JUNIOR MEDICAL STUDENTS

Tuesday, October 9, 1906: 12 P.M.

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There is a front side to the face and a back side, and they are closely associated. The nasal mucous membrane is the nasal face. Here is the front side. These two are associated through a nerve center. Here is the nerve center in the spine. One branch goes to the front side of the face, one branch goes to the back side of the face. The viscera surfaces and the outer surface of the skin are associated. An application made to the front side of the face, to the outer surface, produces a similar condition in the inner surface which is associated with it. That is, apply cold to the face, cold causes contraction of the vessels of the face, and through its nerve center, which is a vasomotor center, it sends branches both to the back side and the front side of the face. The same condition is produced in the inner surface that is produced in the outer surface. Why is that? -- Because the effect produced in the outer surface is a reflex effect, is not a direct effect. When the cold is recognized by the thermic nerves these nerves excite the vasomotor centers in the nerve center which has charge of that area of the skin, and when this vasomotor center is excited it causes contraction of the blood vessels of the skin; and this vasomotor center sends branches to the inner surfaces as well as the outer surface, and consequently the same condition is induced in the inner surface as is produced in the outer surface.

There are two peripheries -- the outer periphery and the inner periphery, and they are both brought into the same condition, because they are controlled by the same center and the same effect is produced in the two. The skin covering the scalp and the face and the neck is in this way reflexly connected with the brain. It is the face of the brain. Every organ of the body has a face, has a representative area in the skin. The skin covering the heart is the heart face; the skin covering the front of the chest and the back of the chest is the face of the lungs. The skin covering the area over the liver is the liver face. The skin over the epigastrium is the stomach face.

There are certain organs of the body that have more complex relations to the skin. The skin covering the palms of the hands is especially rich in vasomotor nerves. There is a reflex relation in this way with the brain, the lungs, the uterus, the ovaries, and the pelvic organs. It has wide spread relations. The skin covering the soles of the feet has more varied and more intense vasomotor relations than almost any other part of the body, so that the feet are more richly supplied with vasomotor nerves than any other part of the body, so if an application is made to the soles of the feet it has very wide spread and intense effects. The vasomotor nerves of the soles of the feet are in relation with the lower legs, from the knees down, are in relation with the pelvic organs, with the kidneys, and the lungs, and the brain; more or less, in fact, with the whole body.

The skin covering the abdomen is the face of the bowels. The skin covering the pelvis, the lower abdomen, the hips, and the lumbar region is in relation with the pelvic viscera. The skin over the kidneys is the face of the kidneys, and in reflex relation with the kidneys the skin covering the lower part of the sternum is also in reflex relations with the kidneys.

There are two classes of blood distribution. There are two vascular areas in the kidney. There is the cortical and the medulla. The cortical is in relation to the lower end of the sternum. In some lower animals the two circulations are given much more distinctly than they are in man. Some of the lower animals have a portal system of the kidney, just as there is of the liver, so there are two vascular areas for the liver on opposite sides of the body-- two reflex areas for the kidney. One is over the kidney, the lumbar region, and the other is the lower half of the sternum. This is a very interesting and useful fact, as we will find when we come to study the therapeutics of the kidney. You can be doing one thing to one of these reflex areas while you are doing another, and a very different thing, to another one. So we can get two effects upon the kidney at one and the same time. You can do that with all organs, as we will see when we get along further. These are so-called reflex areas. Every organ in the body has its face. The muscle is in reflex relation to the skin which overlies that muscle. Consequently very viscus in the body is in reflex relation to the skin which overlies it.

Let us consider again the reflex effects of cold. As we go along I will give you some practical illustrations. In the first place we must get these fundamental principles, then we shall sail on pretty lively, because if we get these foundation principles we have really the whole thing, and the rest of it is simply the working out of the principles and applying them to different places. If you get the principles sound and well, all the rest is easy. All we have to do is to go over it, and you can see yourselves where the different principles fit in.

A short cold percutient application produces first very short contraction, then dilatation. In this whole subject we are talking about internal effects, not about the skin. This is just as true of the skin,

however, as it is of the internal parts. This dilatation which follows a short cold application we call reaction. That reaction takes place inside just the same as it does outside. That is all we have got to remember -- that there is an internal reaction as well as an external reaction. When you put cold water on one cheek pretty soon it will be red and the other not. If you put cold water on your hand, pretty soon it will be red and the other will not. When the application is made over the liver the same reaction occurs in the liver that occurs in the skin over the liver. That is the reason why, when you apply cold water to your face, your brain feels refreshed. When one is real tired and sleepy, if he applies cold water to his face it freshens him up, brightens up the face, brings the blood into the face, brings more blood into the eyes, so that the eyes appear a little brighter, a little more brilliant, and the whole face looks fresher after this application of cold. The way the face acts is an evidence of the change which takes place in the brain cells of the face. The very same thing happens to the brain that happens to the face, because the face is in reflex relation with the brain.

Suppose you want to cool off a patient's head. Here is a patient who has fainted away. His face is pale. What is that evidence of? when the patient's face is pale? It is evidence that the brain is pale also. Mechanical effects and reflex effects are exactly opposite, but they are all operating at the same time more or less, and that is one of the nice things in hydrotherapy, -- to know how to calculate these two things and make them accomplish what we want to accomplish. One of the most interesting and nicest things in therapeutics is to understand that thing. We are studying reflex effects now, and we are not supposed to know anything about mechanical effects. Here is a man who has fainted away. We apply cold water to his face. What for? Would you say you apply cold water to the face

because cold contracts? You don't want to contract that any more. Would you put ice on a person's head when he faints away -- cover the head up with ice? - No, that wouldn't do at all. Just rub the head with a piece of ice or the hand dipped in cold water, or slap the face with a towel dipped in cold water - give it a good hard spat. Why? Because the short cold percutient application causes dilatation. Where? In the face. The cheeks get red, don't they? But don't you want something more than that? You want the blood to come back to the brain, and that is the quickest way to do it, you see. Strike the face with the hand, or with a towel dipped in cold water, and the percussion causes mechanic irritation in addition to the thermic irritation. So you have a double effect, that is percutient. You may spat the face, that is good. Just percussion alone is good. That will help to rally the patient if you haven't any cold water. But if you have cold water, wet your hand in the cold water, or the end of a towel, and slap the face with that; then you will have a double effect, because you are stimulating two sets of nerves instead of one. You are stimulating the nerves of pain and the nerves of touch. That is very interesting. Now if you have cold water in addition you are stimulating the thermic nerves, so you bring some more nerves to bear, and the thermic nerves have a most powerful influence on the vasomotor centers. These thermic nerves that are sensitive only to impressions of heat and cold have the most powerful effect. Their influence upon the vasomotor centers is extremely powerful, because we depend upon these thermic nerves to watch over us day and night; while we are asleep to regulate the blood supply and heat elimination, and these processes of circulation in the skin, to regulate them while we sleep as well as while we are awake; and they do it automatically; so they must be very sensitive. The blood is brought back to the face by the thermic application made to it. At the same time it is brought to the brain, and that restores the patient. With the return of blood to the brain the life is saved.

If we extend this cold application to the chest, especially over the region of the heart, we greatly increase its effect, because then we are acting not only upon the brain face but also through the nerve centers which control the heart, and we are acting upon another set of centers each dealing with the heart face as well. And more than that, we are acting upon the lung face. So we set the lungs going, and when the lungs are set in operation that helps the heart. So if we can make the patient take a deep breath that helps to fill the heart, to stimulate the heart movement, and helps to send the blood to the brain, and that is what we want to do.

Then a short cold percutient application will first cause a short contraction, and afterwards dilatation. Suppose you are going to give a person a cold bath. Do you do anything to the head before the cold bath is applied? Why do you put cold on the head first? -- To prevent a sudden rush of blood to the head. Put it on quickly, that is the way to do it. Yet in the technique of the very cold bath you will see particular pains taken to give instruction to do it in an entirely different way from that. In the case of a patient going into a cold bath we are afraid too much blood will run to the head, so we put a little cold water on his head, rub his face with cold water, and what does that do? It dilates the vessels of the brain. Then you send him to the cold bath, with the blood vessels of the head already dilated, the vessels of the skin contract all over his body safely. It is a great deal better if you don't put any cold water on his face at all. So you see how this principle is brought to bear at once in a practical way.

There is a thing that almost every person does exactly wrong, and it requires a constant effort to get him to do it right. If you are going to cool a patient's head for a cold bath,how should it be done? If the patient bathes his face, that produces a contraction followed immediately by dilatation, and so you must bathe it again. It must be bathed, and

bathed and bathed,--swathed with cold water for half a minute before he goes in. He must have a towel wrapped around his head, so as to keep the cold right on continuously. Repeated applications will cause a firm contraction. If you make one application it makes a contraction, if you make another it follows that up, add another, and it is still a firmer stronger contraction. So repeat it half a dozen times, or wind a towel wrung out of cold water around the head tightly to protect the head. This will contract the vessels, and they will be contracted at the time the application is made. Contract the blood vessels before you make the cold application, then the brain is protected. The very same thing may be true of any other part. If you are afraid of congestion of the lungs, apply cold to the chest, and protect it before you make the general cold application. If you get these vessels contracted in advance, when the general rush of blood comes it will not affect the lungs or the brain especially, for they had that preliminary contraction. In the case of the hot foot bath the blood goes to the head in another way,-- by the heart being excited at the first application.

There are very many practical questions that come in as we go along with this.

Now we come to the second proposition: A percutient cold application causes contraction, but prolonged non-percutient moderate cold application causes contraction of the internal vessels. Why do we say "moderately cold," and why do we say "non-percutient"? The percutient is mechanical, and it brings in another influence which will work against contraction, you see. The tendency of a percutient application will be a short contraction that appears for a short time, and that will tend to produce an immediate reaction, internal as well as external. So that must be avoided, and the application must be prolonged. Here is a patient in a cold bath. The cold

water contracts the skin. If we rub the patient while he is in the cold bath, or percuss him, it promotes reaction of the skin, and when reaction takes place in the skin it takes place internally as well. The thing that takes place on the front side of the face is taking place on the back side of the face also, you see. Remember that the face has a back side as well as a front side. The thing that happens on the front side is happening on the back side at the same moment. The liver is the inside of the skin, and what is happening upon the skin over the liver is happening in the liver. Then if you make an application to the skin that produces reaction of the skin, causes reddening of the skin, that very same thing is happening in the liver, you see. So we say non-percutient and moderately cold, because if it is very cold the thermic stimulus will be so great, the excitement to stimulation from the thermic nerves will be so great that there will be a vasomotor resistance against it, and the reaction will take place in order to save the tissues, you see. So it must not be too cold, because if it was exceedingly cold the excessive thermic stimulation will cause reaction, just as the rubbing would; and if there is reaction in the skin there will be reaction internally as well. The same thing happens to both parts.

There are two arms, you see; -- here is the nerve center, here is the outer arm, and here is the inner arm. Here is the outer area and here is the inner area. What happens in one place happens in the other. The two things are going on parallel all the while. If we have reaction externally the internal reaction is likely to precede the external reaction, because the part is warm,-- warm blood is circulating through the part, and the heat helps the reaction. If we expose the external parts to prolonged cold applications, non-percutient, for a moderate time, what will be the effect of that? It will keep the blood vessels contracted. Suppose you come out of a warm bath, and the skin is warm. You allow the body to only partially

recover, to imperfectly recover, expose to the air, what will be the effect? You get chilly quickly, do you not? Come out of a warm bath into a room of ordinary temperature, and you chill in a very short time. There will be goose pimples, and the skin is very pale. Suppose you go into a very cold bath, very cold water, and come out of that -- what will be the effect? The effect will be just the opposite. You have a reaction. The blood vessels of the skin will be dilated, and the skin will be warm. You see, then, that the simple evaporation of moisture from the skin, that is, slow cooling by evaporation; ~~just~~ slow cooling, just a moderate cold to the skin, causes contraction of the vessels of the skin. Why is that? Because the cold is not intense enough to produce a thermic reaction. That is the reason. It is not intense enough to dilate the vessels and promote activity in the skin, because the vasomotor center is excited by thermic stimuli by cold. If it is only a little cold, the small amount of cold that comes from the evaporation of moisture on the skin, the cooling is very slow, and that slow cooling will not produce reaction.

Suppose you have here three bowls of water,--water in one at a temperature of 40°, in the second at 70°, in the third at 100°. Suppose I put one hand into the water at 40° and the other hand in water at 100°. Now I put both of them into the bowl at 70°. My right hand has been in the bowl with water at 100°. I put it into the bowl of water at 70°. How does the water feel -- warm or cold? It feels cold. I take my left hand out of the bowl of water at 40° and put it into the water at 70°. How will that feel? That feels warm. But the temperature of the water is 70°. One hand says it is cold, the other hand says it is warm. I put both hands together into that water. One hand says it is warm wather, the other hand says it is cold water. So one hand does not agree with the other hand. How are we going to find out how it is? It would be a pretty difficult thing I guess. One hand says warm, the other cold. Why do the two hands make a

different report that way? Because zero of the temperature sense is on the sliding scale. It depends upon the temperature of the skin. Whatever the temperature of the skin is, that is the zero of the temperature sense; and if you bring anything in contact with the skin which is warmer than the skin, the skin says it is warm, and if it is colder than the skin, the skin says it is cold.

