

hours to normal again. An eruption of purplish coloured spots spreads over the body, particularly the trunk, quite similar to those found in the secondary stage of syphilis. The patient feels ill with pains in the muscles and joints. The illness may continue with febrile exacerbations for a period of several months. It is said to respond very quickly to arsphenamine, and the dangers attached to its use are few in number. It has been found that if the intravenous method of inoculation is employed, the occurrence of a primary lesion with lymphangitis is apparently avoided. The advantages claimed are that the organism can be maintained in laboratory animals and consequently they are always available for use. The disease is less exhausting to the patient than malaria. It may be given to patients who are immune to malaria, and it is apparently possible to give it either before or after malaria without modifying the clinical course of either condition. No results are as yet available as to the efficacy of this treatment, and at present malaria remains the safest and most effective form of fever therapy.

The present consensus of opinion, however, is in favour of a combination of non-specific therapy. Von Jauregg begins the specific treatment as soon as the fever is stopped. With the first dose of quinine he gives 0.3 grm. of neosalvarsan, five days later 0.45 grm. is given, and thereafter eight injections of 0.6 grm. are given at intervals of eight days. Varying doses of neosalvarsan, with or without bismuth, are generally recommended to complete the treatment. Personally, I have employed treatment by malaria in combination with tryparsamide, which is an arsenical preparation with an unusually high degree of penetrability. Intravenous injections of 3 grm. are given as soon as a diagnosis is made. The malarial treatment is carried out as already described, and the injections are administered throughout the fever and at weekly intervals thereafter, so long as the serological findings

remain positive. By this method a relatively higher proportion of negative serological findings has been obtained, associated with clinical improvement.

In conclusion, I would reiterate that there is no doubt as to the beneficial effects of malarial therapy, and also that such are increased if combined with specific treatment.

A careful physical examination should be carried out prior to submitting patients to this treatment, to exclude the possibility of renal, cardio-vascular or other disease. If there is no evidence of such, then with proper skill and nursing the treatment is not such a serious matter as has sometimes been maintained. The factor of great value is the early diagnosis of such cases, and for this we must look for the greater co-operation of the general practitioner.

## THE RÔLE OF HYDROLOGY IN MEDICAL PRACTICE.

POST-GRADUATE LECTURE DELIVERED FEBRUARY 11, 1930.

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(Continued from p. 126.)

### VAPOUR BATHS.

The air is charged with water vapour, which has a distinct "thermal" effect on the skin according to the temperature. The vapour bath has been in use from time immemorial, and the ancient method of preparing it was by placing a tub of hot water in a building and throwing hot glowing stones into it. The vapour bath checks evaporation from the surface of the body, in consequence of which heat is retained and the bodily temperature raised.

After a varying period in the "vapour"

room a cold needle or shower bath is administered. The application of cold is most important. In Russia and Finland it is customary to roll one's self in the snow after being in the "sweating" room. Among those people an hour in the sweating room followed by an intense application of cold is regarded as a sure protective against disease.

A more extended use of baths of this description in this country would undoubtedly do much to "tone up" the skin of susceptible individuals and thereby raise their resistance to disease.

#### THE HOT-AIR BATH.

This differs materially from the vapour bath, in that the air is dry and the evaporation of sweat from the body is facilitated. The bodily temperature is therefore not raised. The circulation of the skin is stimulated and the deeper organs correspondingly relieved. The profuse sweating rids the body of impurities. Turkish or hot-air baths are largely employed in cases of obesity, gouty conditions, rheumatism and allied affections.

#### SPA TREATMENT.

A spa is a health resort which possesses a natural mineral water of proved therapeutic value. Spa treatment not only implies the residence at and the use of the natural mineral water, both internally and externally, as special baths and douches of various kinds, along with various accessory physical methods of treatment, but other factors as well, such as change of air, freedom from worry, regulation of diet and exercise. In short, spa treatment aims at placing the patient in such an environment that the "vis medicatrix naturæ" can act to the best advantage.

The success of spa treatment lies in the combinations of these factors and not on the specific action of any particular water or waters in the treatment of any particular disease.

Taking these factors in order, it will be seen that spa treatment has a very definite object.

