ON HYDROTHERAPEUTICS.

SUMMARY.—History of Hydrotherapy—Priessnitz—Physiological Action of Cold—Reaction—Action of Hydrotherapy—Action on the Nervous System—Action on the Circulation—Action on Nutrition—Mode of Application of Cold Water—Douches—Pressure of the Water—Temperature of the Water—Alternating Douches—Duration of the Douche—Sudation before the Douche—Immersions—Affusions—Applications of Ice—Pulverizations of Ether.

Gentlemen:—Applied from the earliest antiquity to the treatment of certain affections, cold water did not take its proper place among the resources of our profession till almost the very epoch in which we live. It was as a result of the efforts of a simple peasant, a kind of country quack, and not till after his empirical employment of the remedy, that scientific labors were undertaken to explain the effects, and to determine the indications of cold water applications.[1]

At Graefenburg, a village of Austrian Silesia, lived, at the commencement of this century, a certain Priessnitz, a very observing and intelligent man, who had noted the beneficial effects of cold water treatment on sick animals confided to his care.

Imagining that diseases impregnate a man as liquids do when they penetrate a sponge, he maintained that in order to cure them it sufficed to remove morbid impurities from the cutaneous surface by repeated bathings and the promotion of the excretory function of the skin. He therefore applied cold water to the treatment of the greater part of diseases, and modified successively the divers procedures of hydrotherapy which he put in practice. At first he

[1] Hippocrates, in his treatise on "Air, Waters and Places," insists on the use of cold water in the treatment of diseases. The Romans made great account of hydrotherapy, and a certain Charmis maintained that all diseases were curable by cold water alone. Celsus, Aretæus, Cœlius Aurelianus, all pronounced in favor of cold water medication, and recommended treating fevers by this means. Then it fell into desuetude till the seventeenth century.

In 1638 Louis Septala recommended cold douches; then a Belgian, Hermann Van der Heyden, employed them in all diseases, and Foyes, an Englishman, advocated hydrotherapy with great enthusiasm.

In 1712 appeared a dissertation by Frederic Hoffman, having for title, *De aqua medicina universali*, and showing the marvelous success which attends the therapeutic use of cold water; the system of treatment advocated spread rapidly in Germany.

In Great Britain, Wright, Gregory (of Edinburgh), and especially Currie, all of whom attempted a physiological explanation of the action of cold water, gave a powerful impulse toward the employment of this method.

In Italy, Giannini, Vallisnieri, Cocchi became partisans of hydrotherapy. [This was about the middle of the last century.] Pomme, who wrote in 1765, was about the only French exponent of the new method. Then comes the era of Priessnitz, who, early in this century, gave so great an impetus to the water treatment, and stimulated scientific inquiry, the results of which are seen in the numerous and able physiological treatises whose authors are mentioned in the text.

employed sweatings followed by cold affusions, then advised wrapping the patient in a wet sheet, and, finally, cold baths. He obtained by this mode of treatment marvelous cures, which spread his fame far and wide.

Soon were seen flocking from all parts of Europe sick people seeking remedial aid from the healer of Graefenburg, and the village hovels disappeared to make way for numerous hotels, which soon became insufficient, so great was the number of patients, which kept increasing every day. Moved by this success, the Austrian government shortly appointed a commission which gave officially to Priessnitz the direction of the "hydropathic" establishment, which he had founded, and a few years after the institutor of hydrotherapeutics died crowned with fortune and with glory.

Such is the curious beginning of modern hydrotherapy, which, it will be seen, owed its popularity to the most gross empiricism. More recently the labors of Scoutteten, of Schedel, of Fleury, of Beni Barde, in France; of Chiapponi, in Italy; of Johnson, and of Manby Gully, in England; of Bell and Nicanor Rojas, in America; of Roser, of Lersch, of Pleniger, in Germany, have given a strictly scientific and medical character to the study of hydrotherapeutics, and it is from their contributions that I shall draw material for the several considerations into which I now enter.

PHYSIOLOGICAL ACTION OF COLD.

