by reliable firms who employ methods of standardization, as is also, I believe, Nativelle's digitaline, but I have had little personal experience of it. Probably the most satisfactory preparation is the powdered leaf which may be given in the form of tablets. It is stable and convenient. It is being employed extensively already, and will almost certainly replace the older preparations to a very large extent. It is important, I am sure, to employ one preparation from a reliable firm on all occasions, and if you do so you will find not only that you will learn how to use digitalis more effectively, but also that you will discover much about your cases from the manner in which they react to it.

THE RÔLE OF HYDROLOGY IN MEDICAL PRACTICE.

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THE term "hydrology" (or medical hydrology) has been widely employed on the Continent for many years. It has recently come into more common use in this country as a more euphonious and comprehensive designation than those respectively of hydropathy, hydrotherapy, balneology, crenotherapy (the internal use of mineral waters), and thalassotherapy (sea bathing), to denote the employment of water, either plain or naturally mineralized, as internal or external remedies.

Hydropathy, at its inception, besides implying the therapeutic use of water (mostly hot internally and cold externally), became elevated to a distinct cult, the adherents of which lost no opportunity of expressing

their profound distrust of any other method of treatment and thus ranged themselves alongside the homœopaths in opposition to their common enemy, the "allopath." With the advance of more liberal ideas the term has largely lost its original meaning and is now only used in association with hotel-like establishments equipped with bathing facilities.

Hydrotherapy came into use as an alternative title to hydropathy as it had no controversial implication. It is still employed, but in the general acceptance of the word is only applicable to baths.

Balneotherapy or balneology has only a restricted terminology in relation to bathing. The other designations, crenotherapy and thalassotherapy, are practically never used in this country.

As the term "medical hydrology" includes the external as well as the internal use of water, both plain and naturally mineralized, as therapeutic agents, it is convenient to consider the subject matter of the lecture under these two headings.

As indications for the therapeutic use of water externally are constantly arising in everyday practice, that branch of hydrology will first be considered, after which the internal employment of naturally mineralized waters which is included under the designation of "spa treatment" will be dealt with.

THE PHYSIOLOGY OF THE SKIN.

The organ most concerned in the therapeutic applications of water, or indeed any other physical agent—heat, light or electricity—is obviously the skin. A knowledge therefore of its reactions both in health and disease is of prime importance.

For this reason it is necessary to begin by referring to some physiological principles on which rational hydrotherapy is founded.

FUNCTIONS OF THE SKIN.

Excretory.—The sudoriferous or sweat glands play a most important part as excre-

tory organs. In health, under ordinary conditions, of the total loss of water by the body, respiration accounts for about 30 per cent., the kidneys 50 per cent., and the skin for 17 per cent. During exercise on a hot day the amount excreted by the skin and lungs would be greatly increased in proportion.

Sweat secretion is under the control of the sympathetic system. The nervous mechanism is very sensitive to temperature changes as well as emotional states and various nervous disorders. In this connection, it will be remembered that a distinct type of individual is recognized whose "autonomic" sensitiveness prevails over his sympathetic. Among the stigmata of the type, slow pulse, deep-set eyes, cool pale skin, &c., is that of sweating easily, often in patches.

Secretory.—The sebaceous glands secrete a fatty substance which serves as a lubricant and protective to the surface of the body. It also prevents the too rapid loss of heat. People with dry skins are liable to feel changes of temperature much more readily.

The Blood Vessels of the Skin.—These are grouped in three divisions:—

- (1) Strong arterioles, derived from the main cutaneous arteries and comprise the cutaneous arterial network and the "arched" arteries and their branches, forming the subpapillary network.
- (2) Minute vessels comprising the terminal arteries, the capillaries, collecting venules and the subpapillary venous plexus, constituting the first and second venous plexus.
- (3) Deep veins, which consist of communicating veins, their venous plexus, communicating veins, fourth venous plexus and the main cutaneous veins.

Practically two-thirds of the entire blood-supply of the body can be contained in the vessels of the skin. In other words, it is possible to bleed a person into his skin.

Alterations, therefore, in the calibre of the cutaneous vessels have of necessity a very far-reaching effect on the deeper organs.

Alterations in the size of the cutaneous vessels can be brought about quite independently of the heart. It has been shown by Van Golz that, after the sciatic nerve of a dog has been severed, the blood-vessels of the limb still react to normal stimuli.

Some observers speak of a "skin heart" in the sense that the peripheral circulation has a certain measure of autonomy.