- (1) Residence at the spa. This of itself puts the patient in a better state of mind for responding to the influences that are brought to bear upon him.
- (2) The drinking of water which, if it has an aperient effect, secures increased elimination of waste products through the bowel, of a diuretic effect by the kidneys.
- (3) The external use of water in the form of baths that have a diaphoretic effect will secure increased elimination by the skin. Massage douches and other physical methods of treatment will bring about improvement in the blood- and lymph-circulation and the removal of waste products of metabolism.
- (4) The improvement in the quality of the air which is breathed has an obvious good effect on the organism generally.
- (5) The absence of work and the lessening of worry makes it possible to secure conditions which will have a psychological effect in promoting a cure.
- (6) When away from business and irregular habits, it becomes possible to regulate the intake of food according to the requirements of each particular case.
- (7) Where the patient is giving up his whole time to his treatment it is possible to give very precise instructions as to the amount of exercise, rest and sleep.

*Drinking Spas and Bathing Spas.*—Although with one exception (Droitwich) the local natural mineral water is employed both externally and internally, its therapeutic indications are best met by either the one or the other. It is therefore customary to

divide spas into two categories: "drinking" spas and "bathing" spas. For example, Harrogate, Cheltenham, Leamington Spa and Llandrindod or Trefriw are primarily drinking spas, although full facilities for bathing exist at all these spas. Bath, Buxton and Droitwich are essentially bathing spas, although in the first two mentioned drinking the water is regarded as part of the "cure."

#### NATURAL MINERAL WATERS.

A natural mineral water can never be successfully imitated. It is something more than a mere concoction of salts dissolved in water. Freshly drawn from its source, a mineral water is a living medium with its salts diffused in an electrostatic field.

The salts of a natural mineral water are dissociated almost completely into the ionic condition. The compound breaks up into its component metallic and acid radicle (ions) which carry equal and opposite electrical charges. The properties of a spa water are therefore due to the properties of the ions present, rather than those of the hypothetical salts. It is no longer correct to speak of such and such a water as consisting of so many grains of sodium chloride or sulphate of magnesia to the gallon. The results of an analysis now record the concentration of each ion present. For instance, the concentration of sodium ions in the Harrogate old sulphur well is 525, while that of Bath is 18, and for Buxton 2. The figures for the concentration of chloride ions in the same waters are respectively 908, 15 and 4.

The old method of allotting each acid radicle chloride or sulphate to some metal was quite arbitrary and followed no particular rule.

Mineral waters are "electrolytes" in the sense that they conduct electrical currents and are decomposed by their passage.

*Osmotic Pressure.*—If two solutions, one more concentrated than the other, are separated by a membrane, pressure proportionate

to the total number of ions, molecules or molecular aggregates in the solution is exerted on the membrane. This is equal to a force of considerable magnitude. As a consequence of this the solvent passes from the more dilute to the more concentrated side until the two solutions are equal or "isotonic." Fluid exchanges are constantly taking place between every organ and cell in the body through the semipermeable cell wall.

A saline solution having an osmotic pressure of 6·8 atmospheres lying in the intestinal canal would not be absorbed by its membranous walls because its "osmotic" pressure is identical with the blood, i.e., "isotonic." A mineral water having an "osmotic" pressure greater than the blood will cause a passage of the fluid contents of the blood through the wall of the intestine, and in this manner act as a purgative. Conversely, a mineral water having an osmotic pressure less than the blood will be absorbed into the blood-stream. The osmotic pressures of the various mineral waters are thus compared with that of a normal saline solution, viz., 0·9 per cent., or 6·87 atmospheres. They are therefore classified as "isotonic," hypertonic, or hypotonic, respectively.

In this connection, mention may be made of some very interesting work that is being carried out with isotonic mineral waters. Several observers have found that if a few cubic centimetres of freshly drawn water are injected hypodermically remarkable results in desensitization have occurred. For instance, Dr. Monod in his recent Hunterian Lecture states that the venom of the adder can be neutralized by the timely injection of a certain mineral water. Many other examples might be quoted, but time hardly permits an adequate consideration of a field of research which is opening up and which will eventually yield astonishing results.

*The Colloidal State.*—All tissues and tissue fluids are "colloidal" in nature. By the term "colloid" is meant the suspension of

separate particles or liquid globules in a continuous medium of a different kind. There are therefore two "phases." The separate particles constitute the "dispersed phase," and the medium in which they are suspended the "continuous phase." As the separate particles are often inside the containing medium, that phase is sometimes called the "internal" phase, while, for the same reason, the containing medium is known as the "external" phase.

For example, foam is a colloid having its dispersed or internal phase as a gas, whilst its external or continuous phase is a liquid. A fog has its internal or dispersed phase as a liquid, whilst its external or continuous phase is a gas. The exact opposite to foam. An emulsion, say of cod-liver oil, has a liquid as its external phase, and another immiscible liquid as its internal phase. Where solid particles are suspended in a liquid the colloid is a "suspensoid." Where one liquid is suspended in another, the resulting colloid is called an "emulsoid."