Numerous investigations have been made the last few years into the physiological action of cold, and of cold water in particular. I shall refer more especially to the valuable study of Winternitz.[1]

Whenever you apply a cold substance, such as ice or cold water, to any part of the body you determine perturbations in the nervous system, affecting the cerebro-spinal axis, and especially the great sympathetic. These phenomena are variable as the application of the refrigerant is of greater or less duration; if the chilling be of short duration, the tactile sensibility is at first augmented; if it be prolonged, all the modes of cutaneous sensibility disappear; a fact which has been utilized in the production of local anæsthesia for minor surgical operations. If, finally, you cease the refrigeration, the sensibility appears anew with a certain degree of hyperæsthesia.[2]

[1] Winternitz, Die Hydrotherapie auf Physiologischer und klinische Grundlage, Vienna, 1877.

[2] Cold raises, lowers, or abolishes the excitability of the sensory nerves, and Richardson has shown the modifications, varying according to the duration of the refrigeration. When the temperature of the skin is a little below 35° C. vascularization becomes more active, and sensibility more exquisite. When the integument is cooled still more, sensibility undergoes diminution, and at eight degrees below zero it is abolished altogether, to reappear as the temperature returns to the normal.

These modifications of temperature have been noted by Winternitz, and with the æsthesiometer of Sieveking by Helmholtz, by the determination of the quickness of our sensory impressions. From 36° C. to 38° C. this velocity is seventy-two meters a second; with lowering of the temperature it becomes ten times less.

These same modifications of sensibility are produced when the cooling body is applied to the trunk of a nerve of sensation, and these applications produce first hyperæsthesia, then

But the most profound modification, and that which effects the most happy results, from the stand-point of therapeutics, is the perturbation occasioned in the vaso-motors. Under the influence of reflex action,[3] following cold water applications, the capillaries are seen to become constricted, the peripheral heat to diminish, the cutaneous secretion to cease, the skin to become pale, the muscular elements to contract, giving rise to the phenomenon known as *goose skin;*[4] at the same time the heart's pulsations diminish, the arterial tension augments, as Delmas, of Bordeaux, has shown, and the patient experiences a general chill.

All these symptoms disappear with a rapidity proportioned to the duration of the exposure to the action of the cold. To this period succeeds another assemblage of symptoms to which has been given the name of reaction, a reaction which is characterized by manifestations of an opposite kind. The skin becomes red, animal heat is raised, the secretions augment, the muscular functions acquire a new energy, and a quite special sensation of *bien être* is experienced. It is in this double action of the nervous system that we must seek an explanation of the effects of hydrotherapy, whether considered as an antipyretic, a nerve tonic, or simply as a means of hygiene.

I will leave at one side for the present the antipyretic effects of cold water, to which I shall return when I shall speak of the treatment of fever by cold baths, and I shall at the present time limit myself to the effort to set clearly before you the results which may be obtained in nervous diseases from the double physiological action above mentioned.

ACTION ON THE NERVOUS SYSTEM.

In order that the functions of the nervous system may be accomplished in a regular manner, there must be not only complete integrity of all the constituent parts of that system, but it must receive a uniform and sufficient supply of normal arterial blood. When one of these conditions is at fault immediately

a period of complete anæsthesia. The experiments of Waller, of Rosenthal, of Eulenburg, of Weir Mitchell, etc., are very instructive and convincing. (Richardson, "Action of Extreme Cold on the Nervous System," Medical Times, vol ii., 1825. Winternitz, op. cit. Waller, On the Symptoms produced by the Application of Cold to the Sciatic Nerve. (Arch. Gén. de Méd., 5th series, vol. xx., p. 346, 1862.) Eulenburg, Lehrbruch der Functionnellen Nervenkrankheiten, Berlin, 1871. Weir Mitchell, Injuries of Nerves and their Consequences, Philadelphia, 1872.)