Then the effect of an application depends upon the difference in temperature between the medium applied and the skin. If there is a great difference between the temperature of the skin and the temperature of the application, then there is a strong reaction. The impression will be great. Take the hand out of water at 40°, put it into water at 100°, and it will feel very hot, almost painfully hot. Put your hand in water at 40° and leave it there a little while, then put it into water at 100°, and it will tingle, be painful, distressing. Take the hand from the water at 70° and put it into water at 100°, and the effect will be different. You see the difference between 40 and 100 is 60. The difference between 70 and 100 is only 30; so the difference in temperature will be twice as great, and the effect will be twice as great.

Now see what happens when you have a slow cooling going on by evaporation taking place. Here is water on the skin. It is the same temperature as the skin. Evaporation is taking place. You see the temperature of the skin and the temperature of water in contact with the skin are the same all the time. They are right together. In order for there to be a reaction, there must be a difference between the temperature of water applied to the temperature of the skin. The water applied must be colder than the skin. Here the water is on the skin. It has the same temperature as the skin. Evaporation has taken place, and the skin is cooled just as fast as the water is by evaporation; so there is practically no difference between

the temperature of water on the skin and the temperature of the skin itself, consequently there is no reaction. So in slow cooling by evaporation there is no reaction. Now then, in order that there should be reaction, there must be a difference in temperature between the water and the skin; and the greater the difference the greater will be the reaction. Then if you put a person in a very cold bath and keep him in that cold bath, there will be a thermic reaction. That great difference in temperature will produce a thermic reaction. If you want to contract the vessels, if you want to make an application in such a way as to contract the vessels, you don't want reaction, do you, because reaction dilates the vessels. What is reaction? It is dilatation of the vessels which follows primary contraction. Then if you want the vessels to remain contracted, you do not want reaction. When you want contraction you do not want reaction, because reaction is dilatation. Then when you make a cold application -- for instance, the liver is congested and you want to get the blood vessels of that liver contracted, you don't want any reaction, do you? Then would you make a short application over the liver, or a long one? A long one. And would you make it very cold? Why not make it very cold? If it is very cold it will produce reaction. Would you percuss the liver and rub it hard, or apply a douche with a great deal of pressure, or a spray over the liver? No, you would not do anything of the sort. You would make a cold compress over the liver, or a fan douche with no pressure at all, or with very slight pressure.

So you see there is a whole lot in the subject when you get down into it, and it is necessary to understand the fine points. The majority of people using hydrotherapy are going right along pigglety pigglety, in a perfectly obstruse and perfectly ridiculous and ignorant way of doing things, which make me sick when I think of it. But you must do something different. Make up your minds to master this thing, just as you master histology and pathology, so when you get through here you will be good for something.

I heard a man say some time ago "You can get is very easily. The books are full of it. You don't have to study it. You can get it from any good text book." I was down in Charleston, West Virginia, some time ago and was called in to see a lady in consultation who had had cancer of the uterus and it had been removed by hysterectomy. Dr. Kelly had done the hysterectomy for her, but the cancer had returned, and she wasin a very very wretched miserable state. Indeed, she was almost dead, lying there in bed. Dr. Osler had been in town a short time before, and he had been called in to see the same case. So you see I had a very distinguished predecessor in the case.

When I came in the lady said, "Now I had Dr. Osler here a little while ago, and I don't want you to prescribe what he did." I said, "I can not tell what I will prescribe until I get through. What did Dr. Osler prescribe?"

She said "Dr. Osler said I had neurasthenia." I thought perhaps he didn't want to discourage her. "He said I needed wet sheet packs; that they were just the thing; and he told the nurse how to do it. He said to the nurse, 'You move the patient over to this side of the bed, then you lay down a blanket on that side of the bed, then wring a sheet out of very cold water -- as cold as you can get it, lay that down on the blanket, roll the patient over on the sheet, wrap that sheet around her, tuck her in tightly -- and she will scream and holler, but let her holler; wrap a blanket around her real tight, and by and by she will get warm and feel a great deal better.'" She said, "The nurse did it just as he said. The nurse rolled me into the sheet and wrapped a blanket around me, but I didn't holler, but I lay there for an hour shaking and shivering, until I was nearly dead, then I begged the nurse to take me out, and I never had another." She said, "I didn't holler, but I didn't warm up either."

Now that was a most ridiculous thing to do. A cold mitten friction was strong enough for such a case as that. You see Dr. Osler does not know

the first thing about hydrotherapy. He says if this thing or that thing does not cure your patients, then try hydrotherapy. He does not tell the first thing to be done, and he does not know how to do it himself.

I was at Johns Hopkins Hospital a few years ago, and my old friend, Dr. Hurd, showed me about. I said, "Doctor, where is your hydrotherapy department?" He said "Oh, we have no hydrotherapy department." "Is that so?" I said. "No," he replied, "Dr. Osler thinks that is a fad that will pass out after a while, so we didn't think it worth while to put it in." He repeated afterwards, and said, "We all think it is a fad that will pass out after a while, so we didn't think it worth while to put it in." All the rest is a fad, comparatively. Medicines and drugs have passed away one after the other. Every drug has had a fashion, has been a fashion, and has had a run, then has passed on; but hydrotherapy is the thing that goes on forever. It is like the brook, you know, that flows on forever. It began at the very beginning and it has been going all the time. These drugs are all modern inventions, new things; but hydrotherapy is old, so it goes on.

We have just been over two things now, and I think we have got these two things learned. The rest of it will be quite easy.

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JUNIOR MEDICAL STUDENTS

Thursday, October 11, 1906: 12 P.M.

By J.H. Kellogg, M.D.

The lymph has a cerebrospinal fluid. That is the way the circulation of the brain is chiefly controlled,--by the lymph flowing out and in the ventricles. The brain case is inelastic. How about the spinal cord case? That can change. It is not absolutely inelastic. It can change very much. Otherwise we could not twist our bodies around. The ventricles are in communication with the spinal cord canal, and the lymph flows out and in. When there is more blood in the brain there is less lymph, and when there is more lymph there is less blood. The ventricles swell out and occupy the space that is made by the contraction of the vessels of the brain. If the brain contains less blood it contains more lymph, but lymph is in the ventricles. The ventricles are simply lymph seas, and they are in connection with the little lymph cells and interstices put through the brain. That is the reason why when asleep there is less blood in the brain and more lymph. The brain is fed from the lymph, and it is only necessary that there should be less blood in order that the brain should be nourished. When the blood is there the brain is excited by the blood. The oxygen in the blood is stimulating, so in order for the brain to rest and be repaired the blood must recede and the lymph must come in.

In that respect the brain differs from any other part of the body. It can have nutrition without blood to some degree. Its nutrition is affected by the filling up of the lymph spaces which thus become a sort of heart to

the brain. There is a reservoir of food to the brain. That is the reason why sleep is necessary for nutrition of the brain, because it must first of all rest. It must get rid of the stimulating blood. The blood is the stream that runs the mind mills. Prof. Huber, of the University of Michigan, two or three years ago discovered that there are controlling nerves in the brain. He was professor of Histology in the University of Michigan. He has worked that thing out, and he has demonstrated that there are nerves which control the blood vessels of the brain. But how about the vessel walls? There are very few, or no, muscles in the vessel walls. The nuclei of the vessel walls contract under stimuli. When a nerve impulse travels through a nerve, or muscle, or gland, or any other part of the body, the real place that the stimulus ends is recognized in the nuclei of the cells. So the impulse begins in the nuclei and ends in the nuclei, so the real action always comes from the nucleus anyhow. If the walls of the vessel contract, it is the nuclei of the individual fibers that contract. That is where the motion starts, and the muscular fiber is simply a cell which has a large amount of contractive tissue, but the real source of contraction is in nucleus which contracts as well as the rest of it. Now then with a wall which is so thin that there is no differential muscular structure, but there are nuclei only, we must have contraction just the same. When a cell acts, when there is a motor impulse coming out, it comes from the cell nucleus; and if there is a gland action it is because the cell nucleus does something. If there is a muscle action it is because the cell nucleus does something. Suppose here is a vessel that is so small, or degenerated in such a peculiar way that there are no muscles in it at all, still there are nuclei, and the nuclei may act just the same as though there were muscles there.

Now somebody will say to you some time, just as Dr. Crain of Kalamazoo did to me when I read a paper down there about reflex effects of cold applications upon the brain. He didn't know that this thing was a matter of scientific knowledge, just the same as the laws of gravitation, because he had not studied this line at all. He got up and disputed it, ridiculed it. He said "It is all nonsense. The brain has no vasomotor centers, and there are no nerves in the walls of the brain blood vessels, so this reflex effect can not take place." As soon as he got through he went out, went away, so I didn't have a chance to tell him what I have told you,-- how that Dr. Huber had discovered these vasomotor nerves. I know they were there before he discovered them. It was exactly the same as Levansieur (?), the man who looked through the telescope and said there was a new star in a certain part of the heavens. He told the astronomers in St. Petersburg to point their telescope in another direction and they would find a new planet. He had figured it out. He had found a disturbing influence, and he knew that nothing but a planet could be responsible for it. He finally got down to the point where he could locate the very spot in the heavens where that planet was. The St. Petersburg astronomer pointed his telescope there, and there it was. So I knew there was a mechanism in the brain somehow by which the brain vessels were made to contract, because the thing happened. When the thing happened, there must be a mechanism carried on. The thing was done. So when Huber discovered these fibers I was very glad, because now I could prove it to the doubting Thomases. So I had an answer for Dr. Crain, but he didn't stay to hear it. The rest of them did, and they cheered mightily. I am telling you this story to impress it upon your minds.

The brain is a mechanism by which we can contract the vessels of the brain, by which we can dilate them, and by which we can produce short contraction followed by reaction. Where is the reaction? There is a reaction

in the whole area which is under the control of the whole center of that part of the skin to which the application is made. Now when we find a nerve center connected with the skin there is an inner part connected with the same center. The thermogenic nerves connect with the portions of skin to which an application is made which connect with the nerve center or nerve centers. Is there any other part of the body connected with the nerve center besides the skin area? The nerve center is a two-legged creature, a biped, like man or bird. It has two legs. One is located in the skin, the other is in the viscera. There is the front side of the face and the back side of the face. Suppose this is the nerve center. Here is one leg and here is the other one. There is one group of nerve fibers that goes out to the skin, and another going to the viscera. When you tickle one nerve center, both legs twitch, so to speak. There is a thermic nerve that comes down from the nerve center, but we are talking about a motor nerve. And there is a sensory nerve, an afferent nerve. Here is a sensory nerve, an afferent nerve, a nerve going in. It may be pain, or it may be heat, or it may be cold. It is the same sort of sensory nerve that excites this center, and when this center is tickled, as I said, in that way both legs jump. Two motor legs -- one of them goes into the skin, the other goes into the viscera. It is the vasomotor nerves we are talking about now, the nerves that connect with the blood vessels,--the reflex influence of an application of cold upon the vasomotor nerves. So think of the nerve centers having two legs, one of which goes to the skin, and the other to the viscera. Every nerve center has two vasomotor legs.

Here is another thing. Suppose we want to affect the viscera. Cold water is applied where? If you are going to apply cold water to a man who has a congested liver and you want to do something for the liver, where would you apply the cold water? Suppose the liver is too large or too

small, and we want to do something for it. We make a cold application. Do we apply it to the liver? No, we can not apply it to the liver, but we want to affect the liver, and we make the application to the skin. So hydrotherapy generally is always applied either to the skin or to the mucous membrane. The mucous membrane is the lining skin. The cutaneous is the lining skin, the cuticle the covering skin. The body is enclosed by a little sac-- the covering skin and the lining skin. It is one sac inside of another, and the real living body is in the space between the two sacs. The way we affect these internal organs, which is the general machinery of the body, is by applications to its covering in some way. So it is important for us to understand that there is one leg for every nerve that goes out to the outside wall, and the other one goes to the inside.

Every nerve center has two vasomotor legs,--one in the skin, the other in the viscera. Here is the great law upon which hydrotherapy stands. When we make an application to the skin through some of these sensory nerves we produce a certain state of the nerve center that causes something to happen away out here in the outer leg, and the same thing happens to the inner leg. If you get that so very clearly settled in your mind that you never can forget it, it will clear up a whole lot of the whole field of hydrotherapy. Both legs work together. When one leg kicks the other leg kicks. When there is contraction in the outer leg there is contraction of the inner leg. When there is dilatation of the outer leg then there is dilatation of the inner leg. So when you want to know what is going on inside all you have to know is what is taking place outside. The same is happening on the inside that is happening on the outside when you are using cold. This is leaving out entirely all mechanical effects. We will come to that later. We must know that simple principle first, and then we can understand the modifications.