Heat Regulation.—The loss of heat by the animal body hardly conforms to the law of cooling bodies, i.e., "proportional to the excess of temperature of that body over that of the external medium." The animal body is transforming energy in the form of heat all the time. According to Rubner's fundamental law of animal thermodynamics, "Energy is neither created nor destroyed in the animal body. The energy appearing as free energy is exactly equal to the energy of the materials consumed. Conservation of energy is as true within the animal body as elsewhere in nature (Matthews, page 282). It has been found that the amount of heat given off under varying conditions of fasting and different diets is very close to the amount of heat set free by the combustion of the foods.

The amount of oxygen consumed has a very definite ratio to the amount of CO_2 exhaled, and this ratio is known as the "respiratory quotient." This quotient varies according to the character of the food.

In the case of carbohydrates there is sufficient oxygen to oxidize all the hydrogen contained in the molecule to water. This leaves only the carbon to be oxidized by the oxygen consumed in respiration. The volume of carbon dioxide exhaled equals the amount of oxygen inhaled and the respiratory quotient of a carbohydrate is unity. Fats, on the other hand, have not sufficient oxygen to oxidize the hydrogen of the molecule, consequently a portion of the

oxygen consumed will not appear in the form of carbon dioxide but in that of water. The respiratory quotient will therefore be less than unity when fat is burning in the body.

The respiratory quotient of proteins lies between that of fats and carbohydrates.

If the respiratory quotient is high, carbohydrates are supposed to be oxidizing within the body. If low, fat is burning.

One of the effects of cold applied to the surface of the body is to constrict the peripheral blood-vessels and thus increase the volume of blood in the deeper vessels. This in turn increases the amount of blood passing through the heart and lungs, with the result that the respiratory movements are accelerated and more carbon dioxide is exhaled. In other words, metabolism is stimulated. It is a matter of common observation that a quick walk on a cold, frosty day promotes a much greater feeling of well-being than a similar distance traversed in hot, muggy weather.

Heat produced by internal metabolic processes is radiated chiefly from the surface of the body. The skin acts as a casing or jacket does to a boiler or machine. It keeps the heat from being dissipated too freely, and at the same time keeps a suitable even temperature at which the internal organs can best carry out their functions.

This constant level of temperature is maintained under the most varying conditions. If large quantities of heat are suddenly set free in the body from any cause, such as muscular work or the ingestion of large amounts of food, the total loss of heat from the body is correspondingly increased. The cutaneous vessels dilate and the warmed skin loses heat more rapidly by radiation and conduction. Perspiration is more free and the loss of heat by the evaporation of water from the lungs is also increased.

To take the opposite condition—exposure to cold—the first thing that happens is a contraction of the skin-vessels, so that heat loss through radiation and conduction is diminished. As the human skin is not con-

sidered adequate to prevent this loss of heat under all circumstances, clothes in varying amounts are worn. In the case of animals the fur is usually enough.

Obese persons lose heat much less readily than thin people. The layers of fat retain heat remarkably well, and as comparatively slight exertion increases the internal heat of the body, the skin endeavours to cool itself and the underlying structures by the stimulation of the sweat glands. Fat people always sweat more for this reason. The first mechanism brought into use against cold is purely physical, i.e., the contraction of the peripheral vessels. If this is not enough, the production of heat is increased by the stimulation of metabolism in the manner referred to above. The latter method of heat regulation is therefore chemical.

If heat be applied to the surface of the body and at the same time, the compensatory loss of heat interfered with, a rise in temperature necessarily follows. Such interference with the compensatory loss of heat would be the inhibition of sweating. A rise in temperature always takes place in a bath of over 100° F. A similar condition often arises during heavy exercise by overclothing soldiers in a warm, moist climate. This accounts for the prevalence of "heat-stroke" under such circumstances.

Adaptation.—By means of the cutaneous nerve-endings in the skin, a contact or awareness of environmental conditions is brought about. It is, of course, not the only organ concerned, as disagreeable sights, sounds and smells can affect the bodily functions by communication through the special sense organs.

The cutaneous nerves of the skin are largely under the control of the vegetative system. It will be remembered that every organ in the body, skin, glands, heart, blood vessels and hollow viscera has a double innervation. One division, from the gangliated cords of the sympathetic proper, which through the grey rami supply efferent involuntary fibres, whose functions are vaso-

motor, vaso-inhibitory, excito-glandular or secretory. The other division includes in its distribution branches from the three great plexuses, cardiac, solar and hypogastric.

