bath does not give him any additional strength,, a d if continued for any length of time may have the effect to use up all his energy, but we will employ it in this case to get out a little more energy out of the muscles than usual. We must take a little different view of the effect of heat than we do of alcohol,or strichnea; we talk about medicinal agents, but certainly they have a different relation to the human body than physiological measures.

Now by the use of water we do two things, prepare the skin for a cold application, and also prepare the nervous system for the cold application--prepare the nerve centers to perform their different functions, and we so prepare the skin that we may have a strong impression made by the application of the cold. If we raise the temperature to 100-8-10°, and then apply a cold application at 60°, you would have a difference of temperature of say 40°--enough to make a powerful impression. It is equivalent to this: If I tap my hand lightly, would there be a reaction? No. Then if I strike my hand vigorously? (Yes.) There must be an impression made. The vigorous application is like striking vigorous blows with the hand, and the impression is made upon the nerve centers.

Now in recognizing this principle, let us see what sort of an application we must make. We have already considered the same combination of the cold and heat in the case of the cold baths, and we have found that we may advantageously use heat after cold baths. And for what purpose? For what purpose do we apply heat after a cold bath? (To increase heat elimination) (To diminish heat production.) We want to get a nervous impression, so it is a very brief application.

In this case we want to do something different with the heat, not simply to get a brief nervous impression, as by sprinkling the face with the water, but we want to warm the skin up, raise the temperature of the skin, and make a stronger impression upon the nervous centers., we want a general excitation--we want to get the whole nervous system excited. The simple sprinkling of a little hot water upon the skin would not be a very exciting application. If we have a man who is exhausted, we would not simply throw a little hot water into his face--for he might be more exhausted than before. But to revive an exhausted man we would put him into a hot bath and keep him there from seven to ten minutes. His pulse would be increased, and we want to keep him there until his arteries are throbbing, and there is a good, strong, full pulse, and the skin is red, and we see the phenomena of excitation, and then, when he is brought into that condition, when he just longs for these cooling drops, when he would like to plunge into a snow bank, then he is ready for the cold application.

The Laplander goes into his little hut, where he has his hot stones and steam, and he stays there until he is most par_boiled, and then he goes out, as red as a lobster, and rolls in a snowbank and has a good time. Then he goes back to his hut and has another stew. That is the same principle that we must utilize in using cold. The trouble is that we are not thoroughgoing enough in hydrotherapy; we just touch it with the tips of our fingers, so to speak. We see a patient with a hot forehead, and we see the nurse apply the little bandage, looking very smooth and nice, about three fingers wide. To cool the head we must have both the hair and the scalp wet. It must be wet. simple a little dash of hot water upon the patient would not help do any good at all, we must get his nervous system actively at work, his nerve centers all into active play, and then we put him into a cold bath. Then we have the blood circulating through the skin, the vessels are filled with blood, and then when we put him into the cold bath then the blood will be cooled, and the heart is beating so rapidly that it will take some little time for the sedative effect of the cold to slow it down. This application of heat brings the blood to the skin and prepares the body for the reaction. The application of heat produces--what kind of an congestion of the skin? (A passive congestion.) A venous congestion. Does This application of heat to the skin increase the rate of the blood-flow through the veins? (No.) It widens the channel ofthe outlet, but it does not open the channel of the inlet. (Blackboard diagram.) When the blood comes in here it dilates the venules and the blood flows more slowly through the veins. And what is the evidence of this? We see the discoloration, showing that a more complete oxidation of the oxyhaemoglobin taking place. Not only the veins are dilated but the arteries as well. (Diagram.) When both the veins and the arteries are dilated,--when the whole channel is opened up, is the rate of the blood passing through the skin increased or diminished? The amount is increased, but the rate is not increased. The rate depends upon the heart beat, and upon the arteries themselves-- and cold stimulates that also. Heat excites the heart at first, then it dilates these surface vessels, and that has the effect to slow the heart. Now we see the difference. We apply the heat, and we have the veins dilated, and we apply the cold and the cold directly afterwards causes a contraction, and immediately afterward comes a dilatation of both the veins and arteries. Now you see what a beautiful result we get here by first applying heat and then cold; we get the very condition we want--both the veins and the arteries dilated--and the result will be a more rapid cooling off of the blood..