There are certain conditions under which what I am telling you now is not true, but the general law is true . The balance of this subject of reflex action is correlated with these two principles that we have learned: (1) That the short percutient application produces dilatation, (2) That a prolonged, non-percutient, moderately cold application produces contraction externally and internally. A short cold application to the face, neck, and scalp produces dilatation of the vessels. The effect on brain activity would be to increase it. When a cold application is made to the skin it causes contraction first. Why? Through what nerve is this whole impression transmitted to the nerve centers? The thermic nerves. These thermic nerves carry an impression inward, which ends in the end of the nuclei and nerve centers of the brain. Then an impulse is sent out to cause contraction of the vessels in the skin, and contraction of the vessels of the liver also. When the brain vessels are excited to contract it is because an impulse has been communicated to the nuclei of these vessels, because there are no muscles in their walls. But they have nuclei, and these nuclei contract. Would that impression be communicated to anything else besides these vessel walls? The vessel walls are stimulated, excited, and that is why they contract. The nerve centers also are in the brain, the ganglion cells and various other cells. When an impulse is sent out, that excites the vessel walls and causes them to contract. When a cold application is made to the skin impulses are sent into the vasomoter centers. The other centers, or centers connected with the skin, are immediately excited, then motor impressions are sent to the vessels or the cells of the vessel walls in the brain where the nerves finally end. They are excited. At the same time is there anything happening to any other cells of the brain? You can see, if you consider for a moment, every other cell in the brain must be excited as well as these vessel cells. When the impression is made upon the vessel, a strong cold impression, stimulating impression, the thermic nerves are

stimulated, and that sends exciting impulses into all parts of the brain. And while the vessel cells are excited the ganglion cells and other cells are excited too.

There are various excitants of the brain. A certain amount of pain is exciting to the brain. All kinds of sensations excite the whole brain, so it is not simply the vessel walls that are excited. That point will help you out of a difficulty some time.

The effect of a cold application to the face, neck, and scalp then is to excite the blood vessels. When they are excited what happens to them? They contract. It also excites the ganglion cells. What happent to them? The mental functions are rendered more active, the brain is stimulated. There is nothing in the world so full of contradictions as hydrotherapy. If you do not have the foundation principles you will be mixed up perpetually. You will be up against contradictions all the while, because there seem to be two forces all the while acting directly contrary to each other. When a thing does something it seems to do the very opposite. You make an application to accomplish a certain thing, and you see it is doing the very opposite thing also, more or less. That is the thing that renders hydrotherapy such a fine art, because it is the molding of the application which enables you to bring out one effect, or the very opposite effect, as you like. You can use almost any application to produce one effect or the very opposite effect. So there are all modifications between minus and plus, and all the effects between that can be gotten out of almost every application.

A cold application applied to the face causes contraction of the blood vessels of the brain by exciting the blood vessels. At the same time it excites the ganglion cells, which will increase mental activity. The cold application excites the vessels, and at the same time excites all the brain cells, and the blood supply being cut off by the vessels being

shut up, what is the effect that will soon follow? The ganglion cells must have blood to maintain their activity, so if the nerve cells are closed, and keep closed for a sufficient length of time, the result after a while will be lessened mental activity. But suppose we make the application short. Then the blood vessels dilate, then they are excited, they stimulate the cells that increase blood supply, so the mental activity will positively definitely be increased. The mode of application determines the effect.

Hydrotherapy is the most wonderful and the most beautiful thing in all therapeutics. There is nothing at all in the study of medicine that compares with it -- with hydrotherapy, when you come to understand it. The more you study water the more you will be convinced that this pure, pellucid, transparent water, in which there seems to be nothing, has everything in it. It is the divinely appointed agent for healing effects.

The greatest mobility and the greatest space is in the cervical region. There is a lot of room up there. There is plenty of room for the lymph to flow down there at once. Now what is true of the brain is true of every other part of the body. When you make a short application it not only dilates the vessels but it excites the activity of the cells. It excites every other cell as well as the vessel cells. Suppose it is the liver or a gland. It not only excites the vessels of the liver, but it excites the hepatic cells of the liver. The same is true of every stimuli of the body.

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JUNIOR MEDICAL STUDENTS

Friday, October 12, 1906: 12 P.M.

By J.H. Kellogg, M.D.

The short cold application to the face, neck, and scalp excites the brain. A prolonged cold application in the same region lessens the activity of the brain, lessens the circulation of the brain. The cold application to the chest first excites then slows the heart, which excites the respiration. The short cold application to the chest produces deep expiring respiratory movements. Prolonged cold application to the chest makes deep and slower movements. A short cold application over the heart quickens the heart. The more prolonged cold application over the heart first quickens then slows the heart. A very prolonged cold application over the heart weakens the heart and depresses the circulation.

A short very cold application to the breasts causes contraction of the uterine muscle. A short very cold application to the lower part of the sternum excites the activity of the kidneys. A short very cold application to the abdomen contracts the abdominal muscles -- excites contraction of the abdominal muscles, the bowels, the bladder, and the uterus.
Now we have gone from the head right straight down.

The prolonged cold application to the upper dorsal region lessens the circulation in the lungs. A long cold application, as an ice bag to the lower dorsal region, contracts the vessels of the stomach. A short cold application to the lumbar region dilates the vessels of the uterus, ovaries and prostate -- the pelvic vessels. The more prolonged, moderately cold

application to the lumbar region, non-percutient, contracts the vessels of the uterus, ovaries, and prostate -- the pelvic vessels generally. A short very cold percutient application to the thighs dilates the uterine vessels. A short very cold application to the feet contracts the uterus and the thighs. A short very cold application to the hands contracts the bladder and the uterus. A prolonged immersion of the hands contracts the vessels of the head and of the lungs. A prolonged immersion of the legs contracts the vessels of the lungs and kidneys.

A short cold application to the face, scalp, and neck stimulates the brain to increased activity. So that is the kind of application one would make to a patient who has fainted away. Many times I have done it. Here is a patient whose face is pale -- very anemic, looks as though he were dead. Dash cold water into his face, percuss the face, the patient opens his eyes and begins to live again. I remember very well a patient whose face was flushed,--veins were standing out of the temples, the eyes were projecting and red, the patient was wild and delirious. We employed a bag of fine ice to the head, and an ice bag around the neck, and a compress over his face. In just a very short time -- in an hour or two, the patient was composed and sane. It is invaluable to know that thing.In treating acute mania, congestion of the brain, and delirium of typhoid fever, a prolonged application of cold to the head will produce contraction of the blood vessels of the brain.

Here is a patient who stops breathing. A dash of cold water on the chest sets respiration going again.

Some years ago I was out West and I was talking about the effects of cold water and its wonderful curative powers as a divine healing agent, and I called upon the audience to testify if there was anybody there that knew this was true -- that water would accomplish such wonderful things, and a man

jumped up and said, "Yes, I know. One of my neighbors had a sweet little girl, two or three years old, who had diphtheria, and the doctors gave her up to die. I called there, and I said, Now I believe water properly applied will help that child, and I helped them give it a hot blanket pack, and we put ice cloths around its neck, and the child began to get better. We kept it up, and the next morning the child was wonderfully better. The next morning the neighbors came in, and one old lady said to the mother, 'You are killing this child. Why don't you let the child die in peace? Why will you torture it to death in this way? How can you be so cruel to the little girl? Why don't you let your little child die in peace?' They gave it a dose of castor oil, and immediately it was awful sick, and I really thought it was going to die. I got there again very quickly, and kept on applying treatment all night long, and the next morning the little one ~~xxxx~~ was so bright she seemed almost well, and a few days later was perfectly well."
He said "I had a hard time to save that child from death between the diphtheria and the old ladies, two. That dose of castor oil nearly killed her."
Now that man was so happy about that thing that tears just ran down his face when he stood there telling what a delight it was to see that little child saved, and he thought just as much of it as he did of his own child.

Then another man sprang up in the back side of the audience. This was at Portland, in a big camp-meeting. He said, "I will tell you a story of a case." You see how cold to the neck can relieve congestion there, and you see the hot blanket pack in that case drew the blood away into the skin, and they both worked together, you see. Sometimes they work opposite. Another case to illustrate this very point. A man got up and he said ~~XX~~ Our little baby was sick. It seemed to have convulsions,"- of course it was toxemia. "We were twelve miles away from a doctor. We did what we could, and I rode to town on horseback as fast as I could go, and told the Doctor about the case, and he said there was no use for him to go,

that the child was just as good as dead now, and that it would die probably by midnight, and I might as well go home." So he says "I tell you I was nearly heart-broken. I prayed to the Lord all the way home to show me what to do for that child, if there was anything that could be done. I got home and we sat there, my wife and I, and we talked it over, and it seemed too bad to sit there and let the little child die, and I began to examine it, and I noticed its head was awful hot, and it was stupid,--it didn't seem to know anything; just rolled its eyes up and there it lay perfectly stupid. Its head was awful hot, and I said, Wife, may be it would be a good thing to put some cold water on the child's head. It is too hot anyway. So I wrung out cloths as fast as I could and she put them on, and the child seemed to brighten up a little, seemed to feel better. By and by it came 12 o'clock, and just as the clock struck 12 it seemed to sink away, and it stopped breathing a little while afterwards, -- seemed to be getting worse, and all of a sudden it stopped breathing entirely, and its face turned ashen color, and my wife said, Oh, it is dead! and I said, Yes, I guess it is dead, and our hearts were just bursting with grief. But something occurred to me, and I said, Bring me a pail of cold water. I held that child up and threw a pail of cold water over the child, and the child just made a big gasp, and it has gone on breathing ever since. That cold water saved its life."

Now what led that man to do that? You say it was instinct. Water is the divine agent, the healing agent, the divinely appointed healing agent; so that man's instinct you see led him to do that thing, just as the instinct led the deer to go and put its wounded leg in a spring, where Priessnitz got his first hint that water was a healing agent, when he saw that deer crouching down on the edge of the spring with its wounded leg in the water. The deer came twice a day and took this cold bath, and got well. That led Priessnitz to adopt the same method. That is the origin of our

system of modern hydrotherapy. Priessnitz evolved a system of different modes of applying water, and they may call him a quack as much as they like, he was not a quack, he was an inspired man, and he developed a system of divine healing which is a long ways in advance of Christian Science. It really is the thing, it is the real thing; so that man was led to do the right thing. And you find great numbers of people among the common folks that have gotten hold of the right thing, that have been divinely led to do the right thing in the use of water.

Now then it is a lesson to me, and I hope it is to you, that that man was not allowed to use some kind of medicine or drug. He was not allowed to go to the drugstore and select nitroglycerine or ipecacuanha, or something else. He was led to use water -- a thing he was familiar with, a thing he was in contact with every day. It is just as familiar to us as the air, and instinct told that man that water had that power in it. And what was the effect of the cold water upon the thermic nerves of the chest? It aroused the dormant nerve centers, got the respiratory movement to going, and set the heart to going. In fifteen minutes more, perhaps three minutes more, it would have been too late. The carbonic acid gas accumulating in the blood would have destroyed the vitality of the centers, and nothing would have saved the child. Every time that man looks at that child he thinks of that tragic experience, and he feels grateful for that knowledge, doesn't he? When that man told this story the tears were just rolling down his face. Before he was through speaking the whole audience was in tears, because they knew he was telling the truth; it was a real thing.

Then a woman got up and she told a similar story of how she had been led to do this thing and that thing in cases of sickness, and how wonderfully the application of cold cloths worked in a case of pneumonia.

It is worth while to know all the principles that are applied to regulate and control the application of an agent that has such wonderful power in it, isn't it? It is a most beautiful, fascinating study. When we get into it there is no end to it. It is a perpetual delight. And when you come in contact with sick people you know the thing to do.

The skin is like a keyboard on which you play,--like a musical instrument to play tunes on. You may make harmonies, and you may make discords, two. The skin is this keyboard for the body, and every single organ can be reached through the skin. The blood supply of every organ can be controlled. The activity of every organ can be directed, controlled, and modified in either direction by applications to the skin. By the proper kind of applications to the skin you can control the activity of every single organ of the entire body -- can influence it. And it is not hypothetical, it is not imaginary. It is a real thing, and you can see it done. You can know it is done. You can see it accomplish it if you know how to go at it. But you must do it right. You might get the very opposite of what you want if you do not do the thing right. I will tell you a story I heard, so you will never forget it.

We had a man from away down in Illinois who was a patient here. He had a serious heart trouble when he came. His legs were all swollen up. His pulse was running away -- 120, or more. We applied an ice bag to his heart and the beats came right down. The heart went to beating slow and steady, and returned to its normal beat. The swelling disappeared, that man got well, and went home. It was not very long after he got home before he found a friend of his suffering in the same way. He recognized that he had the same trouble. He had heart trouble; had a very rapid pulse. He had Dr. Bower from Chicago. He sent for him to come down and see the man. He had seen him before, made several visits, and gave him strychnia, digitalis, and various other drugs. This man sent for him, and he said,

"Stop this medicine. Get a Battle Creek Sanitarium nurse, and he will save your life." So he telegraphed up here for us to send down a nurse.

I saw the nurse, had a talk with him and gave him some advice. He was a very wise intelligent nurse, who knew more than some doctors. He got there and found the man taking digitalis and strychnia every two hours, and he was not feeling a bit better, but was getting worse all the while, and was in great distress. And the nurse said, "Now just let me put an ice bag on your heart. Stop taking these medicines. They are not doing you any good."