[3] Edwards, Brown-Séquard and Tholozan, and Vulpian have shown that when the hand is plunged into cold water the temperature of the other hand is lowered or elevated. Brown-Séquard has, moreover, remarked that the reflex phenomena determined by the local application of cold to the skin are produced in a point symmetrical to that where the local application was made. Dumontpallier has quite recently insisted upon the study of the localization of the æsthesiogenous points of the skin. (Edwards, De l'influence des agents physiques sur la vie, Paris, 1824. Brown-Séquard and Tholozan, Recherches experimentales sur quelques uns des effets du froid; Arch. Gén. de Méd., 5th series, vol. xii., p. 683, 1858. Dumontpallier, Leçons sur les actions reflexes; Un. Med., 1880.)

[4] Samkowy has noted the following effects on the unstriped muscles of frogs subjected to intense cold. During life these muscles contract, but after death they are not influenced by cold; a contrary result has, however, been observed in mammals.

modifications, more or less profound, in the nervous system result. This first fact being posited, we may immediately deduce consequences of the most positive kind from the stand-point of hydrotherapy, which acts on the nervous system, on the circulation, and on the nutrition.

On the nervous system by the sudden perturbation which it causes in the functioning of the sensory and motor nerve apparatus, hydrotherapy reëstablishes the regular operation of the cerebro-spinal axis; it, moreover, brings into exercise the vaso-motor centres, and thus produces an equilibrium between the functions of the brain and cord on the one hand, and the great sympathetic on the other. Moreover, it attenuates the exclusive action of certain local affections, which, by reason of reflex influences, become the point of departure of important secondary perturbations of the brain and spinal cord.

By its action on the circulation, which it regulates and renders active, hydrotherapy still further modifies in a happy manner the functions of the nervous system. Finally, by its general effects on nutrition,[1] by its direct or indirect action on the vaso-constrictors and vaso-dilators, on the secretory nerves, and lastly on the trophic nerves, cold water stimulates nutrition, promotes the regular play of the different organs, and becomes one of the most active agents of tonic and reconstituent medication. Under its influence the globules become richer in hæmoglobin, the oxygenation of the blood more active, and we ought to make a capital point of this fact in the treatment of nervous diseases.

Such is the veritable effect of hydrotherapeutics in nervous affections. I know that there has been much discussion as to whether the action of cold water were sedative, excitant, or perturbing. Some, with Trousseau, have pretended that cold water is the best of sedatives; others, as Fleury, have affirmed its excitant action; others, with Bloch, its perturbing action. These are, I opine, trivial questions, for according as you consider the effects of cold water during its application, or after its application, you observe opposite symptoms, and that it may be at one time perturbing, at another exciting or sedative.

MODES OF APPLICATION.

It is not enough to know the physiological or therapeutical effects of cold water, you must understand the conditions to be fulfilled in order to obtain the most favorable effects. I am, then, going to enter somewhat into details which I believe are of importance, for I have seen physicians prescribe hydrotherapy without insisting either on the mode of application, or on the duration of the douche, or on the temperature of the water. It is necessary, on the contrary, that you should carefully determine all these points in your directions, and that you should not leave, as is often done, to persons who are strangers to the healing art the management of the hydrotherapeutic treatment.

[1] Kund has experimented on the influence of cold in cases of poisoning by strychnia. Frogs poisoned by this medicament, he placed, some in water at 34° C., others in very cold water. The muscles of the former very speedily returned to their state of physiological relaxation, those of the latter, exposed to a low temperature, kept their tetanoid state a long time. The same experiments have been repeated in cats with like results. (Kund, Gaz. Med., 1857.)

The means of application of cold water are numerous; these may be arranged in three distinct groups: In the one the water is delivered under high pressure, in the second there is no pressure, in the third the applications are made to the naked body by means of cloths or sponges. I shall then speak of three modes of application—douches, baths, and lotions.

DOUCHES.