Now what would happen if you did not apply the cold? We see that the patient is quite cold, so we just wrap him up and apply the heat and warm him up--would that be good? (No.) Why? The application of theheat would dilate the veins and arteries, and they would have a tendency to stay in this dilated condition, but the application of the cold will make a contraction, and make the flow of blood more rapid. The application of heat dilates the veins and the arteries and the blood flows more xx slowly, but by the application of cold we cause a contraction and push the blood along.

The more rapidly the blood is changed the more rapidly it is cooled Let us see what it is that cools the body: First it is the extent to which the blood is cooled, or, first, the rate at which the blood is changed. Now suppose we havea great big chunk of ice in the corner of the room, and it is all wrapped up, so that the air of the room will not come in contact with it--so a to prevent the circulation of air--what will be the effect of that? It will not melt very rapidly . Now suppose we have a pair of bellows or a fan, and we blow the air against the chunk of ice--that would increase the cooling. No the Question is whether we are going to slow the rate at which the blood passes through the skin, or whether we are going to increase the elimination as much as we can in some other way. We have lowered the temperature of the skin. We have the same rate at which the blood passes through the skin, but it is spread out a little in its passage, so we would have an increased lowering of the temperature, because we have the same quantity pasing through the skin , and it is spread out more over the surface, and consequently it will be cooled a little more. But now suppose we would do both these things at once. Now the thing I wish to call your attention to is this; that a short time after the dilatation it is succeeded by a contraction, so in this case although there is temporarily a little benefit, that benefit is very soon lost by the contraction which follows. If you dip your hand into hot water, and it is red, the heat is being rapidly eliminated, but as soon as it gets rid of the heat that was communicated to it, then the bloodvessels will be contracted again . So you see the actual valueof the application of heat alone would be almost nothing. By the time he temperatu e of the skin of that hand is reduced to the temperature of the skin of the other hand, the blood vessels will be contracting, so that there will be no increase ofheat élimination. In other words, the veins have treturned to their normal size.

Now on the other hand, with the cold applications we have not onlt dilatation of the veins, but of the arteries also when the reaction takes place,, but the moment the contraction takes place the blood is forced along by the contraction of the arteries. When the reaction takes place there is dilatation of both the veins and the arteries, and thus the whole skin is open--the flood gates are open, so to speak, and the blood rushes through, and this condition is more permanent and will last for some half an hour or an hour , or a longer time, and in this reaction there is an increase of the rate at which the blood passes through the skin; the application of cold increases the rate of transmission, and the increase of rate is the thing which is most useful in the elimination of heat. Now suppose a persons hands were at a temperature of 40°--they would be quite cold . Why would you not put them into warm water instead of cold to warm them up? Now suppose they are at a temperature of 32° or freezing, and the temperature of the air is at zero. That man puts his hands into water at a temperature of 32°--that would not warm them up very much, would it? But suppose we apply snow, at zero--that is cooler-- and then apply the water at 32, and then there would be a reaction, and the reaction is the thing that would warm up the feet and hand when they are freezing . Now we want to do this very same thing; we raise the temperature of the skin so that we can make an application of cold, which will be followed by a reaction, which will abstract some of the heat. The cold application will almost instantly remove the heat you apply. Make a hot application and it raises the temperature; make the cold application, and that brings it down, abstracts the heat from the skin before it has had time to work in to the center of the body and heat the body up to any considerable extent, and then we have the reaction following immediately after, and the condition is improved.

There are several baths by which we can do this. The first would be the hot full bath, followed by a cold bath. This hot bath may be either the hot full bath or the hot blanket pack, fomentation to the spine, or it may be a hot enema, or any kind of a hot application; It may be to the legs or arms. This may be followed by a cold bath, a graduated bath.

We may have

Hot blanket pack followed by cold application,
fomentation to the spine, " "
hot enema " "
Fomentation to the abdomen " "

And so we may have ten or twelve different applications. We may take any of these cold applications and employ any one of them after a hot application, but we must not continue the hot bath too long, for it will communicate heat to the skin too rapidly.

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