The man stopped taking the medicines at once, put the ice bag on his heart, and began to get better right away. The next day Dr. Bower was over there. He came and saw the man, and he saw the ice bag on him, and he said "Are you taking the medicines?" The patient said, "No, Doctor, they don't do me any good." The doctor said "That ice bag won't do you any good." "But," he said, "I am better." So the patient took off the ice bag for a little while, then the nurse said, "Look here, Doctor,-you feel his pulse, then you watch me put this ice bag on and see what happens." So the doctor felt his pulse, counted it, and the nurse put on the ice bag for fifteen minutes, the doctor counted the pulse again, and it was twenty beats slower, stronger and fuller, and the doctor could see it, and was persuaded. He stayed there over night. He had to stay, because long about 10 o'clock at night he had a terrible attack of sick headache. He was subject to those attacks, and he had an awful attack, and was so very sick he just had to go to bed. The doctor sent for the nurse, and said, "Now look here, haven't you something to do for my headache?"-- and he was a nerve specialist. So the nurse treated him, cured his headache, and he went home in the morning all right. Now that doctor won't forget that.

We had an interesting experience at the Chicago Branch some time ago. Dr. Paulson told me this experience. We had a patient there who had heart disease some years ago, and the patient was using ice bags and other things.

Digitalis didn't do him any good. The patient lived in Chicago, and they thought they ought to have some great Chicago physician come in to see the patient in consultation. So they called in Dr. Ingalls. He came, felt the patient's pulse, and he said, "Now this is new treatment to me, but it seems rational. I have not seen the ice bag used before in that way, but it is evidently doing good;" so he told the friends the patient was having the very best possible treatment. The patient was not taking any medicine at all, and the doctor learned something new.

Ten years ago I don't suppose there were four doctors in the whole United States, outside of our own doctors, who knew anything about ice bags or who were using them at all. It was not mentioned in the books. But now doctors are beginning to use the ice bag. The idea of putting ice over the heart when the heart is feeble -- they thought that was terrible. They didn't understand the secondary effect that comes from the thermic nerves, you see. They tried it and it didn't do any good; but it was because they put the ice on and left it on too long. A short application to the heart excites the heart. It does not do anything more. A more prolonged application, fifteen to thirty minutes, causes first excitation, then slowing of the heart with increasing force of beat energizing the heart. A long continuous application to the heart depresses the circulation. Why does it depress the circulation? Why does a prolonged application depress the circulation? The heart comes right up close to the sternum, and the cold application is made continuously, it is probable that the cold passes through to the heart to some degree. Another influence comes along, the excitant effect is lost entirely by benumbing the skin nerves; so we would make a short application to get a short stimulus which excites the heart, but not long enough to produce any decided and lasting effect, so the heart returns to its old pace again, and if it is slowed it is so imperceptibly slowed, so slightly slowed that you do not notice it. But a longer application, of fifteen to

thirty minutes produces a decided effect upon the heart. We get repeated reflex effects. This is true of repeated applications to the brain. When you put an ice bag over the heart you can see breathing movements change just a little bit --a little changing, a little fluctuating all the while by the change in shape and position of the chest.

If you are going to make an application of an ice bag to the heart, where would you put it? I found a nurse the other day who had the ice bag over the apex of her patient. You see how little good was accomplished by that. It was a fleshy woman, two, so the heart got no benefit from it at all. The tissues fell against the bag and forced it down. The ice bag must be over the heart. Your study of the heart shows you where the heart is, and you know where to make the application over the precordia.

A short very cold application to the breasts contracts the uterus. It must be made. It can be made with the cold hand, or with a piece of ice rubbed quickly on one breast then the other breast, or a cold towel taken out of very cold water slapped upon the chest, then taken away again. Or even a percutient application to the breasts. Just the cold hand or the end of a towel slapped upon the mamae would cause contraction of the uterus muscles. It should be done for two or three seconds, then taken off, then do it again. It could be anywhere from three seconds to fifteen seconds, or thirty seconds. But do not leave it on more than thirty seconds. That is not long enough to give a depressive effect, but it is the first impact that does the good. It is better to take it off, then do it again; -- take it off, wait a few seconds, then do it again. The reaction will occur, then the application should be renewed.

I remember very well the first case in which I ever tried that. I was a medical student -- it was thirty years ago this winter, in New York, and I had a place in the Outdoor Department of the Northeastern Dispensary, away out on Fifty-second Street, and my preceptor had a position there,

and he put me in as his substitute. It was during the holiday vacation. A call came for an obstetrical case. I was scared half to death, for I never had attended an obstetrical case in my life,-- never had been anywheres around. I was just ready to graduate, and there had never been a case presented to the class and I didn't know anything about it. I was scared half to death. I read up, studied up; I expected all possible complications. I got there and found a very fat young woman with her first child -- just exactly the kind of case to have trouble with. She had been in labor for several hours. She was an Irish girl -- an ignorant Irish girl, about eighteen years old. Her husband was there, but he kept out of sight most of the time. The mother was there, and all the Irish women in the neighborhood were there, and we had an awful time. She was just yelling and screaming -- had hysterics. I stayed there several hours -- got there early in the evening and stayed there all night. Finally about midnight she made up her mind she was going to die. We didn't use chloroform on these days. It was only used in extreme cases, used very seldom. Chloroform had been introduced only a few years before for use in obstetrics. There was a great prejudice against it. Patients were scared half to death. Ministers and priests had all taken a great stand against it. When James Y. Simpson first introduced chloroform forty years ago ministers preached sermons against it. All the ministers and priests preached against it terribly. What was the objection? -- They said the Lord said "in pain and sorrow" don't you know, so it was removing the curse, getting in the way of Providence, interfering with the curse; it was a curse put upon woman and it was flying in the face of the Almighty; it was a terrible thing to do. It would have brought all sorts of troubles down on my head if I had suggested chloroform. It was used one time then where it is used 100 times now. So I never thought of chloroform, and even if I had, it was out of the question.

At midnight she said we must send for the priest. There was no headway being made at all. Of course I didn't know then, didn't think then, as I know so well now, that it was necessary and proper that the progress should be slow, so that there would be time for adaptation of the tissues. To precipitate labor would have been the worst possible thing for her. So I was trying to encourage her along, told her that all was going well, but my heart was beating very hard and I was shaking in my knees. There was such a turmoil and confusion that I got very tired and sleepy. I had to lie down on the sofa. They would ask questions of me continually, so I lay down on the sofa, closed my eyes, shut them up tight, breathed deep and heavy, and they thought I was sleeping sound, so they kept still to give the Doctor a chance to sleep. In the meantime I was listening very hard to see what was going on. By and by I began to see that the pains were really beginning to come on stronger and more normal. I got up, but there was no progress made, and to my disappointment the pains ceased entirely. What should I do now? It just occurred to me that I had read that cold applications to the breasts would produce uterine contraction. So I got some ice water. I didn't tell them anything about what I was going to do with it, and before they knew what was going to happen I saturated a towel with cold water and slapped it on the breasts. The patient made a great scream, the uterus contractions started again in good earnest, and the child was born within fifteen minutes and the whole thing was over.

That was my first experience with cold water, but our doctors here use it regularly. In a case we had in the operating room we had just the same experience. The uterine contractions ceased entirely. We applied cold water to the breasts and the contractions began again at once. There is a direct special reflex relationship between the nerve centers that are in that part of the body and the uterine muscles.

Now a cold application to the abdomen causes contraction of the

bowels, and bladder, and uterus. Those are the three muscular organs within the abdomen. Cold applications to the abdomen causes contraction of something else -- the intestines;--The bladder, and the uterus, and something else -- the intestinal muscles themselves. You must not forget that, because the muscles of that part of the body contract both voluntarily and involuntarily. When cold water is applied to the abdomen you know the first thing that happens is the abdominal muscles are pulled right in quick. When a cold compress is put on a typhoid fever patient you see the muscles sink right in. It is involuntary because reflex influences of cold increases the tone of these muscles. When one goes in swimming there is contraction of these muscles right away. A cold application to any part of the body has a tendency to contract these muscles, but especially of the abdomen. It has a specific effect there. So when you make cold applications to the breasts you get contraction of the abdominal muscles. It is a good plan to go on beyond that, and if the ice is applied to the breasts to go on clear down all other the whole abdomen. The application of ice to the loins and any part of the trunk tends in the same direction. These organs are the centers of the most intense action produced by putting cold applications upon the abdomen or breasts.

When the ice bag is put upon the hands, or any other part, it has somewhat the same effect. We had a case in which all this had been done. Cold had been put upon the breasts and upon the abdomen, but there was no effect. Dr. Dryden had the case down here on Barber Street, and I was called in to see the patient. The patient had been lying there all night, and when I got there there were six Sanitarium lady doctors there. It was a very bad case. The woman was a nurse, and her husband was a nurse also. The people had been here a long time and had a great many friends, and the woman was just then in a miserable state. It looked as though she might die. She had been in labor twenty-four hours. I was sent for early in the morning.

I had a tub filled with cold water at 60°, just as it came out of the pipe, and had the patient lifted out of the bed and set right down in that cold water, and the cold water splashed up all about the abdomen and the breasts, and the pains began right off quick. Things began to move right off, and the child was born. That is, it got started, so the head came down and could be engaged by the forceps. We brought it down, got the forceps on, and got it out, but there was a terrible tear of the perineum and cervix. We brought her up to the operating room, repaired everything, and packed everything with iodoform gauze. She would have died without those things being done.

When we get the knowledge we can put it into practice almost anywhere. We only have to have the knowledge, and the knowledge is simple. Truth is always simple. I just mention these circumstances so you will see the principle of cold applied to a small area on the chest to the abdomen itself, and the application of cold on the skin.

The prolonged application of cold to the lumbar region of the abdomen has the effect to contract the pelvic vessels.

Twenty-seven or twenty-eight years ago Dr. Lindsay came to me one day and said there was a girl down on Champion Street who was flowing so terribly, had such terrible hemorrhage she was afraid she would die. She was frightened. She had been flowing for two or three days, and Dr. Lindsay said "I have done everything in the world to stop it -- given alum douches and packs, and hot douches, and everything I could for it." Dr. Lindsay had done everything she knew how to do,-- had given her ergot, and still she flowed I went down and I said to myself, "Dr. Lindsay has done everything else, there is nothing else to do;" so I had a tub filled half full of water with ice in it -- as cold water as I could get. We lifted the girl out of bed -- a girl about fourteen years old, she had been flowing two or three days -- took her out of bed and put her right down in that cold water, and she stayed there for about ten minutes, and the flowing was stopped. Dr. Lindsay

said, "Why, do you dare do that? Cold at the menstrual period is such a dangerous thing!" It was not normal, it was pathological. She had been flowing two or three days, and that was long enough. That cold bath stopped the flow right away. She didn't have hemorrhage for some little time, but a year or two afterwards it came back again, and in the meantime we had learned about curetting. A Vienna surgeon, a great obstetrician, had described the use of curetting, had a curette made, and curettage had come to be performed, and we learned about it. The first instruments that were brought to this country were exhibited at a meeting of the American Medical Association. So we had her come up here, did curetting, and scraped out a whole hand full of vegetations, so she was relieved. But these vegetations had been there all the while, yet that cold bath relieved it and stopped the hemorrhage. I have thought a great many times what a wonderful proof that was of the efficiency of the cold bath.

So you see what prolonged cold will do. It stopped that thing when nothing else would do it. If I had such a case to deal with again I would not do that unless I had to, because, being a surgeon and used to operating, the first thing I would think of would be the cause, and the most certain thing would be to put the patient in the Sims's position, find the uterus, wash it out, and pack with iodoform gauze. The gauze put into the uterus would help to form a clot and stop the bleeding.

As you see, it proves the fact. It is important to have these proofs, because we have not the physiologic proofs. We have the experimental proof. Nobody has been able to examine the arterioles of the pelvic viscera at the same time that the cold application is being made outside. The clinical evidence is the principal evidence upon which we rely for these facts. They are inferences drawn from clinical observations, most of them. Some of them have been experimentally proven by observations upon rabbits vivisected and by observations made in special conditions of disease.

Dr. Bowditch when he was here, talking about hydrotherapy -- heard my talk to patients one time, and he said "What is the physiological proof of it? what is the laboratory proof?" Now I could not give the laboratory proof. But haven't we proved it in this case? Doesn't that prove it? That is clinical proof. We haven't laboratory proof. You know this thing does not rest on a theoretical basis. Some one has not gone to work and concocted up this stuff about hydrotherapy, or pulled it out of their own brains or out of their own stomachs, as the Hindoos say, but it rests on solid facts; and a thing is no value at all unless it does reat on facts. Here is a woman who gets her feet wet at the menstrual period. Does that necessarily produce profuse menstrual period? No. She gets her feet ~~xxxxx~~ wet, gets them warm again right away, and there is a reaction. Then there is no effect at all. But if she goes out, gets her feet wet, and takes a walk and sits down with shoes and feet wet, there is prolonged cold, you see. The feet are wet for half an hour or an hour, and this prolonged cold application would cause contraction of the vessel, spasm of the vessels, and that spasm makes suppression, and which may set in a train of morbid processes which will reach over into the next period and into the next one, and last for a long time. So the thing to be done right off is to antagonize them by a prolonged hot application first, followed by a short cold application . And so by several short applications a woman who has had her feet wet in that way ought afterwards to train the vessels into normal activity by short cold with reaction. A short application, rubbing and percussing the soles of the feet, or a short cold application with rubbing is the best way to antagonize the effects of that prolonged cold. Short cold will antidote long cold. So the hair of a dog cures the bite of the dog, and the little pill antidotes the big pill. This is a principle that seems to come in here to come degree.