These two divisions of the vegetative system being antagonistic in their action, their equilibrium keeps the body in a state of health. In other words, a normal reaction to environment is only attained when the two divisions exactly counterbalance one another. The clinical significance of altered states of excitability of the two divisions of the autonomic system has been extensively studied by Biedl, Eppinger, Hess Falta and others. They find that exaltation of the sympathetic tone accelerates and strengthens the heart. The coronary artery dilates while the systemic vessels are constricted with consequent increase in blood-pressure. If, on the other hand, the parasympathetic is in the ascendancy, the opposite state of affairs is brought about, viz., slowing of the heart and extra-systoles, marked respiratory irregularity, lessened strength, excitability and dilatation of blood-vessels and consequent decrease in blood-pressure. To take another example, the effects of an imbalance on one or other of these systems on metabolism is equally well-marked. An exaltation of sympathetic tone inhibits peristalsis of the stomach, small intestine and rectum. It contracts the pyloric and ileo-cæcal sphincters. If the parasympathetic overshadows the picture there is increased peristalsis, gastric and intestinal, aerophagia, eructations, hyperchlorhydria and frequent motions or spastic constipation.

These examples might be multiplied, but the two which have been chosen will serve as a reminder of the importance of the study of the vegetative nervous system in this connection.

The autonomic nervous system has a very close relationship with the endocrine system. In intimate association with the paired sympathetic ganglia are the chromophil cells, which are indistinguishable from those of

the medulla of the suprarenals. The paranglion of Kohn lying on the abdominal aorta consists of chromophil cells. Just as the autonomic nervous system is composed of antagonizing elements, so are the ductless glands opposed either singly or in groups. The thyroid, pituitary and adrenals are in opposition to the pancreas in metabolism and to the thymus and pineal gland as regards development. The thyroid is stimulated by the sympathetic proper and it lowers the threshold of sympathetic stimulation. The tendency to hyperglycæmia induced by thyroid or sympathetic stimulation is counteracted by parasympathetic stimulation which thereby directly affects the pancreas.

The skin functions are largely under the control of the thyroid, pituitary and adrenals. Krogh and his school consider that the smallest arteries and capillaries owe their tonus to the hypophysis hormone. Adrenalin strongly contracts while ovarian gland dilates the capillary vessels.

Pemberton has pointed out that there is strong evidence that at least part of the pathological change in the rheumatic syndrome consists of interference with or obstruction to the flow of blood in the finer capillary beds. Schulhof further corroborates this observation by stating that the essential cause of rheumatic symptoms is a trouble of capillary circulation in the organs of locomotion. He suggests that cold or climatic irritation sets up an autonomic capillary spasm, followed by stasis in the capillaries and subsequently in the lymph-spaces.

What has been briefly referred to above is of importance in the consideration of the influence of climatic conditions on health. Rheumatism is regarded as a disease of temperate climates. In tropical countries its incidence is slight. One of the most important factors in its production is the relative humidity of the atmosphere. By this is meant the amount of moisture expressed as a percentage of the amount

necessary to cause saturation, i.e., the "dew point." In temperate climates the pleasantest degree is round about 75 per cent. of saturation.

In cold climates the body loses its heat by radiation in contradistinction to hot climates where heat is lost by evaporation. If in the latter case there is, in addition, a considerable degree of humidity, the excess of bodily heat is with difficulty got rid of. In cold climates, where the body is continually giving off heat, the temperature must be maintained by rapid metabolism and increased tissue changes, i.e., a "chemical" regulation is essential.

Under ordinary conditions the human organism is capable of adapting itself to these numerous changes in temperature and humidity. People vary enormously as to their liability to take cold. Some individuals can sit for hours in damp clothing and nothing special happens. Others again are most susceptible to the slightest chill. The fault lies primarily with the skin. If it cannot adequately protect the body from changes of temperature, humidity, &c., it is not carrying out its functions properly. This has a most important bearing on the practice of hydrology. In directing treatment towards the skin, an endeavour is made to increase its powers of resistance and thus afford a more adequate protection.

REACTIONS.

The reactions associated with hydrological treatment are classified as primary or immediate and secondary or remote.

Primary Reactions.—These are transient in character, depending for their degree on the nature of the treatment. They may be either local or general.

Local Reactions.—According to Sir Thomas Lewis, "Blood-Vessels of the Human Skin," an irritant applied to the skin, whether in the form of a prick, a scratch, freezing, heating, irritant substances, stings, &c., contracts the vessels in the subpapillary venous plexus and causes a transient pallor.

This is quite independent of nervous reflexes, central and local.

