it really did for our patients, since it seemed to me that rather extravagant claims had been made for it. The effect desired was chiefly stimulating or tonic, and great care has been used to secure a good reaction; that is, a permanent return of blood to the surface vessels after cold applications. The problem has been to adapt the temperature of the water, the pressure under which it is delivered, and the time of its application to the strength of the individual so that this reaction may be as perfect as possible. Patients differ in regard to their ability to respond, and there is also a variation in the same person at different times; even healthy people should use caution in taking these baths when they are tired. The neurasthenic, if the bath is too vigorous, complains of exhaustion, which seems to contradict the claim that these baths increase the capacity for work. To determine whether this is so, a series of experiments has been conducted with the use of the ergograph with practically negative results. We could not obtain fatigue curves showing the great increase in work done after the bath that has been recorded by others. Observations on the pulse rate, respiration and temperature during the various stages of an ordinary bath show that they all vary directly with the temperature to which the individual is subjected; while the blood pressure varies inversely with the temperature, — hot applications lower it, cold applications raise it. The sudden fall of blood pressure is no doubt the reason why some people faint while in the hot air cabinet.

Considerable importance has been attached to the fact that some observers have found a large increase of red and white cells in the blood after various hydriatic procedures. We have been unable to confirm this, and, in my opinion, any increase of cells in the surface vessels after cold baths is purely a local phenomenon, and a disadvantage if long continued.

Theoretically, cold applications to the entire surface of the body at once should cause a flushing of the internal organs and an increased activity. Observations have been made by Dr. Otto Folin in our laboratory to determine whether such baths as we give really cause any increase in destructive metabolism of the body, with practically negative results.

The wet pack has been found extremely useful in cases of exhalation or excitement for its soothing and even hypnotic effects.

While I have been unable to confirm many claims made for hydrotherapeutics, there are, in my opinion, many and sufficient reasons for its use.

Dr. R. T. Edes of Reading: There have been several points in these papers which have interested me very much, and I am glad that they were read together, as Dr. Millet shows that a very efficient use of this highly important agent can be made without complicated and expensive apparatus.

Dr. Pratt's paper, in its very thorough treatment, gave one the idea, although he did not exactly say so, that hydrotherapy is quite a recent introduction in Germany and that it was introduced into this country by Dr. Baruch.

In a report on "Therapeutics" for the *Boston Medical and Surgical Journal*, 1872, I quoted from German authorities statistics on the subject, and in 1875 I read to this society a paper based on my experience of three years at the Boston City Hospital on the "Treatment of Typhoid by Cold Baths." This was published in the *Boston Medical and Surgical Journal* and in the Second Series of the City Hospital Reports.

Of course, the subject is growing and developing. Much elaborate apparatus has been devised and the scope of its application much extended. Probably

it is more scientifically understood but it is not absolutely new here.

Dr. Pratt: Certainly, as Dr. Edes says, the use of water in the treatment of disease is no new thing. Probably no therapeutic method is of greater antiquity. I regret that I failed to make it clear that I was dealing only with the development of scientific hydrotherapy. Baths as a curative agent were highly valued by Hippocrates. Galen considered cold water most important in fever, as did Celsus, Avicenna and Rhazes. But the origin of hydrotherapy on a physiological basis dates from the work of Winternitz in the third quarter of the last century.

Over a hundred years ago the distinguished New York physicians, Samuel Bard and David Hosack, following the teachings of Gregory of Edinburgh and Currie of Liverpool, used cold sponging in the treatment of fever. Somewhat later Nathan Smith of Yale College employed with success cold water in typhoid fever. But the influence of these men soon ceased to be felt, and water as a curative agent was forgotten, and hence this period has but slight historic interest and played no part in the development of the hydrotherapy of to-day.

It is certainly not generally known that the modern cold water treatment of typhoid fever, developed in Germany by Brand, Ziemssen, Jürgensen and others, was introduced into America by Dr. Edes. I shall take pleasure in giving him deserved credit in my published address.

THE PRACTICAL APPLICATION OF HYDROTHERAPEUTIC MEASURES.*

BY CHARLES S. MILLET, M.D., BROCKTON.

It will be my purpose, in the short time that I shall detain you, not to discuss *all* the hydrotherapeutic procedures, but only those with which I have had a personal experience. These procedures, like so many other things in medicine, are at first perplexing and seem well-nigh impossible in private practice; but if they are analyzed a little, and one begins to use them, he will soon find that their application is as simple as it is effective.

The skin contains far more nerves, blood vessels and glands than any other organ; in fact, so numerous are the blood vessels that it is said that they will hold half of all the blood in the body. Its function is to convey impressions to the brain and other nerve centers, to carry off waste products, and to regulate body heat. In other words, it is the organ of sensation, the next most important sense to that of sight. It is a powerful excretory organ, sifting out from the blood carbonic acid gas, various other products of metabolism, and water, in which enormous quantities of pathogenic bacteria have been found.