Here is a man who has bladder trouble -- an old man, with retention of the urine. His bladder has got weak and he can not empty it. An old man told me this story: "I have discovered when I get up in the night I can relieve my bladder without any difficulty." I said, "What do you think is the cause of it?" He said, "I don't know, but I have noticed that when I step upon the cold tile floor of the bath room I am at once relieved." Now that was simply the stimulus of the cold to the soles of his feet. It was a short cold application which caused contraction of the bladder.

I am giving you these facts so you will remember them, because they will help you to fix the principles. These things have impressed my mind because at once when I met the incident I saw it was a demonstration, so they remained in my mind, and I would not forget them in a thousand years.

I operated upon a man who was suffering terribly with toxemia of the bladder, and when I operated on him I cut into the bladder from above and I found an enlarged prostate, as big as my thumb, about the shape of the thumb, projecting into the bladder in the opening of the urethra, so when the bladder contracted it shut right down upon the prostate. In addition to that there was stagnation of the urine in the bladder that had become constant. It was simply terrible the way he suffered. The next day after I removed the prostate and removed the stone I had to put in a small vaginal speculum, because there was so much blood,-- considerably larger than my thumb, an inch in diameter, packed with gauze and bound it down with a bandage; so there was that man with an excoriated bladder and this cylindrical speculum in the bladder packed full of gauze; and the bladder packed full of gause, and a bandage outside forcing it in. I called in to see him and I said "How are you?" He said, "Oh, Doctor, I feel so much more comfortable. I am so relieved. It is such a luxury, it is such a comfort to be able to wash my hands without straining my bladder." He said, "If water would touch my hands the bladder would begin to strain and I could

not relieve it at all." There is the proof of the reflex from the hands to the bladder. A short cold application to the hands excites the contraction of the bladder. The bladder was abnormally sensitive, so he felt it and appreciated it right away. It produced straining. So what happened to that man's pathological bladder happens to the physiologic bladder as well.

A short cold application to the hands excites uterine contraction, excites bladder contraction, excites contraction of the bowels to some degree. So you see how these short cold applications to the hands and feet through extensive vasomotor nerves and the reflexes set up in the centers, excites internally all these muscular organs, causing contractions there. If a man stays in cold water too long he is likely to have cramp, isn't he? If a man goes into cold water and gets too cold, he gets cramp. What is that? It is the same thing, you see. It is a reflex extending to the entire body, the involuntary muscular contraction, excessive increase of tone in all the muscles of the body, internally and externally.

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JUNIOR MEDICAL STUDENTS

Monday, October 15, 1906: 12 P.M.

By J.H. Kellogg, M.D.

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I was called one day to see a woman with hemorrhage of the lungs. The blood was pouring out of her mouth. She was gasping for breath, pleading for help, and the nurse stood beside her and was doing all she could. She applied cold cloths to the chest, and had given the patient some salt; had a turpentine inhaler, and yet the patient was simply pouring out mouthfuls of blood as fast as she could cough, and it looked as though she was certainly going to die right away. What was to be done? She had hot things to her feet, cold compresses to the chest, the nurse had given her some salt and had her sitting up in bed, but nothing had done any good. What else could be done? Her limbs were well wrapped so her feet were warm. Suppose she applied the hot blanket pack to the legs, including the hips and lower part of the abdomen. The first effect of heat is to excite the heart. I saw some ice there, and I seized a block of ice, and put one block in each hand, took another block of ice and rubbed her forearms with it, and the blood stopped instantly. She didn't cough or expectorate any more. She cleared out what was in her mouth and she stopped right away.

Your book tells you that cold applied to the hands contracts the vessels of the lungs. How do you know? There is proof of it. We did it, and it did it. If I had done that thing only it might not have been sufficient, but all other things had been done, and it needed just that additional help, you see. You need to bring all the forces to bear here, so if

a patient has got hemorrhage of the lungs, put cold on the chest. But this is not enough. An ice bag between the shoulders also aids in contracting the vessels of the lungs, but that may not be enough. Warm to the legs. That may not be enough. There is something more to do.

A friend of mine, who was not a doctor, called at a house and he found a doctor's wife who had consumption, and she was having hemorrhages of the lungs, had been having them for twenty-four hours,--not very profuse, but coughing and spitting up some blood every few minutes; and the doctor had heard that the water-cure was good, so, as he had tried medicines and they had all failed, he had put ice to her chest. Yet she was coughing more and expectorating more. My friend said, "How about her hands and feet?" He felt them, and they were as cold as ice. The feet and legs were cold, and the hands were cold, and of course there was an enormous increase of blood on the inside of the body. This gentleman got some hot water, and some hot bottles and had them placed at her feet and hands, got her wrapped up warm, and the bleeding ceased at once. Her life was saved, and she lived twenty years afterwards.

The body of the first patient I mentioned was warm. You see the blood was mechanically forced into the interior of the body by the contraction of the surface vessels. By getting the blood out of the surface vessels the patient is relieved. That was a case of profuse hemorrhage, as in the case I was speaking about. It was a similar hemorrhage and continuous, had been going on for twenty-four hours. She was very pale and very weak; could not have gone on very much longer. But she was relieved at once by getting her extremities warm. I think we have learned most of these reflex effects.

We had a man arrive here some two or three years ago from New York, who had been under the care of the leading surgeons there. He had a peculiar heart trouble. He was suddenly taken with a feeling of terrible oppression

in the region of the heart, and he had difficulty in breathing. His lips would become blue, and the circulation would seem to fail entirely. He had been here about a week when he had an attack, and the doctor -- I think it was Dr. Eggleston who had charge of him -- ordered a cold compress over his heart at once. The doctor told me that three hours afterwards he met this man coming down the stairs completely covered with smiles. The man was smiling and was as happy as he could be. Meeting the doctor, he said, "Doctor, this is simply wonderful! -- wonderful! Why, I am all right. When I have had these attacks before I have sent for a doctor and he gave me some medicines, and it took me three or four days to get over the medicines. I was always sick for three or four days, and generally confined to the house for a week; but here I am, and I am all right; and only three hours ago I had as bad an attack as I ever had in my life. And now I am all right, -- and nothing but a wet rag on me. Just think of it!" Three weeks afterward this man came into the office, and he said, "Doctor, I want to tell you something. This is the most wonderful institution -- I have learned the most wonderful things here of any place I ever saw." He said, "I was out walking this morning, out on Manchester Street, and I had one of those attacks come on -- the second attack I have had since I came here, and I have been here three weeks now, and this attack came on and it was very sharp. I thought, What am I going to do now? I thought of that wet rag of yours, and I thought if I only had that I would be all right. But I stepped up to a walk and sat down on a porch. While I was sitting there with my elbows on my knees and my head in my hands, wishing I had a wet rag, the lady of the house came out, and she said, 'Can I do something for you?' I said, Just give me a towel with one end of it wet in cold water. So she sent and got a towel and wet one end of it in cold water and gave it to me. Then I unbuttoned my collar and shirt and put the towel down inside my shirt, and in fifteen minutes I was all right, and I walked back." He said,

"Now just think of that!" That man made the application you see. That cold water applied to his heart, in contact with his skin, set the heart to going reflexly. There is no chance for any reconstruction.

Now what a wonderful thing that is. Suppose the doctor had given that man some medicine of some kind, some strychnia. In order for that strychnia to have any influence whatever upon the heart it must influence every other organ of the body,--every nerve in the body, every nervecenter of the body; the entire body must be brought under the influence of that toxic strychnia. We do not want any part of the body but the heart to be affected. The heart is the only thing you want to influence. When you make this cold application over the heart the cutaneous nerves the cold comes in contact with have a direct relation with the cardiac centers, with the heart through the vasomotor centers -- all the spine and cardiac centers are in direct relation with the heart, and so you get the effect right where you want it. He said it took him several days to recover from the effect of the medicines. Like the Irishman, who said he didn't like a certain doctor's medicine, because when he took it it took him so long to recover after he got well. So this man observed that it took him a long time to get well. After he got over his heart trouble there was something else the matter with him. See what an absurd method it is to treat the whole body in order to reach one single point. The patent medicine vender recommends his particular cough medicine because it has a special predilection. Somebody would say to him, "How can that medicine do the lungs any good when it goes right straight to the stomach?" He said, "That is just the advantage of my medicine. There are two ways to the stomach,--one straight down, and the other a side track through the lungs. My medicine goes in here and passes through the lungs, so reaches the lungs first and benefits the lungs."
Of course the patent medicine vender always has some theory. When you make applications of hydrotherapy, you aim straight for the mark, and you are able

to hit it.

These illustrations are not extraordinary ones, but simply the things that happen here every day all the time. Every patient coming here and getting an application, if it is a rightly prepared prescription, nails it on the head,-- something is accomplished by it. It is simply delightful to see the results. It is so common place here we do not think what it really is. We do not think what a wonderful thing it is. We forget about it. I have just been up to the surgical ward to see a patient I operated on yesterday -- a gall bladder case, and the temperature is 98.4 this morning, pulse is 60, and everything going all right. The patient had a comfortable night's rest last night,--took a very small dose of a narcotic. She had been taking narcotics right along to relieve her pain, so she had a small dose last night, but it would have been better if she had not had any at all. The treatment relieved her. Hot applications to the feet and limbs diverted the blood in that direction. We know that a hot application has the effect to inhibit the pain, lessen the pain, for heat kills pain, so there is not very much use for a narcotic. The father, Dr. Maddin, is just delighted with the way the thing is going on. That is what we expect in hydrotherapy with the physiologic method. We expect greater things to be done, and we see greater things done than can possibly be done by the old and dying drug system. It is a new thing come into the world, and the old things are passing away, and it is important now for a generation of doctors to go forward who understand the new methods, who understand the thing, know the whole thing, know it thoroughly, just as the drug doctor, the professor of materia medica knows his drugs -- knows all about them. Now then we must have men who do that thing. As yet we have not got them. There are not ten men in the United States who understand hydrotherapy. I doubt if there are twenty men in the whole world who know this thing thoroughly as they ought to know it. The people are satisfied with a little smattering. They see

the thing done, and they say "Now I can do it just that way." They know sitz baths are good for something, they know foot baths are good for something, they know fomentations are good for something.

There was a man here yesterday who wanted to sell us Fango. Fango is Italian mud from certain lakes in Italy, and this man wants to sell us the mud to use for rheumatism, and he wants to sell it to us for ten cents a pound,-- 7 1/2 cents a pound in New York, but it will cost us ten cents a pound to get it here. He guarantees that this Fango will cure rheumatism. It is put around the joints, plastered on the patient, then the patient wrapped up in blankets, and kept there for half an hour or so, then it is washed off. I told him I didn't think we needed it, that it was only the heat that did the work. He said "That is true. It is the heat that does it. But this mud holds the heat longer than hot cloths do. Why," he said, "a compress of mud put on won't lose two degrees in three hours." I said, "How does it heat the body then, if it loses no heat? If it does not lose any heat it does not give any heat off, and the body won't receive any." "Well," he said, "I can't explain that. You will have to ask our doctor. I am only a business man. You will have to ask the doctor to explain that." You see how many things are being talked about the country, and people are being gulled. Their institute is being started in different cities to import this volcanic mud all the way from Italy to apply heat with. We have just as good mud at home, and just as good heat at home. It is the heat that does it, and some people are finding that out.

I got a letter from Mr. Gould, a business man of New York, some time ago. He had been recommending a friend to come here who was going to Mt. Clements. The gentleman said "I have been thinking of going to Mt. Clements, but it is a very uninteresting place, and really I am satisfied it is the heat that does the business anyway, and if you get the heat it does not make any difference where you get it."

Now that is what we know, and that is the advantage of knowing scientific principles. You will not be led off by Fango or by mineral waters, or anything else. You will get hold of the foundation principles, and then you can utilize them anywhere.

Down in New Zealand they get hot baths by simply heating some stones in a fire, rake off the embers, then cover these stones with green leaves, then put the patient on top of these green leaves, then cover him over with a mat; and that is a good enough vapor bath for anybody, just as good as you can get. They put those hot stones under green leaves, and the water is evaporated and that makes the steam; they cover the patient with a mat, and there you have the whole thing. It is the heat that does it. It is not the green leaves or the stones, but it is the heat. Heat and cold are the powers, the forces that work in hydrotherapy. They are the chief things, so we learn how to make those applications, how to use them, and we have this powerful agency right at hand.

You will have the question asked you one of these days -- What are the different ways in which the circulation of the head can be controlled? What are the different ways in which the circulation of the lungs can be controlled? What are the different ways to control uterine circulation, pelvic circulation? What are the different ways in which you can stimulate contraction of the internal viscera? What are the different ways in which you can excite the heart? These are a few of the questions that will come along to you pretty soon, and if you study these reflex effects carefully you will have all that in mind.

What effect does cold have on the blood? In the first place it promotes the formation of blood and increases the blood count. How does it increase the blood count? An application of cold which is immediately followed by reaction increases the blood count by bringing into the circulation a large number of blood cells which are in hiding. The liver is a very

vascular organ. The portal circulation stirs up a great amount of blood; that is, it is capable of stirring up a great amount of blood. The portal circulation will contain all the blood in the body. When a cold application is made to the surface of the body the first effect of that is to cause contraction of the entire splancnic area. All the vessels of the splancnic area contract. Does the portal vein have any muscles, any muscular walls? That is the point in which the portal vein differs from the other veins of the body. They have muscular walls. The portal system is a wonderful mechanism. By these muscular walls the portal system becomes the regulator of the whole circulation of the whole body. It is the balance of the circulation. But we will study that further at another time.