The pallor is followed by redness due to active dilatation of the terminal arteries, capillaries and minute venules. This is also independent of the central nervous system. If the irritant is strong enough a "flare" takes place beyond the site of its application. In addition to the flare or diffuse response, there is always a certain amount of local oedema due to the outpouring of fluid into the tissue spaces.

This "flare" is dependent on local nervous mechanism. In susceptible subjects the local oedema appears as a wheal (urticaria, dermographism). Some "released substance" is regarded as being the cause of this triple response, viz. :—

- (1) Primary and local dilatation of minute vessels of the skin.
- (2) Widespread dilatation of neighbouring strong arterioles through local nervous reflex.
- (3) Locally increased permeability of vessel walls.

This highly organized defence mechanism is summed up in the term "inflammation" (redness, heat and swelling).

The agent that alarms the garrison and mobilizes the first or vascular defences is a chemical agent derived from the living epidermal cells. The quantity of this substance released depends entirely on the nature of the injury. Lewis sums the process up as one of simple transition from the simple response of healthy skin, through the more severe yet trivial local injuries—the bruise and the blister—to the more grave effects of mechanical injury and severe burning, which in their later manifestations endanger life. The transition is one of quantity and not of quality.

General Reactions.—Certain general reactions follow immediately on the taking of a hot or cold bath. Attention will be directed to them in dealing with the various kinds of bath treatment.

Secondary Reactions.—These reactions are

seen in their most typical form in patients who are undergoing a course of treatment for one or other kind of arthritis or fibrositis.

The reaction usually begins a few days after the treatment has been commenced. A joint that may have been more or less quiescent for months suddenly "flares" up and the patient may have to take to his bed. With the local manifestation there is usually considerable general disturbance, characterized by a rise in temperature and malaise. It is very common in patients of a gouty habit, and typical attacks of classical regular gout are repeatedly seen in patients who have been free from such manifestations for years. It is so usual among those who frequent spas that it is taken quite as a matter of course. A very satisfactory explanation from the patient's point of view is that the treatment is "bringing out the disease."

The toxic material which is presumably the proximate cause of the various kinds of arthritis and fibrositis is usually regarded as being made up of proteins or lipoids and their spilt products, albumoses and proteoses. One recognized method of treatment of these chronic conditions is by means of "non-specific protein shock," or the introduction of a protein to the blood-stream. It is quite a reasonable proposition that the so-called vaccine treatments by specific organisms are not specific at all, but rely entirely for any measure of success that may be attained on the introduction of a protein foreign to the blood-stream. Ordinary T.A.B. vaccine has been repeatedly used successfully in the treatment of some joint conditions.

When a protein "foreign" to the blood is introduced, enzyme activity is stimulated. These enzymes, on making their appearance in the blood, have the power of digesting the albumoses and proteoses formed by the acid hydrolysis of the actual proteins thus introduced. They are known as "proteolytic enzymes." Apart from gastro-intestinal processes, proteolysis is normally an intra-

cellular phenomenon. The possibilities of toxic effects on the organism are always present when the process takes place outside the cells to any extent.

What might be termed the opposite process, or that of "detoxication," implies the ability of the cells or fluids of the organism concerned to digest toxic protein fragments, and this is brought about by the stimulation of enzyme activity. Besides the latter phenomenon there is increased cellular activity generally, the stimulation of the bone-marrow, the mobilization of leucocytes and the formation of antibody. Recovery eventually comes about through changes in the lymph, fluids rich in antibody being forced through the lymph-channels. This causes a varying amount of constitutional disturbance along with a rise in temperature.

Now, the reactions that have just been briefly described can be induced either by protein introduced into the blood-stream by means of a syringe and needle, or derived from the body itself in the following manner:—

Stimulation of the skin by hot baths, packs, hot air, sunlight and the like, produces an active hyperæmia therein. This is associated with increased lymph-supply, and in consequence certain enzymes from the skin, such as lipase and protease, are swept into the circulation along with exudates from the joints or fibrous tissue. These combined act as antigens or stimulators of enzyme activity. In other words, they act precisely as would a "foreign" protein. In this connection it is useful to remember that blood so slightly altered as being drawn from one part of the body and re-injected at another is capable of setting up a reaction and in reality acting as an antigen to itself.

BATHS.

The absorption by the skin of the mineral constituents of the water is negligible in the case of an ordinary immersion bath. In the case of a natural sulphur bath there may be some absorption of H_2S . This

may also apply in medicated baths where an essential oil is used in the preparation thereof.

Speaking generally, the therapeutic effects of an immersion bath are entirely due to the mechanical and thermal action of the water on the skin, and through it on the deeper structures.