The heat of the body is produced by the combustion of non-nitrogenous substances, chiefly in the muscles, and it is given off by perspiration and radiation from the cutaneous surface.

Hydrotherapy, then, has to do with sensation, excretion and heat radiation, and if we could only keep these facts in our minds when applying this sovereign remedy, the application would be

* Read before The Massachusetts Medical Society, June 8, 1904.

much easier; it would be oftener made; and the results would be more satisfactory.

Of course, in endeavoring to influence any one of these three functions it is impossible not to affect the others to a greater or less degree; but at the same time, it is not at all difficult to so use water as to vary these impressions and cause the one most desired to become prominent.

Furthermore, by applying water to the skin at various degrees of temperature and in various ways, we can, through reflex action, produce decided effects upon the mind, the central nervous system, and all the internal organs.

Let us first consider the treatment of fever, which is largely, if not wholly, due to diminished heat radiation; there is nothing that will produce quite so much perturbation in the average medical mind as an excessively high temperature. The personal experience of any man who has been twenty years in practice must have carried him through a disappointing period with so-called antipyretics, — the principal one used being acetanilide, I fancy. I well remember a case of typhoid fever, in which the temperature reached 105° before the end of the first week, that I treated with large doses of this drug, some fifteen years ago. The medical magazines at that time were teeming with articles, telling of the efficacy of these coal-tar preparations.

Convinced by the brilliancy of the results claimed, I proceeded to give it on alternate days, and in liberal doses. The effect upon the temperature was as marvelous as it was temporary; but the resulting anemia and peculiar lividity were most distressing. And when Dr. Fitz, whom I called in consultation, wondered at it, I must confess I did not dare to tell him how heroically I had dosed the young woman, — for I had not forgotten his method of showing us our mistakes in the classroom, and I feared he might use it here, the cause was so just.

The reign of drugs in the treatment of fever was, as you all know, very short, and we soon began to hear of Brand and the remarkable results which he had obtained by the use of cold baths in typhoid; and while the idea has been very generally accepted, and its great value acknowledged, yet I firmly believe that his method of using water is so often modified that it would be very hard for the originator to recognize it. The so-called "typhoid bath" of to-day usually consists of sponging with cold water; and while this is quite sufficient when the temperature is not over 104°, any rise above that is not properly treated unless the tub, with friction while in the water, is used. On the other hand, it is to be remembered that reduction of temperature is by no means the main object in view, yet the strengthening of the heart and the calming of the nervous system are not obtained without a gradual fall in this respect.

In any given case, the use of water must be in the nature of an experiment, but failure to produce marked signs of improvement must not deter one from persisting; but rather should cause deep thinking, lest a measure far more

productive of good than drugs shall be neglected. Take, for example, a case of scarlet fever which I once saw, — a strong, rugged girl of sixteen, so large and well developed that she looked twenty; there were other cases in the family, so that when she was taken sick it seemed very probable that it must be the same disease; the trained nurse had just taken her temperature when I went in, but said nothing. Placing my hand upon the patient, I found the skin quite cool and said that I did not consider her very ill, whereupon the nurse showed me her thermometer, which had registered 106°; and then when I counted her pulse, I found it to be 140. The extremely high temperature so startled me that I neglected to consider the other symptoms and cold sponging was ordered; the next day exactly the same condition was found, — the skin was cool, but the temperature and pulse were very high, and again the same mistake was made, the belief that the temperature must be reduced being paramount; and a more persistent application of cold baths was insisted upon. And so, on a third day there was found to be no change. It then dawned upon me that something else must be done if that girl was to live, and the nurse was told to wrap her up in a hot, wet sheet, — or in other words, to give her a hot pack.

The result was so remarkable as not to be forgotten; the eruption, which had been delayed, almost immediately appeared, and the pulse and temperature rapidly fell to not much above 100. The explanation is, apparently, that the blood vessels in the skin were so irritated by the poison of the disease as to be in a state of tonic contraction, so that the application of cold had no effect upon them.

Spencer says that *science* is nothing but common sense, systematically and thoroughly applied. Therefore, one can use a little here, and be guided by the condition of the patient, in determining whether the water should be hot or cold; its application long or short, and with or without force. If the pulse is high in tension and full in volume and the skin hot, a cold bath will produce better results, even though the patient cries out against it. I have seen a boy of five scream frightfully for ten minutes, every four hours, for days when the nurse gave him a cold bath, then dropping off to sleep almost immediately, his temperature and pulse being perceptibly improved thereby, in spite of his fright.

If it is true that the heat of the body depends upon and is regulated by the action of the skin, and is kept at a normal degree by the automatic working of this organ, and if it is true that an abnormal rise is in every case due to an impairment of this action, then certainly in hydrotherapy we have a method with which we can at will influence enormously one of the most important functions of the body.