When a cold application is made to the surface of the body the first effect of that is to contract all those portal vessels and shut them right up like a sponge, and that squeezes the blood out of the liver and out of the spleen, and out of the whole splancnic area, and forces the blood into the circulation, so that the blood count is increased. That is where the blood is in hiding. It is in a state of stasis. This cold application, as we have already learned, -- the first effect of the cold application to the surface of the body is what? It contracts all the blood vessels in the body. The cold application to the skin contracts every blood vessel in the body. Where does the blood go to then? It goes into the veins that have no contractile wall. The veins are capable of holding twice as much as the arteries. So this is the reflex effect, you see. It is a vasoconstrictor effect, and it affects only those vessels which are controlled by the vasoconstrictor nerves, and they are the small arteries and the portal veins, and splancnic nerves. So there is plenty of room for the blood in the veins that haven't any contractile walls. When this short application is made in this way the first thing is to start the blood out of the splancnic nerves, the portal veins, the peripheral arteries, and the small vessels. That

immediately puts a whole lot of blood into the circulation and gives the blood a great force forward, a great push, and the splancnic vessels being contracted, that forces this blood out into the systemic circulation, so you will find more in the skin.

But you say, "Why is the proportion any greater?" Here is a patient who is very fat. That patient is nearly always anemic. The blood count is very low. Why? Because the blood is spread out over a greater area. That is the reason why the blood count is low. The very same principle applies here. When the blood is forced out into the portal circulation the blood-pressure is increased in the peripheral vessels, and the serous part of the blood, the lymph, is forced out into the tissues, leaving behind a larger proportion of blood cells. That is my theory of it at any rate, so it is a very important thing.

So a short application of cold followed by reaction -- if it is not followed by reaction then it has no such effect at all, it does not produce any such effect, because the superficial vessels are contracted you see, and this effect has not taken place. The peripheral circulation had not been opened up to let this new supply of blood in, so the internal reaction has occurred and the external reaction has not occurred. The superficial vessels are still contracted, while the internal vessels have been dilated, and the blood count is not increased. If a reaction does not occur, the superficial vessels remain contracted while the internal vessels are relaxed, so the blood does not enter into the general circulation, and the blood count is not increased.

<u>The Effect of Cold Upon the Blood Vessels</u>: The effect of cold upon the blood vessels is to increase the blood count. If this is applied day after day it does something more than simply force the blood into the general circulation. It stimulates hematogenesis -- increases the entire volume of blood in the body. That comes from repeated applications day

after day. It also increases the amount of oxygen in the blood. And the third thing it does is to increase the alkalinity of the blood. By increasing the oxidation it burns up acid wastes of the blood, so diminishes the acidity of the blood, and so increases alkalinity. It burns up the acid wastes which are present in the blood, --uric acid and other acid wastes and improperly oxidized proteid substances in the blood which diminish alkalinity. If these waste substances are perfectly oxidized, and burned up completely, the alkalinity of the blood is increased.

What is the proof of increased alkalinity? The uric acid is extracted from the blood. If the acid of the urine is high, the alkalinity of the blood is low. If the acid of the urine is low, the alkalinity of the blood is high. That is the way we know. It is not by qualitative test, it is a quantitative test. We must know the total amount of acid in the urine for twenty-four hours; that is the thing we must go by. If that is low, then we know the alkalinity of the blood is high. It is the total acidity for the entire twenty-four hours. That is the thing we measure by. So we have increased blood count, increased blood production, increased alkalinity, increased oxygen, and increased oxidation.

One thing more, I think is not mentioned in the books, but is mentioned in the new chapter, which was not known until a short time ago. Experiments made at Johns Hopkins University shows that the application of the general cold bath produces an increase in the viscosity of the blood. It is important to know that, because it has an influence upon blood-pressure.

Then we have five things: Increased blood count, increased blood production, increased oxygen, increased alkalinity, and increased viscosity.

Leucocytes are increased more than the red cells, so it produces leucocytosis. We might put that down as another thing. So we have six things.

Why it is that in diabetes we always have such high acidity of urine? It is because of diminished oxidation; because diminished oxidation is the cause of diabetes. There is diminished oxidation of sugar, and diminished oxidation of proteid. There is an increased oxidation of proteid, but there is also an increased breaking down, an increased amount of urea. More proteid is being oxidized in the body than there should be. There is a great waste of proteid. But the oxidation is not perfect. There is a breaking down, so there is being thrown into the blood constantly a great quantity of imperfectly oxidized proteid substances. Then cold applications will most assuredly be the thing in that case.

What is the effect of cold upon metabolism, upon assimilation, and absorption in general? It increases absorption from the intestime and absorption from the skin also. There is practically no absorption from the skin except in a tub in a bath. Put the patient into a bath, and there is no absorption, or very little, unless the temperature is below that of the body. In the cold bath there is absorption. In the hot bath there is elimination. There is an inward tide when the bath is below the temperature of the body, and an outward tide when the temperature is above the temperature of the body.

A French physician made some experiments a few years ago to show that.

What is the effect of a cold application upon the functional activity of the organs? What is the effect upon functional activity of a general cold application? It increases functional activity. Suppose you make a cold application over the liver, or some other individual part, it increases visceral activity. But a general cold application, in order to produce

general visceral activity, must be very short. If it is long it creates too much heat,-- exhausts the body too much, so that it becomes depressing. It must be very short and very cold in order to give the highest tonic effects. But for local stimulating effects it can be somewhat more prolonged. That is, if we make a very short general cold application it will excite the heart very considerably, but afterwards it will be slowed, because you get a tremendous effect and apply it to the whole surface of the body. But when you make a local application to get the same effect the application must be somewhat more prolonged, so we leave an ice bag over the heart for fifteen or twenty minutes.

Suppose we want to excite gastric activity. Here is a patient who has no appetite. What do we do? Rub a little piece of ice over the stomach, or put an ice bag over the stomach. A common prescription for a patient who has no appetite is an ice bag over the stomach for fifteen minutes before dinner. But you do not want to learn that by routine, and do it because Dr. Kellogg or some other doctor prescribes it, but you must know the reason for it. That ice bag over the stomach for fifteen minutes increases visceral activity. It excites the glands of the stomach, and makes those glands ready for work. Percutient short cold, or longer non-percutient applications would be good. Percutient short cold would be very good. The douche over the stomach is a very excellent thing to produce appetite, but it is such a powerful remedy that it must be used with great care. A severe douche to the stomach is something very few people can stand. In the Life of Priessnitz you will find a picture of Priessnitz treating a drunken man. He found a man by the roadside dead drunk. He got a pitcher full of water, stood up high, and poured a stream of water on the man's stomach. And in the picture you can see the man unloading his liquor or his beer. In another case you see a picture of great big syringes, vaginal syringes, and he was forcing a strong stream of water against the patient's stomach. That produces emesis.

It produces the same muscular effect that a cold application to the lower abdomen produces in the bladder.

What is the effect of a short very cold application upon metabolism, upon tissue activity in general? It promotes it. Then there are three things cold will do. It promotes absorption, and that facilitates nutrition, encourages appetite and assimilation. Then it promotes the general metabolic activity by which food is used up after it has been absorbed, and it promotes visceral activity in a general way, stimulates vital activity of all the organs of the body, as well as the general assimilation, and may be used to specially stimulate the activity of an internal part by using a somewhat more prolonged application.

See what a wonderful thing that is. When you know you have got that power at your command you can control the functional activity of every single organ in the body. Is there any medicine that will do that? Can you give a man a drug at any time that will cause his liver to act especially, that will cause his muscles to increase their activity especially? Can you give a man anything that will cause his spleen to be particularly active, or any other part? You can make an application over the liver that will affect the liver and no other part at all. You can make an application over the spleen that will affect the spleen and no other part. Is there any drug you coubd get that will affect one organ and leave all the other organs without any effect? It is utterly impossible. Here is a man whose brain is so active he can not sleep. You say, "Well, I will give him a sleeping medicine," and you give him some opium to put him to sleep. The opium puts his brain to sleep, and it paralyzes all the other organs. It benumbs every function in the body. But you can apply a hot application to a man's feet, get the blood into his legs, relieve his head of blood, and the brain is relieved physiologically, you see, so the man sleeps. That is the difference between the wrong way and the right way.

I am going to keep up these exhortations all the way through my class, because I don't want any of you to go out of this school and backslide into the old drugopath method, which the world is getting sick of. The world's stomach is turning at the polypharmacy that is being forced down to the stomach during these last years. They simply can not stand it. The stomach revolts. But there is something better, and you are getting something better. I want you to see the difference. So many folks think there is not so very much difference.

Water is a very handy thing sometimes, and sometimes it is not very convenient. Before us are these other remedies that we can use. Every dose of medicine you are giving to a man is a lie. You are fooling him, cheating him, swindling him, you are lying to him; you are saying "This thing will help you" when you know it won't. You are making a grafter of yourself, and I want this class to go out from this school straightforward, honest, physiologic physicians who understand principles. Here are these other principles, just as beautiful, delightful, as anything can be, because they are harmonious, physiologic, rational, true, and genuine, and you know it.

What is the effect of cold on the heat-making functions, upon heat production of temperature and heat elimination? The short cold application increases heat production, and the long cold application depresses it.

What is the effect of a cold application to the body in general on temperature? It lowers temperature. A cold application to the skin lowers the temperature of the skin. What does it do to the body? The effect of cold is to lower the temperature of the skin and of the body. That is the general effect of cold. Do you know any other way you can do it beside a general cold application? A cold douche to the soles of the feet will lower body temperature slightly. So you see if you have got a difficult case to deal with, and you can not make a general cold application, you can make a cold application to the feet. It is necessary to know some of

these things.

What is the effect of a cold application to the head? It lowers temperature.

What is the effect of prolonged cold application to the heart? It also lowers temperature.

So there are four ways in which you can lower temperature: Applications to the skin -- the whole skin or part of it; applications to the soles of the feet; applications to the head; applications to the heart. But it needs to be a prolonged application to the heart. Suppose we have here a stove with some coal in it. Cold air makes the fire burn brightly. It stimulates the fire, and you say "Cold weather is coming." The coals are brighter in cold weather than in hot weather. At the same time cold will cool off the stove. That fire in that stove is just like heat production going on in the body. In cold weather the fire burns brighter, but the air in the room is colder with the same fire. When there is a temperature of 100° outdoors the fire does not burn so bright, but if you keep the temperature of the room this high in the wintertime the cold air makes the fire burn brighter, but the temperature of the room is lower than in the summer time, because the cold air carries off heat, you see.

Now it is just the question of the mode of application. It is like burning two fires all the time. It is like something being done, and the opposite, and by regulating these two things, by balancing them, this thing becomes very versatile. Cold air itself increases heat production, but at the same time it lowers temperature.

We will discuss conditions under which temperature is lowered. A short application of cold increases heat production. A prolonged application of cold lowers heat production. So we have four ways of lessening the body temperature,-- the general application to the skin, the application to the soles of the feet, application to the head, and an application to the heart in the form of an ice bag. These must be long applications.

Those applications do lower temperature, but they must be long applications, because a short application has the effect to reflexly set in operation the heat-producing forces of the body, and so increase heat production and raise the temperature. If you take the temperature of a man who has just had a short cold spray you will find it very slightly raised. It comes up a little bit. Why? Because the blood is beneath the skin. The skin vessels are shut up, so that elimination has diminished, so the temperature rises for a few seconds, and reaction occurs. The blood goes back to the skin. The skin vessels are open, heat elimination is increased. Evaporation of water carries off moisture, so the temperature falls quickly below the normal, and gradually works back, and the oscillation brings it a little above, but it comes down again. Sometimes there are two or three oscillations after general cold, as the body is elastic and it acts and reacts, so the thing is not mechanical at all.

Now there is another fact to be learned, and it is that there is a compensatory rise. Put your elbow in a cold bath and see what effect that will have on the temperature of the axilla. Put one hand in cold water, and that will raise the temperature of the other hand. That is a compensatory rise. It is a reflex effect observed first by Brown-Sequard.

There are interesting things to study on all these points. When you make a long cold application to the head, how does it lower temperature? It does it by lessening the activity of the thermogenic centers. It is the depressing effect of the long cold. A long cold application is a depressant, so it depresses, lessens the activity of the thermogenic centers; lessens the amount of blood in the head, and so has the effect to diminish the activity of the blood, has the effect to diminish the activity of the nuclein in the blood, lessens the activity of the thermogenic centers.

How will a prolonged application of cold over the heart lower the temperature? By depressing the circulation and perhaps to some degree lowering the temperature of the blood.