The external hydrological or balneological methods of treatment in ordinary use comprise the following :—

- (1) Immersion baths, which may be either full or partial, and consisting of plain, naturally mineralized or artificially medicated water at varying temperatures.
- (2) Douches with plain or mineralized water at varying temperature and pressure.
- (3) Douches of plain or mineralized water combined with manipulation.
- (4) The application of water vapour or hot air.

Immersion Baths.

Mechanical Effects.—The pressure of the water tends to empty the veins and increase the peripheral circulation. When employed as a “deep” bath the water gives support to the limbs and allows movements that could not otherwise be performed. This is especially valuable in the stiffening following some forms of arthritis.

HOT BATHS.

The effects of a full immersion hot bath may be taken as a type of those associated with other applications such as natural mineral water or artificially medicated baths, as well as “partial baths” and douches.

Temperature.—Water above the temperature of the body, 98° F., is recognized as hot. 105° is considered very hot, while anything above 115° cannot be endured for more than a few seconds.

A hot bath is a vital excitant at first, afterwards it is depressing. Depending on

the exact temperature employed, the effects are as follows.—

The Skin.—Moderate heat increases the activity of both sweat and sebaceous glands. If of fairly high temperature, the rate of perspiration may be increased thirty times the normal amount. In such instances the skin surface is roughened, due to contraction of involuntary muscle fibres. Slight shivering may be produced by excitation of the vasomotor nerves. Very hot applications lessen sensibility. Tactile sensibility appears to be abolished at 130° F., but sensibility to pain remains.

Circulation.—Moderate heat relaxes the surface vessels. Great heat constricts them. The pallor due to the excitation of the vasoconstrictors soon gives place to a dusky redness. The stimulating effect on the vasoconstrictors is made use of in the employment of very hot water to check hæmorrhage. Taking the three great vascular areas, the skin, muscles and portal systems, if one is in a state of congestion the others are more or less anæmic. This explains the faintness which may overcome a patient subjected to a high degree of heat while in the upright position.

Venous congestion of the brain is produced at first by a bath at 103° F., but after a few minutes a state of anæmia is brought about. The same effect on the cerebral circulation may be obtained by a hot foot-bath at 105° F. Hence the hypnotic effect of the latter.

Although the first effect of a general application of heat is to increase the force of the heart, with the onset of perspiration arterial pressure is lowered somewhat and the pulse quickened as a final result.

Holmes (*British Medical Journal*, January, 1930) points out that the lowering of pressure in baths of 102° F. and thereabouts chiefly affects the diastolic pressure.

Respiration.—A general application of moist heat facilitates respiratory movements. Dry heat has the opposite effect, owing to irritation of the alveoli. With the ease of

respiratory movements, their depth is lessened and the amount of tidal air diminished. If the heat is sufficient to raise the temperature of the blood, there will be an increase of lung activity, as seen in fevers.

Muscles.—Prolonged applications above 100° F. diminish muscular excitability and capacity for work. Very short applications have a reviving effect in exhaustion after severe exertion. This may be due to increased elimination of the by-products of muscular action.

The Nervous System.—Baths at a high temperature, 100° F. and over, are at first exciting and later exhausting.

Blood.—The red-cell count is diminished, possibly due to the detention of blood-cells in the viscera. There is a proportional decrease in hæmoglobin.

Temperature and Heat Production.—Prolonged applications of heat cause a rise of bodily temperature. To obtain this effect the bath need not be much above the temperature of the body. With the body immersed in a medium the same temperature as itself heat cannot be radiated from the surface, and as heat production from the general metabolism is going on the whole time, it accumulates with a consequent increase in amount. It must be remembered that water is a very bad conductor of heat, hence the "water jacket." With a test-tube three-quarters full of water, the upper part can be almost boiling while the lower portion is comparatively cool.

On the other hand, a short application of heat is followed by a lowering of temperature, because heat elimination is encouraged by increased perspiration, relaxation of surface vessels and increased activity of the heart.

Reactions following Hot Applications.—Kellogg sums them up as follows :—

Vasoconstriction, pallor of the skin, frequent low-tension pulse, respiration free, frequent and superficial, lessened perspiration, gradual cooling of the skin, depression of internal temperature from increased heat

elimination and decreased heat production, diminished nervous and mental irritability, drowsiness and depression, and muscular weakness.

Therapeutic Indications.—Chiefly used as an eliminative measure. Followed by a dry pack it promotes sweating most efficiently. A valuable remedy in chronic rheumatism and fibrositis. Also in chronic bronchitis, nephritis, dysmenorrhœa, gastric and intestinal colic, and as a palliative measure in gall-stones and renal colic.