Douches are by far the most employed. They are divided into a number of varieties, which depend on the apparatus by which they are administered. Thus we have the *douche en pluie*, or shower bath; the *douche à colonne*, in which a column of water is let fall upon the body; the *douche à lame concentrique*, in which three or more concentric streams are directed on some portion of the body surface; the *douche en nappe*, in which the water comes in sheets; the *douche en cercle*, in which a circle of jets plays upon the patient; the *douche en jet mobile*, in which a varying direction is given to the jets. I need not occupy much of your time with a consideration of these douches; you are familiar with them all. In the shower bath the douche is applied by means of a large globe sprinkler (*pomme d'arrosoir*); in the *douche à colonne* the water descends with some force by a circular opening; in the third variety the globe sprinkler, instead of being pierced with a multitude of holes, has several circular chinks through which the water pours; in the *douche en nappe* the watering globe has the form of a bell; in the *jet mobile* a tube of leather or caoutchouc enables one to give a varying direction to the stream. The most used of these douches are the *douche en pluie* and the *mobile jet* douche.

In general, the stronger the pressure of the water, the less painful the sensation of cold. At the same time care is needed in the management of the pressure, which, when too violent, produces painful traumatisms. In the shower bath the douche strikes more especially the upper part of the body, and you ought to avoid, save in exceptional cases, douching the head. As for the *douches en jet* (the jet sprays), you can make use of different attachments which modify the form of the jet, and give the full jet or the broken jet, which may be directed, according to circumstances, on different parts of the body.

It remains for me to say what should be the temperature of the water, what ought to be the duration of the douche, what preparation the patient should make before, what he should do after, the douche.

As far as the temperature is concerned, the douche may be cold, it may be tempered, or it may be alternately cold and warm. The colder the douche the more intense the reaction, the more painful, too, the application of the douche. So in very susceptible subjects, and those who experience under the influence of cold a painful sensation of cardiac constriction and of suffocation, it is better to have recourse to tempered douches. In administering these douches a jet of cold water and a jet of hot water are turned by means of stop-cocks into the douche apparatus, and you can at your pleasure vary the temperature of the douche. Ordinarily at the commencement of the douche the water is tempered to 25° C. (77° F.), and is lowered during the douche so that finally it is not more than 10° C., or 15° C. (50° F. to 59° F.).

In the douches alternately hot and cold a much more active physiological reaction is obtained. In the so-called "Scotch douche" you begin with a douche of the temperature of 30° C. (86° F.), and gradually rise the temperature to 50° C. (122° F., which is about as hot as can be borne), then you give immediately a douche about as cold as ice. There is another kind of alternating douche in which a succession of warm and cold douches is given to the patient.

DURATION OF THE DOUCHE.

The douche ought always to be exceedingly short. You have just been told that the favorable results of hydrotherapeutics are due to the double action on the nervous system; to obtain this double action the impression of cold must be of short duration. As a general rule its duration should not exceed thirty seconds, and the first application of cold douches ought not to exceed ten or fifteen seconds.

PREPARATION FOR THE DOUCHE.

There are certain rules which should govern the patient before, during, and after, the douche. The greater the difference between the temperature of the body before the douche and that of the water, the more active the reaction will be. It has therefore been advised to cause the patient to take vigorous muscular exercise before the douche, in order to induce some degree of sweating. In our great gymnastic establishments, where the happy idea of douche compartments for the public benefit finds realization, it is at the moment of greatest muscular activity that the douche is taken.

This important condition, to have the skin in a state of prespiration, in order to derive from cold douches all their desirable effects, is little known, not only to the public, but also to physicians. Does not everybody in fact maintain that a cold bath taken when one is sweating is a bad thing, and that it is to this cause that are due the evil effects which sometimes follow the free external use of cold water? I believe this to be a complete mistake; and if we occasionally see congestions of the lungs follow a cold plunge, it is more probable that the individual was chilled before the bath was taken, than that the pulmonary congestion resulted from the bath.

Elsewhere we see, as a medicinal measure, a disposition manifested to favor as much as possible this state of sudation by exercise and artificial means. As artificial means, in Germany they make great use of the *dry blanket*, the patient being enveloped in several blankets thoroughly tucked around him, and kept in the hot, dry, sweating room, or subjected to a powerful vapor bath till a state of free perspiration is induced; then the wrappings are removed and a cold douche is administered, or he is immersed is a bath of cold water. The Russian bath, so much in use among a great many nations, and of which we possess in Paris a very complete establishment, the Hamman, is based entirely on this double action of heat and of cold water.