How does a general cold application lower the temperature of the body? By removing heat and cooling the blood. When the blood is cool it stimulates the thermogenic centers, because the blood is cooled and the thermogenic centers are stimulated to increased heat production. When the blood temperature is cooled, the more it is cooled the more the thermogenic centers are stimulated, and it does something else also. It cools the thermogenic tissues. Where are the thermogenic tissues? In the muscles, and the cooler xxx the blood flowing through these thermogenic tissues the greater the lessening of the activity right there, because the direct effect of cold is depressing. What would be the effect of cold applied on the thermogenic tissues, then? It is a depressant. It puts out the fire, puts water on the fire. So you see while at one end, in the thermogenic center, it is stimulating the centers to increased activity, stimulating the fires of the body, the cooled blood goes around and lowers the temperature. When you build a fire on the hearth you have to put a blower up, because too much air comes in there. You must cut it down to a small intake of air--just the proper amount to supply the fire. Then it will burn. Too much air will put your fire out, so it cools it down; it raises the temperature to the point where intense combustion can take place. The same thing is true of the body. The cooled blood lessens heat production, and the warmed blood increases heat production. But the effect on a nerve center is just the opposite. But the great volume of blood flowing through the tissues cooling them off has a greater effect, greater reflexing stimulus, has a result of the defensive effort of the blood coming in contact with the nerves. The direct effect and the reflex effect are always just the opposite.

v--m 11-14'06

JUNIOR MEDICAL STUDENTS

Tuesday, October 16, 1906: 12 P.M.

By J.H. Kellogg, M.D.

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The effects of hot applications are both similar and dissimilar to those of cold applications. Hot applications can be made in such a way as to produce nearly all the effects of cold applications, but in lesser degree. And the same is true of cold applications. But there are some effects of heat which are specific and which can not be produced to any extent at all by cold applications.

First we will consider the general effects of hot applications. The primary effect of a general hot application is excitant. A cold application is depressant, but produces a tonic reaction. The hot application is excitant, but produces an atonic reaction. So you see we have these two things -- contrary effects.

A short hot application is inside excitant. Here is a patient who can not stand a cold application, and we ought to produce tonic effects. You can use very hot and very short applications, instead of very cold and very short applications, and those very short very hot applications have almost identically the same effects that very cold very short applications have, and will be tolerated by the man who can not take a very cold application.

Here is a poor neuritic, neuralgic, neurotic, nervous old man, or an old lady -- emaciated, neurotic, neuralgic, senile; -- two pictures. That is just the sort of picture you get very often in chronic patients who have been suffering from chronic autointoxication. I just saw an old lady sixty years old, brown as leather, bent over with an asthmatic cough, ballooned abdomen, dilated colon, all the marks of autointoxication, and had had the trouble for years and years and years. It seems as though it is impossible for a person to live in such a state. Give that old lady a cold bath and it would almost kill her. She could not react at all. She would be so shocked by it, so distressed she would not take another treatment, so we would lose the patient even though she did not die. That sort of treatment would almost kill such a patient. That is the kind of patient for hot treatment. Very mild cold applications, like wet hand rubs and mitten frictions, can be used in these cases.

I am just introducing you to the idea so you will see the importance of this principle. Short hot applications are tonic, excitant. All hydriatic applications which are tonic are excitant. An excitant application is tonic because it is excitant. It excites the bodily functions and nerve centers of the bodily functions through the nerve centers.

Do you know anything more about the general effects of hot applications? What is the effect on the skin of a general hot application? The general effect upon the skin is to dilate the vessels of the skin, and that produces a revulsive effect upon the whole body, so that the general effect is revulsive to the skin. It diverts the blood from the interior to the surface, so it produces that general effect upon the body as a whole.

What is the effect of the prolonged hot application?

Prolonged hot applications are exhausting. We tried that experiment on a man in the bath room some time ago -- a large, strong, thoroughly healthy man. We took his strength test, found it to be somewhere about seven thousand pounds. We put him in a bath, kept him there for half an hour -- in a real hot bath, as hot as he could stand it; kept him there for thirty minutes. At the end of that time he was so weak it took two men to hold him up when they took him out of the bath. He stumbled about, and it required a man on each side of him to support him. We marched him up to the dynamometer and took his test again, and it was only half what it was before he took the bath. In thirty minutes he had lost half his strength; so you see how exhausting it was. We took him right off and gave him a cold shower bath for a couple of minutes, then took him back to the dynamometer, and he lifted more than he did in the first place. He was stronger than he was before he had the bath. So you see this effect is a nervous effect entirely. The prolonged bath produces depression by inhibition, you see. It simply lessens the power of the body to put out its energy, to exert its energy. The energy was all in the body, because we took him back and gave him a cold bath and he was stronger than he was in the first place. So it didn't deprive the man of energy, it only deprived him of the power to put forth his energy. It lessened the excitability of the nerve centers. At the same time there are certain excitant effects mixed with these exhaustive effects. The skin is always excited. The man keeps on sweating as long as he is in the hot bath. So it excites the skin. It excites other functions, two, as we will see later.

Did you ever hear of goose-flesh produced by heat? Yes, goose-flesh is produced by very hot spray. When the spray is very hot is produces a very similar impression to the effect produced by cold. It contracts the

vessels of the muscles of the skin, and so produces goose-flesh. It sometimes produces a slight shivering. The same effect would be produced if you go right into a cold bath. Put the arm in very hot water and you see goose-flesh produced on the arm just the same as in the hot spray. It could not be due to cold air, because it is an immersion bath. A very hot fomentation produces the same effect. That, however, is only the first effect. It paralyzes the white fiberous tissue and contracts the involuntary muscles of the skin. A very sudden short hot application applied to the skin produces pallor from contraction of the blood vessels, followed by reddening. The effect of a long application of heat to the skin dilates the vessels, and is followed by contraction of the vessels. There is a contraction due to evaporation of moisture from the skin backward, which is generally followed by contraction afterward of the vessel.

Heat increases perspiration and cutaneous respiration. There is a little respiration in the skin -- one-fiftieth of the total respiration of the body. That is 2 per cent. The skin respires more than the lung does - more than an equal amount of lung surface. The skin activity has a respiratory activity greater than that of equal amount of lung surface. How much skin surface is there? The skin surface is about twenty square feet. The activity of the skin in respiration is one fiftieth that of the lungs. Multiply that by fifty and see how big it would be. There are two thousand square feet of lung surface, so a square foot of skin has twice the respiratory activity of a square foot of lung, according to the data which is given us. I believe the figures are correct. It is worth while to know that. So we must keep the skin clean, keep it active. There is no doubt that the patients are more or less benefited by the increased activity of the skin, especially when the lung is crippled. When the lungs' activity from a weakness of the heart is cut off by a half or a quarter, it is an important thing to keep this factor in operation. Suppose in a case of pneumonia,

for instance, the lung activity has been reduced to 25 per cent of the normal. That would be only 25 out of 100, and the skin can double its activity. It is estimated 2 per cent. Suppose you can double that by proper applications and make it 4 per cent instead. That 4 per cent added to 25 per cent makes quite an addition. That is a factor that it is important to remember -- that respiratory activity of the skin is valuable.

The skin has blood vessels that are in close contact with the air, and air works through, oxygen works into the blood vessels. Wherever the skin is exposed to the air, this change is taking place. The alimentary canal works in the same way.

Some twenty years ago I made some experiments upon guinea-pigs. I opened the abdomen of a guinea-pig and injected some oxygen into the colon. I saw the portal veins becoming red. At first it was easy to distinguish the alternation of the veins by the color, but in a very few minutes afterward after the oxygen was introduced into the rectum I could distinguish the veins from the arteries. The portal blood became red as well as the arterial blood from the absorption of oxygen through the intestine. I published a paper on oxygen, and I notice now it has been taken up and utilized in insane asylums and various other places, but I was myself disappointed in the results of it. I have not got through with it yet. I shall make some further experiments upon it.

Hot applications to the skin increase heat elimination, first by dilating the vessels, that brings more blood to the surface; second, the vessels being opened, more blood passes through the surface -- all the vessels are open; third, by evaporation; fourth, by increasing the conductivity of the skin, ~~thus having~~ which dilates the vessels, and that brings more blood into the skin, and more blood being brought into the skin increases the area of exposure to the external air. In the second place it brings more blood to the skin because the vessels are open, so that the blood can move

rapidly through the skin. Third, it produces evaporation. Evaporation is an important factor in elimination.

How much heat is carried off by the evaporation of a pound of water? How many heat units are rendered latent by the evaporation of a pound of water? I think we ought to go right back to the beginning of this book and go through it in order to get our physics. -- A thousand heat units, or 1960 perhaps. It depends upon the original temperature of water. It is practically a thousand. It is so near that you can call it a thousand. It may be even more than a thousand. It may be less -- 950 to 1000. Call it 1000 heat units. If the perspiration is increased from an ounce in half an hour to three pounds an hour, that would be considerable. Itmay be increased even to 3 1/2 pounds an hour when a person perspires very freely.
And at such a rate of increase how much heat would be carried off from the body? That would be 3000 heat units. Suppose a person weighed 100 pounds, how much would the temperature be reduced? If there were 3000 heat units carried away, how much would that reduce the temperature? If the evaporation is increased to such a degree as to carry off 3000 heat units, how much would that reduce the patient's temperature if he weighed 100 pounds? -- 3000 divided by 100 equals -- that is, 3000 heat units taken away from the whole body would be equivalent to 30 taken away from each pound. The heat unit corresponds one degree for each pound -- a British thermal unit. So 3000 units would amount to 30 degrees for 100 pounds. Three thousand heat units to be furnished by 100 pounds would mean that each pound would have to furnish 30 heat units.

Would it be safe to reduce the patient's temperature that much? Do you believe it does? If the patient is made to sweat three pounds, does that reduce his temperature 30 degrees? Some heat is being generated at the same time. At what rate is heat generated in the body? that is, about how many heat units a minute? -- 7.2 heat units a minute. Then how many would that be in twenty-four hours? What is the total output of

of the body? From 2500 to 3000. Divide that by the number of minutes in the day, and it will tell you how many calories are lost in a minute. Divite 2500 by 24, that gives us practically 100 calories per hour. Divide 100 by 60, and that gives us practically 1.8. And that is the exact amount to put down -- 1.8 calories. But when it comes to the British thermal unit, how much would that be? How many degrees F. are there in one degree S ?- 1.8. How many pounds avoirdupois in a kilogram? -- 2.2. Multiply these things together and you will get 3.96, which is practically 4. So you see there are four British thermal units in a calory. If you multiply 18 by 4, what does that give you? It gives you 7.2. Call it 7. Seven heat units in a minute. How many in an hour? That would be 420. Here is three pounds or three thousand lost, and 420 gained. If a man weighed 100 poundw 420 units would be how much to the pound? -4.2 . Four degrees. And we figured out the loss of 3000 calories would reduce the temperature 30 degrees. Take off 4 degrees from that, and that would leave us 26. So his heat production would not help him out much at that rate. What is the explanation of that? The prespiration does not evaporize. It runs off, falls down on the floor. I was reading a story in a New York paper a day or two ago written by a Mr. Louis Prang. He sent me a copy of a Boston paper giving an account of his experience with Priessnitz. He took treatment under Priessnitz seventy years ago, and eight years ago he was a patient at Grafenberg, and he tells how they gave him a pack,--wrapped him up in it, gave him a wet sheet pack on a feather bed, then put another feather bed over him, and put a tub under his bed to catch the perspiration, because they kept him there from morning until 11 o'clock,--from 5 o'clock in the morning until 10 o'clock, and had a tub under his bed catching the perspiration. It ran down into the tub,--didn't evaporate, you see. He was not chilled by it. So you see there is only a small amount of the perspiration which is actually vaporized.

v--m 11-14'06

JUNIOR MEDICAL STUDENTS

Thursday, October 18, 1906: 12 P.M.

By J.H. Kellogg, M.D.

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We want to get clearly in our minds, if we can, the physiologic effects of cold applications and hot applications, remembering that these are facts, -- they are observed facts, and are the foundation stone of practical hydrotherapy.

Yesterday we were considering the effects of heat upon the skin. We found that heat contracts the elastic tissue and relaxes white fiberous tissue. Heat contracts the smooth muscles and produces goose flesh. Short sudden applications and very hot applications contract the blood vessels, producing pallor, which is quickly followed by congestion; and a long application of heat dilates the vessels, followed by contraction later.

Increased perspiration and increased respiration: If a man sweats say three pounds in an hour, what effect is that going to have on his temperature? It will lower his temperature. About how much? Seven heat units a minute. A hundred pound person will produce heat enough to raise the temperature 4.3 degrees. Then in sweating three pounds, a sweating bath increases the perspiration to that extent that there would be water enough to lower the temperature 30 degrees, or rather 26 degrees. How is that accounted for? The water is not all evaporized, but considerable of it is. I think a man can evaporate from the surface of his body at least a pound an hour. Experiments I have made lead me to believe that -- that a man can evaporate a pound of water from the skin in an hour. That would lower the temperature about how much? Three pounds would lower the temperature of the body 30 degrees in a hundred pound man. One pound would lower it 10 degrees.

We found the body would produce 4.3. How much then would a man's temperature be lowered? -- The difference between 4 1/2 and 10, or about 5 1/2 degrees. Do we actually get that effect? No we do not. Why not? There is some heat communicated to the body by the hot bath itself. The sweating is to antagonize that extra heat that is being communicated. Heat applied to the skin has an effect upon the tactile sensibility. At 98° how about the tactile sensibility? It is increased. What is the effect of 113°? At a temperature of 98° cutaneous sensibility is increased. At 113° it is decreased. At 130° it is abolished. Heat applied to the skin decreases cutaneous sensibility.