Relief of pain. The power of relieving pain seems to be a specific property of heat. This is probably brought about by the production of a collateral hyperæmia and the breaking down of vascular stasis. It has been suggested that it inhibits the sensory nerves and so relieves by acting through the thermal nerves of the skin. To obtain the best results it must be intensive or as hot as can be borne.

Contra-indications.—The hot bath to be avoided in cases of organic disease of the brain or spinal cord, cardiac weakness or hypertrophy, arteriosclerosis, especially where there is any likelihood of cerebral hæmorrhage.

COLD BATHS.

Heat and cold are relative terms. Water is recognized as cold when it has a temperature lower than the skin. In hydrological prescriptions more accurate terms are used. Temperatures are thus classified :—

	Degrees F.		Degrees C.	
Very cold ...	32 to	55	...	0 to 10
Cold ...	55	65	...	10 " 17
Cool ...	65	80	...	17 " 27
Tepid ...	80	92	...	27 " 33
Warm (neutral) ...	92	98	...	33 " 37
Hot ...	98	104	...	37 " 45
Very hot ...	104 and above			45 and above

A cold bath is a vital depressant and the lowering of bodily activity continues as long as its duration. For this reason cold applications should be very short, and the time reckoned in seconds instead of minutes, as is the case of warm or hot applications.

If a cold bath is unduly prolonged the

depression may remain for some time after its cessation.

The effects of a cold bath are as follows:—

The Skin.—The skin is pale at first, due to the sudden contraction of the small vessels. If the immersion is continued, the venules relax and the skin becomes blue, the excitement of the involuntary musculature causes the condition known as “goose flesh.” The application of cold to a very small surface may cause this appearance. On removal from the bath the blueness gives place to redness due to the active dilatation of the arterioles. This is known as “reaction.”

The sweat glands are reflexly inhibited. This may be brought about over the entire body by a cold application to a very small surface.

The Circulation.—There is a momentary quickening of the heart-beat with the first shock of the application, after which it is slowed, and if prolonged, depressed. Arterial tension is increased owing to the depletion of the surface vessels.

Respiration.—With the first shock of the application the breath is momentarily held, but afterwards becomes slower and deeper. The tidal air is therefore increased in amount.

Muscles.—With long continuance the temperature of the muscles is lowered and their irritability and energy thereby greatly decreased. This is accounted for by the fact that the by-products of muscular activity are not got rid of.

The Blood.—A temporary leucocytosis as well as an increase in the red cells and the content of hæmoglobin have been noted after short cold baths. The rate of oxidation is also accelerated.

Excretory Functions.—Perspiration is induced by the reaction following short applications. If prolonged the opposite is the case and more strain is thrown on the kidneys. The increase in urine in cold weather is an example of this.

Metabolism.—A short stimulation of the skin by the application of cold has a very favourable effect on metabolism generally. Strasser found many years ago that a cold bath increases the amount of urea, uric acid, ammonia, earthy phosphates and the xanthin bases that is excreted, a proof of the stimulation of general metabolic activity.

Temperature and Heat Production.—This depends on the duration of the application. With a short bath the lessening of skin circulation diminishes heat elimination. With the subsequent reaction an increased quantity of blood is exposed to the chilled surface of the body whereby heat elimination is accelerated. When a cold bath is given for its antipyretic effect, friction of the surface of the body during its continuance will cause a larger amount of blood to be exposed to the chilliness of the medium.

Reactions following Cold Applications.—These are most important. Practically speaking, a cold bath should never be given unless a definite reaction is desired. If for any reason a reaction is not desired, a tepid bath should be substituted for actual cold. This specially applies in the treatment of hyperpyrexia, to which reference will be made later.

Kellog summarizes the phenomena following short exposures to cold as follows: Dilatation of superficial vessels; redness of the skin; a soft, smooth, supple skin; a sensation of warmth and well-being; slowing of the pulse with increased tension; respiration free, slower and deeper; heating of the skin; fall of internal temperature and increase of perspiration.

The conditions favourable to reaction are: A hot bath or douche immediately preceding the cold application, a warm room, warm clothing, vigorous exercise and friction of the skin.

Unfavourable Types.—Old people with arteriosclerosis should never indulge in cold baths. Very young children do not react well. Cold bathing is contra-indicated in most renal conditions. Subjects who are

known to have no reactive power should never take cold baths.

Therapeutic Indications.—The chief use of a cold bath is to tone up the skin after a hot application. According to many authorities the omission of a cold bath or douche in such circumstances is a "hydrological crime." Of course it must be omitted if the patient does not react favourably.