To reduce fever, three kinds of baths are used: that with a sponge, the water containing perhaps alcohol or soda; the cold bath, either in a tub, or in bed with a rubber sheet; and the warm bath, gradually reduced. The question is, of

course, what shall determine our choice; to which the answer is,—*Experiment*; it does not matter which, so long as a good reaction is obtained. Long before any damage can be done to the patient, his own senses or the observation of his nurse, no matter how inexperienced, will give the desired information.

The sponge bath will do for febrile conditions not severe enough to cause any anxiety, and which will evidently be of short duration. But any infectious fever which is at all severe, is certainly poorly treated if a full tub bath, or a bath in bed, with lots of water and friction, is not employed. In order to obtain the confidence of the relatives, it is well to begin with a bath of 100°, and run it down to 90 in about ten minutes; the head should be wrapped about with a cold, wet towel, or the patient will be liable to faint. This is an excellent bath to give a child who has bronchitis, pneumonia, measles, or any other acute infection; and if it is not effective in producing sleep, the temperature of the water should be reduced two or three degrees every three or four hours. If no bath tub is available, an ordinary wash boiler or wash tub is a good substitute. But in a severe case of acute febrile disease in an adult,—of which typhoid fever might be called the type,—it will be necessary to use cold water, which is again mentioned in order to emphasize the point that unless friction is used with it, there is liable to be little or no reaction. The term “reaction” is so often heard in connection with hydriatics that a definition of it might not be out of place; a perfect physiological reaction takes place when the blood, having been driven out of the surface, is caused to return with redoubled energy. In other words, the restoration of heat after heat abstraction is the one thing essential. If the blood is not in the cutaneous vessels to begin with, it is necessary to first apply heat; if one realizes that the nerve filaments which convey the sense of cold act like lightning, while those which carry the heat sense act more slowly, it is very easy to understand why it is so often necessary to apply the latter for the long period; and why, when warmth is alone used, the reaction appears only after a time. Often this is desirable,—say, when one wishes to produce sleep and does not care to arouse the nervous system. But sometimes it is impossible to produce rest and quiet without stimulating the nerves. Such a condition is present in melancholia or acute mania, which it has been my good fortune to see greatly helped by means of bathing. Here the patient should be set in hot water, and a pailful of cold should be quickly and forcibly thrown over the shoulders. It is truly marvelous the way an extremely restless patient will quiet down and go to sleep after such rigorous treatment. Such cases, too, almost always refuse to take medicine; and if they do not, the hypnotics are ineffective except in lethal doses. *It is neither difficult nor dangerous to give baths.*

The hot wet-pack is relied upon by most physicians in eclampsia, and in fact whenever

the kidneys are blocked or diseased. But the result obtained is not so much due to vicarious action, as it is to the withdrawal of blood from the internal organs. If used continuously,—I mean day after day,—in chronic Bright's disease, it is better to supplement the heat with a short, quick, cold affusion, and rubbing.

The water poultice is very beneficial in pneumonia, and in all acute pulmonary affections. This is made of three layers of old linen, which are wrung out of cold water and wrapped around the chest, and then dry flannel is placed outside of that. This should be wet as often as it gets warm.

Chlorosis, secondary anemia, chronic, pulmonary and organic heart diseases have all been decidedly benefited by systematic bathing. In these it is advisable to first produce warmth to the point of perspiration,—either with a hot air cabinet, or, better, by a sun bath,—and then to give the patient a warm shower, and to follow that with cold water through the hose. If possible, perambulatory cases would better be treated at a place where medical baths are given,—for a limited time, at least,—after which, if necessary, the treatment can be continued at home. If the physician would go with his patient and see him take a bath in the institution which Dr. Putnam and others have so generously placed at our disposal, he would very quickly discover that there is something in hydrotherapeutics other than charlatanism.

The local application of heat and cold acts on the part treated in a similar manner as the full bath does on the whole body. If a joint or muscle is very hot, apply ice; but if the disease is of a subacute nature, and the circulation and function impaired, first apply heat, and then cold, perhaps with gentle friction. Ice is too often used to need more than a passing word. It is certainly the best substitute for opium, but should not be used constantly, because it will finally cause paralysis of the vaso-dilators. I do not think it is applied over the precordia with the frequency that it should be; placed here, its effect is exactly like digitalis; and the beauty of it is, that it acts with great rapidity; that it has no cumulative action, and that it does not disturb the stomach. In cases of collapse or shock, it is as important to put an ice bag over the heart as it is to apply heat to the extremities; and how often is it done? Ice over the epigastrium will greatly relieve the thirst which follows abdominal operations.

As I said in the beginning, my remarks have been in the nature of a personal experience; and with an apology for the crudeness and cursory way in which I have treated the subject, I will close,—adding an urgent solicitation that you will give a remedy which is as powerful as it is harmless, the confidence which it deserves. Certainly, the skin, by which we are in close communication with the central nervous system, the heart, and in fact all the internal organs, should never be neglected; and half-hearted care and attention are worse than absolute neglect, because they deceive the physician himself.