I met a case of this kind, a case of extreme urticaria covering the whole arm. My prescription was a very light spray of hot water, as hot as possible. The effect of that was simply magical. The pain, itching, and burning all disappeared in less than two minutes. It was gone. And the beauty about this is that this method will relieve it for a long time, and it is a remedy you can repeat a thousand times and the last time the effect is just as good as it was the first time. That is the beauty of physiologic remedies -- it works just as well the thousandth time as the first time. Cold is just as good a stimulant the thousandth time as the first time. Heat is just as good an anodyne the thousandth time as it was the first time. That is not true of opium. You have to increase the dose. But you do not have to increase the dose of heat. When you give strychnia you have to increase the dose of it. There is a slight tolerance to heat, but it is only slight. There is a slight tolerance to cold, but it is only slight, a matter of a few degrees. Cutaneous sensibility is diminished, but not at all temperatures: 98° increases it. So you see a warm compress may increase pain -- put on a hot fomentation and let it get cool and the patient's pain will be increased, so the cutaneous sensibility will be increased. The fomentation gets down to about the temperature of the body,

then the patient gets very irritable and nervous, because the cutaneous sensibility is increased. So the nurse sometimes makes that mistake, and the patient is worse instead of better. But at 113° it is about as hot as you can stand it in an immersion bath. But you can stand it for a very short time in 130. So that is the reason why when you have to relieve pain you apply fomentations just as hot as the patient can bear. Put it on and take it off, and put it on again and take it off. That is why the skilled nurse can relieve pain and the unskilled nurse can not. That is just the difference. That is why you get benefit from putting on a dry flannel and putting on a hot fomentation over a dry flannel, so the heat will gradually increase and increase. Now we have a method better than the fomentation cloth,--the electric thermaphore, because we put on a moist cloth, put a thermaphore on over it, turn on the current, and the heat gradually increases more and more, and the temperature rises steadily instead of going the other way. There is a steady increase instead of steady decrease. So the thermaphore is better than the fomentation, but by careful management the fomentation can be made to gradually increase in temperature by means of a dry flannel put on next to the skin before applying the fomentation.

We first employed that method about twenty-five years ago. Before that time I do not know that it had ever been used. I adopted it for that reason. By this method the skin has a chance to acquire tolerance, so the heat is gradually raised and the patient can endure it better.

Now there is one thing more about the skin. A hot application to the skin increases heat elimination by dilating the vessels. It increases the amount of blood passing through the skin by evaporation, and so increases conductivity. A skin filled with blood is a better conductor than a skin that is heated. That is the reason why when cold is applied the skin contracts and is rendered a better non-conductor. It saves the heat,

retains the heat in the body, and when the heat is applied you wish to promote the escape of heat, because the greatest danger is from an accumulation of heat within the body. That is the first danger. When heat is applied to the skin of the body the power of the body to eliminate heat is destroyed. Put a person in a hot bath, can his body eliminate heat? If the temperature of that bath is above the temperature of the body, can the body eliminate heat? The body is shut in by the bath, and surrounded by a medium hotter than the body itself, so the body is immediately put in peril. There is a fire burning in the body. The production of heat is going on all the time at the rate of 7 heat units a minute. Suppose you put a patient in a bath at 102°, which is approximately the temperature inside of the body. The body is making heat at the rate of seven heat units a minute. We keep the patient in that bath for fifteen minutes. How many heat units would that be? One hundred and five. Say the patient weighs 105 pounds. How much will his temperature rise? Keep the patient weighing 105 pounds in a bath tub with water at a temperature of 102°, what ought the patient's temperature to be at the end of that time? It ought to be increased a little over 1°. It would be one degree if the patient weighed just 105 pounds, because you see we have 105 heat units and 105 pounds -- one unit for each pound. With one hundred people and one hundred cents, how many can they have apiece? So there are 105 heat units and 105 pounds. So the patient's temperature at the end of fifteen minutes ought to be increased one degree. The normal temperature is 98.4, so the temperature would be 99.4 at the end of fifteen minutes. The temperature of water is 102°. That is about the inside temperature of the body. The patient can not throw off any heat. The heat will be retained. The body is giving off some heat to the water, but the temperature of the water is a little more than the outside of the body, so I think probably they would just about even up. There would not be very much difference. It might be worth

while to try the experiment. When you get a chance take a hot bath and take your temperature. Of course the temperature is not influenced by the bath at first. Take your temperature at the end of fifteen minutes and you will find it has risen just about that much, because there is an actual increase of heat. If you remain in the bath very long the rate of increase will be much greater than that, as we shall see a little farther on.

One thing more a hot bath does to the skin. It prepares the skin for the application of cold water. It prepares the skin to receive an application of cold water.

So there are eight things a hot application does to the skin. It contracts the little elastic fiber that relaxes the white fibers. A short sudden hot application produces pallor of the skin, produces contraction followed by relaxation. A prolonged application produces stasis, followed later by contraction. It increases prespiration and respiration. It increases tactile sensibility at 98°, it diminishes it at 113°, and abolishes it at 130°. It increases heat elimination, and finally prepares the skin for the application of cold.

What does the hot application do to the respiration? In breathing moist warm air the respiration is facilitated. The rate of respiration is quickened and the respiration seems easier. In cold dry air the opposite effect is produced. Respiration is hindered, and one is inclined to cough. After a hot application the depth of respiration is diminished and the rate of respiration is increased. The patient breathes more slowly and not so deeply after a hot application. Remember that. In respiring air at a temperature below 40°, and above 60° or 70° CO_2 is increased. The amount of CO_2 in inspired air above 40 and below 60 or 70 is increased. Ninety-two degrees is the neutral point for water. Sixty degrees is the neutral point for air -- that is, in respired air when the body is protected with the patient in bed. It is important to remember that thing. It has an

important bearing upon the treatment of fever cases.

So there are four things to remember about respiration: Moist warm air facibiiates respiration and quickens the respiratory movement; cold air hinders respiration. By applications of heat the rate of respiration is diminished, slowed, and more superficial. That is very different from cold. Cold has the opposite effect. Cold applications make deeper respiration, while the hot leaves the patient with more superficial respiration; so if you have a patient who is not breathing well you want to look out about making too long applications of heat to his chest. I have found many patients that have been half smothered to death by fomentations over the heart. The patient has pain. Well, the doctor applies heat, because heat kills pain. The patient says "I have so much trouble breathing. I can not understand it. It seems to me I can not breathe." That is a very common thing, and you will observe it very often, and you want to know this physiologic effect of heat. Lastly, breathing air below 40°or above 60°or 70°the amount of CO_2 is increased You will find the reason for that a little further on.

<u>The effect of heat upon the circulation:</u> A short application of heat quickens; especially a sudden percutient application of heat, like a douch or a spray; a short application quickens the heart then slows it. A hot or warm percutient application raises blood-pressure. A very hot bath always raises blood-pressure. A very hot immersion bath, or a very hot pelvic pack, or very hot applications of any sort, will always raise blood-pressure. A warm percutient application will raise blood-pressure. On the other hand, a warm immersion bath lowers blood-pressure. It is important to know that. A warm douche will raise blood-pressure, whereas the warm bath lowers blood-pressure. That is just the difference between the immersion bath and the percutient application.

A very short, very hot application is tonic -- excites the brain and general nerve centers. A prolonged hot application is exhaustive,

depressant. The secondard effects of heat are depressant. A very hot prolonged application is toxic. That is the way to explain the effect of sunstroke. It seems to develop certain toxins in the body rapidly so that the patient passes off into coma. Prolonged very hot applications produce nervousness and exhaustion.

A very hot application inhibits pain. That is the great thing we use heat for. Heat lessens nervous sensibility. We have found that hot applications to the skin lessen cutaneous sensibility. A hot application through the thermic nerves lessens sensibility throughout the body. It inhibits pain acting through the thermic nerves and lessens the activity of the nerve centers. That is a very important thing to know -- that that is one of the specific properties of heat. Heat kills pain. I like to remember it that way -- heat kills pain. Here is a man who is in pain. Put on something hot. Heat kills pain, antagonizes pain, just as opium does. You say, How? I don't know anything about it. Nobody can tell how opium relieves pain or why. It is its peculiar property. You hear a great loud barking outdoors. You say That is a dog. How do you know it is a dog? Because a dog barks. How does the dog bark? why does he bark? -- It is the characteristic of the dog. So it is the specific property of heat to inhibit pain and kill pain. And it does it, not simply by drawing the blood to the surface, but because it produces an inhibitory effect and lessens the nervous sensibility. It is a most wonderful thing that while heat is stimulating it at the same time inhibits pain. It is an excitant, a stimulant, but at the same time it inhibits pain. But it is chiefly the reflex effect of heat which is inhibitory. The direct effect of heat when the temperature is up to the very highest point is to increase pain, increase sensibility, because it is an excitant, and when you get up to 130°, while it relieves cutaneous sensibility it produces actual pain. You touch a thing with a temperature of 130° and it produces pain. Suppose you pick up something with a temperature of 200° or 300° -- can you tell whether it is hot or cold?

No, you can not tell. If you have ever tasted an ax on a frosty morning outdoors you know something about that. Some of you have probably had that experience. At such a temperature you can not tell whether a thing is hot or cold, because the normal sensibilities are reversed. You may think it is hot or cold either one. These are very important facts in relation to the nervous system and worth while to remember.

A very short hot application is tonic, excitant. So if you have a patient who can not bear cold baths you can give him tonic effects with hot applications. But they must be very hot and very short. Prolonged hot applications are always exhausting, irritating. They produce insomnia, general disturbance and derangement. So you must be awfully careful if you are giving patients warm baths at night to see that they are not given in such a way as to produce insomnia. Many a man can not sleep at night because he does not know that. The neutral point is 92° to 96°. Give a patient a bath at 100° and he won't sleep perhaps. The ordinary person can take a warm bath and go to bed and sleep, but not the neurasthenic, whose brain is over-irritated, over-excited. The average person can counteract or antidote it, his body can readjust itself.

What is the effect of heat upon the blood? That is an exceedingly interesting story. First, it diminishes the blood count. Cold increases the blood count. Second, it diminishes leucocytes. Cold increases leucocytes. Third, diminishes alkalinity. Cold increases alkalinity. How does it diminish alkalinity? Fourth, it diminishes viscosity. You say things are "slow as molasses in January." Cold has the effect to increase viscosity and heat diminishes viscosity. Warm the molasses jug and the molasses will run out. A hot bath raises the temperature of the blood and diminishes viscosity. Heat diminishes hematogenesis, so blood cells are not manufactured in such large number. There are five things in which the effects are just the opposite of those of cold.

Heat followed by cold increases blood count, but increases the white

more than the red.

Absorption: A sweating bath increases absorption from the intestinal canal. We found out that cold applications will do it. Why? By increasing the circulation in the skin, that promotes evaporation afterwards there is less in the skin. But a sweating bath will do it four times as well. The sweating bath does it with ten-fold more vigor than a cold bath. So if you want to get the very best effects, give the patient a sweating bath, and follow it up with a cold bath. The sweating bath acts only while it is being applied, but the cold bath leaves its effects to remain for a long time afterwards. So, if you want to get durable effects -- Suppose you have a patient whose assimilation and appetite are poor. Give him a hot sweating bath and a cold bath after it. The cold bath prolongs the effects of the sweating bath. If you know that fact, that the hot bath will promote absorption from the alimentary canal, and does it while it is being done, while the application is being made, and the cold bath fixes the blood in the skin permanently, increases the activity of the skin, and so prolongs the effect of the hot bath. So the effect of the cold bath in the end, the same general effect of the cold bath may even be greater than that of the hot bath.

Suppose we give a man a hot bath. Make him sweat half a pound, 6-8 ~~&~~ ounces. That would promote absorption from the alimentary canal to that extent. It promotes the movement toward the anterior. The cold bath afterwards doubles a thousand rate the insensible perspiration. A thousand rate to an ounce of insensible perspiration is an ounce and a half an hour,--say an ounce and a half, and it doubles that rate, so it would be three ounces. Then the cold bath would have the greater effect. Probably that effect would not continue the whole twenty-four hours, but you can count upon it that that bath does as much good as a hot bath in the way of promoting absorption, because the effect lasts a long time, while the effect of the hot bath

lasts only during the hot bath. The effect of the cold bath lasts just as long as the effect produced by the reaction of the cold bath continues.

Here comes an old dyspeptic with a dry scurvy skin, with sallow yellow looks. His skin looks like leather--wrinkled, inactive. It is like a horse whose hair is ridden and is hide-bound. That is the situation of the chronic dyspeptic suffering from chronic autointoxication. See what sweating and cold baths will do to that man. His skin is almost dead. The great emunctory organ has become almost entirely inactive, and the hot baths and cold baths, and rubbing the skin causes it to become renovated, almost rejuvinated, and it makes a new man of him. That is one of the things we see in our patients here at the Sanitarium. When a man is getting better we see his skin has improved. He is getting a better color, getting the glow of health in his skin. That is the thing that Priessnitz recognized. He saw that he should always examine the skin of his patients. He made a diagnosis by the condition of the skin, and made a prognosis by the effects of the cold bath upon the skin. If he got a good reaction he knew that man was able to react to the treatment and it would help him.

The hot bath promotes absorption. The second thing is that a short hot application excites metabolism. A short hot bath excites general metabolism. A sweating bath excites glandular activity. Short percutient applications diminish glandular activity. Prolonged local hot applications increase local glandular activity. Put a hot bag over a man's stomach when he has hypopepsia for two or three hours after his meal, and it helps to digest his dinner. But very short hot percutient applications have another and different effect.

v--m 11-15'06