Cold bathing is useful in cases of obesity without marked cardiac degeneration, more particularly where the obesity is due to slowed metabolism.

It has a very extended use as a daily measure for promoting appetite, stimulating metabolism, and for the production of a general feeling of exhilaration.

THE TEPID BATH.

The temperature ranges between 80° and 92° F. (27° and 35° C.).

The tepid bath slows the pulse and reduces temperature by the abstraction of heat. In order to avoid any possible harm from undue contraction of the surface vessels, friction to the skin should be applied while the patient is in the bath.

Its main use is in the treatment of fevers and hyperpyrexia. The temperature should be 85° F. to start and gradually reduced down to 70° F. Twenty minutes to half an hour, and repeated every three or four hours, is the usual practice.

Osler summarizes the good effects as follows :—

Influence on the nervous system ; tremor of delirium tremens diminishes and toxic effects less marked ; tonic effect on the circulation ; heart-rate falls and blood-pressure rises ; vaso-motor paresis lessened ; increased excretion by kidney ; in typhoid, initial bronchitis benefited ; liability to bed sores diminished ; reduction of temperature.

THE SUBTHERMAL OR NEUTRAL BATH.

Skin temperature, 93° F. (33° C.), is regarded as the point of thermal indifference

for an immersion bath. Usually the range of temperature for a subthermal or warm bath is between 90° and 97° F. The action of such a bath is entirely sedative. The temperature being very near that of the body the heart is slowed, the peripheral circulation equalized and a massive and equable impression of temperature replaces a multitude of varying cutaneous impressions (Fox).

It is therefore indicated in cases of mental excitement, psychasthenia and anxiety neuroses. An element in the treatment is the fixation of the patient's attention on something outside himself.

MEDICATED IMMERSION BATHS.

These may be either natural mineral water baths, or prepared artificially natural mineral water baths.

Their action is very much the same as that described above. The chief difference between a plain and a mineralized water is that the latter is more stimulating to the system and induces sweating more readily.

For instance, a Droitwich brine bath brings out the most profuse perspiration. When employed as at Bath, Buxton and Droitwich, in the form of deep pools, the patients are enabled to perform various movements that could not otherwise be indulged in. When given at tepid or indifferent temperatures, mineral waters are distinctly more sedative in their action than plain water. The thermal effects of a natural mineral water can always be obtained with a lower temperature than applies to plain water. Where possible, the natural mineral water is always to be given in preference to a bath of plain water, especially where a definite therapeutic effect is being looked for.

EFFERVESCING BATHS.

Natural thermal effervescing baths are found at Nauheim (temperature 82° to 95° F.), Oeyhausen (77° to 91° F.), Royat and Chateaufort (70° to 80° F.), and Chateaufort (70° to 80° F.).

Cold effervescing waters at Spa, Schwalback, Kissengen and Marienbad. No natural effervescing waters in this country.

Artificial effervescing baths can, however, be readily prepared by means of packets containing the necessary ingredients, which are sold under the name of "Nauheim Bath Salts."

Physiological Action.—The effect is due to the liberation of carbonic acid gas which settles on the surface of the skin in the form of bubbles. The cooler the water the more gas it will contain. The first effect is to produce a slowing of the heart, said by some observers to be due to reflex stimulation of the vagus. The skin quickly reddens, and the demarcation between the immersed and non-immersed parts is quite obvious. With the increased circulation in the skin the amount of blood in the deeper organs is lessened. Hediger (*Archives of Medical Hydrology*, June, 1923) points out that the CO₂ bath is the only physical method of treatment in which the cardiac muscle is trained without at the same time increasing the frequency of the beat. By the slowing of the pulse the extended diastole enables the cardiac vessels to be better filled with blood, which reacts favourably on the myocardium.

Therapeutic Indications.—Cases of myocardial weakness do best. Combined with resistance gymnastics, i.e., slow movements executed by the patient and resisted by the operator for gradually increasing periods, excellent results have been obtained. Cases of simple hypertension of the pulse do well, as do those of irritable or "neurotic" heart. Not so suitable in broken compensation.

DOUCHES.

Kellog defines a douche as a single or multiple column of water at varying temperatures, pressure and mass directed against some portion of the body. The pressure varies from 10 to 60 lb., depending on the height of the reservoir or source of supply. The mass varies from a "filiform" douche

of extreme fineness to a column of water an inch in diameter. The column may be in the form of a jet, fan, filiform, rain or shower, and its direction may be horizontal, vertical, multiple, circular, or ascending.