During the douche the patient ought, as Beni Barde recommends, to suppress, as much as possible, strong contractions of the muscles, and keep a firm hold of the bar for support. The respiratory distress is mitigated by freedom

in outcries. In the event of congestive tendencies to the head or to the uterus, it is well to take a warm foot-bath, or douche the lower extremities with warm water, after the cold douche.

IMMERSIONS.

When remedial effects are sought from immersions, the patient either takes a single plunge into cold water, which should be of sufficient depth that the whole body may be immersed, then immediately rubs himself dry till the skin glows, or he remains several minutes in the bath; the latter course is recommended when an antipyretic effect is desired.

Partial baths are often beneficial, such as foot-baths, sitz-baths; those with running water, furnished with implements for local douching, are preferable.

AFFUSIONS AND PACKING IN THE WET SHEET.

Affusions consist in pouring cold water on the naked body of the patient, or in what is called the wet pack. Wrapping the patient in wet blankets is a very active hydrotherapeutic method. It has this advantage, that it may be employed in all places, and without having recourse to the quite complex apparatuses just described. It is, however, a painful application, and is by no means free from danger. The mode of procedure is simple enough: You wrap the patient in a sheet that has been wrung out of icy-cold water,—you may apply the wet sheet with the patient standing or lying, and keep him thus enveloped ten to fifteen seconds,—then with brisk rubbing with dry cloths you try to promote vigorous reaction. This envelopment may be partial; in this case it has been advised to leave the wrappings on during the entire period of reaction.

Such are in general the methods of application of cold water. There are other modes of using cold from a therapeutic point of view, and I shall now speak of applications of ice and pulverizations of ether.

It has been advised to treat certain neuroses by the application of ice along the vertebral column, and in England chorea is much treated by this method, and so is hysteria. Charcot has even attempted this method at the Salpêtriére, the ice being placed for the space of a half hour, then an hour, over the ovarian region in hysterical patients. By this means he has observed a diminution in the number and intensity of the attacks.[1]

[1]Experiments have been made by Weir Mitchell, and by Richardson, to determine the direct action of cold on the spinal cord, the brain, and the cerebellum.

Cold destroys the vital properties of the cerebro-spinal axis when it is too long applied. The first effect of chilling the cerebrum is a brief sedative action. Then phenomena of motor excitation are developed, sensibility is lessened, and if the application of cold is continued, the animal falls into a profound stupor, and surgical operations may be performed on him without the least movement. This state resembles the hibernal sleep.

When refrigerant applications are made over the cerebellum of birds, backward movements are produced of a very marked character, the explanation of which has not yet been satisfactorily given. According to some they are due to the cerebellum serving as counterpoise to the opto-striate bodies which contain the centres for backward movements. According to Richardson, the cerebellum is the seat of instigation of forward movements, and when its action is suppressed, backward movements take place.

When cold is applied to the medulla oblongata, the respiratory movements are first tumultuous, then they are slowed, and finally cease altogether. (Bourneville, De l'emploi de la glace; Progrèss Médical, 1876. Weir Mitchell, Injuries of Nerves and their Consequences, Philadelphia, 1872. Sur les movements de recul produits chez les oiseaux par l'application du froid, etc.; Arch. de physiol. norm. et path., t. i., p. 477, 1868. Richardson, On the Application of Cold to the Cervical Region, for the Reduction of Pyrexia; Medical Times and Gazette, March 21, 1874, pp. 312, 313.)

A physician of Varsovie, Lublesky, has advised another means of producing refrigeration—the application of ether spray over the spinal column. He has thus treated chorea.

Such, gentlemen, are the divers applications of cold in the treatment of nervous diseases. In the next lecture I shall treat of electricity in the same affections; a subject much more complicated, and which will require much more persevering study to master.