The Cold Douche.—Only given for a few seconds at high pressure, in order to bring about a reaction after some bath of a heating nature. Its chief indications are those of a general tonic and stimulant.

The Hot Douche.—Average temperature round about 110° to 115° F., beginning at 100° F. and gradually working up. The stream must be kept in constant motion, otherwise there is a risk of scalding.

Its effects and indications are very much those of a hot bath, with the addition of the mechanical factor of percussion.

The Neutral Douche.—Given at a temperature of between 92° and 97° F., it acts as a general sedative and has a greater influence on the vessels of the skin than a bath of the same temperature. It produces no reaction and is used in cases of insomnia and nervous excitement.

The Scotch or Alternating Douche.—Carried out by two hose-pipes, one delivering very cold water and the other very hot. The cold application a few seconds and the hot as many minutes. The blood-vessels of the skin are alternately contracted and dilated. This assists in the removal of old inflammatory products. It is extensively used in cases needing tonic treatment, also in the later stages of muscular rheumatism, lumbago and sciatica. It is a valuable application in strains of joint, especially in the later stages where there is thickening round the tendon sheaths.

The rain or shower bath and the needle bath when given cold are intended to tone up the circulation after hot applications. Their general applications are much the same as those already dealt with.

The Intestinal or Colonic Douche.—Douching of the lower bowel is extensively carried out at both the British and foreign spas. The local mineral water is usually

employed. Two injections of about a pint and a half each are given with an interval of about twenty minutes. The results of the "washings" as regards the presence of any abnormal material is reported to the physician.

Certain kinds of so-called cases of intestinal toxæmia do benefit from this treatment, or at any rate the patients say they feel better. Its reputation has, like many other useful measures, suffered from the extravagant and unsubstantiated claims advanced on its behalf.

Manipulative Douches.—These consist of general massage under a stream of water, either from a hose-pipe or a rose-jet. The patient is either sitting on a chair with the Aix system, or lying on an air mattress in the case of the Vichy system. The effects are practically those of a neutral douche with massage superadded. It is probably one of the most valuable methods of treatment in vogue at the spas. The massage douche has a most extensive use in cases of obesity, rheumatism, fibrositis, and painful conditions of the fibrous tissue beneath the skin. It is also used in the late stages of sciatica as a means of restoring tone to the muscles.

(To be continued.)

WE have received the annual report of the British Empire Leprosy Association. In this country it is difficult to realize that there are over 467,000 lepers in the British Empire, and the urgent need that exists for treatment and relief to these unfortunate sufferers.

The report of the Association will repay reading as it is full of interest and shows the good work that is being done.

The headquarters of the Association are 29, Dorset Square, N.W.1, and from this address those interested in this subject will be able to obtain literature and further information.

EDITORIAL.

THE M.R.C.P. lectures proved so popular last year that another course has been arranged, beginning on May 13, 1930.

We publish below a full syllabus of the course and it will be noticed that, in addition to the ordinary lectures, there are three special lecture-demonstrations on medical ophthalmology and a special demonstration in the diagnosis and treatment of certain bacterial infections.

It is hoped that those who wish to attend the classes will send their names in to the Secretary of the Fellowship of Medicine and the Post-Graduate Association as soon as possible.

M.R.C.P. SPECIAL COURSE.

May 13 to July 4, 1930.

The following Lectures will be delivered at the Medical Society, 11, Chandos Street, Cavendish Square, W.1, at 8.30 p.m., unless otherwise indicated.

- 1 Tuesday, May 13.—Dr. J. W. McNee, "Recent Views on Diseases of the Liver and Biliary Tract."
- 2 Friday, May 16.—Dr. J. W. McNee, "The Structure and Functions of the Spleen in Relation to its Diseases."
- 3 Tuesday, May 20.—Dr. L. S. T. Burrell, "Intrathoracic Tumours."
- 4 Friday, May 23.—Dr. L. S. T. Burrell, "Bronchiectasis and Abscess of Lung."
- 5 Tuesday, May 27.—Dr. B. T. Parsons Smith, "Coronary Thrombosis."
- 6 Friday, May 30.—Dr. B. T. Parsons Smith, "Cardiac Failure."
- 7 Monday, June 2 at 4.30 p.m. At Royal Westminster Ophthalmic Hospital, Broad Street, W.C.2.—Mr. C. I. Gimblett, "General Medical Ophthalmology."
- 8 Tuesday, June 3.—Sir William Willcock, K.C.I.E., "Some Points in Connection with the Toxic Effects of Lead, Arsenic, Morphine and Cocaine, etc."