*Adsorption.*—Colloidal particles, however small, have a surface which is in contact with the medium that surrounds them. The smaller the particle the greater the surface in proportion. If these colloidal particles are immersed in a solution containing electrically-charged ions, and if such ions are deposited on the surface of the particle, the process is known as "adsorption." According to Bayliss, the pull exerted by a muscle when it enters into activity is due to the adsorption of lactic acid or its ions at the boundary surface between some longitudinal fibrillæ and the sarcoplasm. Adsorption explains the action of certain drugs which do not enter the cell, but are deposited on the surface of the cell wall and act from that situation. As Bayliss points out, muscarine and pilocarpine are inactive after they have actually entered the cells of the heart and intestine respectively. There is evidence that potassium and calcium exert their influence from the outside only.

Now this phenomenon of adsorption has

a most important bearing on the action of mineral waters when taken internally. As already pointed out, a mineral water has its salts diffused in an electrostatic field, and in the majority of instances mineral waters are colloids themselves. The effect of a mineral water is no doubt brought about by the neutralization of charges carried by its ions as against those carried by the particles of the tissue colloids, or vice versa.

From what has been briefly referred to, it will be readily understood that the action of a mineral water on the bodily economy is largely a question of the multiplicity of its contained ions and their relative proportion rather than the actual concentration of the solution.

It will be remembered that in the employment of solutions for ionic medication, comparatively weak solutions are used because increasing the degree of concentration causes no appreciable increase in the absorption of ions.

#### TYPES OF BRITISH NATURAL MINERAL WATERS.

There are five types of mineral water found in this country which are classified as:—

- (1) Simple thermal waters.
- (2) Saline waters.
- (3) Sulphur waters.
- (4) Chalybeate waters.
- (5) Bromo-iodine water.

(1) *Simple Thermal Waters.*—These are characterized by low mineralization, relative excess of calcium ions. Temperature varies between 120° and 82° F. They are radioactive in varying degree.

Taken internally, they are diuretic. Mainly employed for bathing purposes. Chief therapeutic indications: Gouty states, stiffened joints following arthritis, fibrositis of either muscle or nerve sheaths. Examples, BATH and BUXTON.

(2) *Saline Waters.*—Saline waters of this country are all cold. They are divided into three groups.

- (a) *Muriated*.—Contain sodium and chloride ions in large concentration. In some cases up to ten times that of sea water.

These waters are only used for bathing purposes. Brine baths have a very extended use in fibrositis and stiffened joints.

Example : DROITWICH.

- (b) *Muriated Sulphated*.—Contain, in addition to the above, magnesia and sulphate ions. Internally, they are mildly purgative and diuretic, and are indicated in various metabolic disorders associated with middle life.

Examples : CHELTENHAM and LEAMINGTON SPA.

- (c) *Muriated Alkaline*.—Contains carbonate in addition to sodium and chloride ions. Indicated in gastric disorders and chololithiasis.

Only example in the country, CHELTENHAM (Pittville).

- (3) *Sulphur Waters*.—All cold at their source, in this country, but usually warmed for drinking purposes. There are two kinds, saline and alkaline.

- (a) *Saline Sulphur Waters*.—These contain sodium and chloride ions in excess. In addition, there are calcium, magnesium, carbonate and sulphide ions with sulphurated hydrogen in varying amounts.

Sulphur waters are mostly hypertonic and therefore purgative. They have a distinct value in the treatment of metabolic errors due to carelessness in diet and habits. They are also indicated in cases of gouty fibrositis and neuritis.

Examples : HARROGATE, LLANDRINDOD WELLS, STRATHPEFFER.

- (b) *Alkaline Sulphur Waters*.—Contain, in addition to the above, a relatively large concentration of carbonate

ions. Springs of this kind are mostly used for bathing purposes.

Example : HARROGATE.

- (4) *Chalybeate Waters*.—Two kinds, saline iron and pure chalybeate.

- (a) *Saline Iron*.—Contain chloride and carbonate ions ; used as a tonic and mild aperient.

Example : HARROGATE.

- (b) *Pure Chalybeate*.—These contain a relatively large proportion of iron ions. Springs of this kind are to be found at *Buxton, Harrogate, Llandrindod, Strathpeffer, Trefriw, &c.* Chalybeate springs are extremely common all over the country.

- (5) *Bromo-iodine Waters*.—Contain the ions of bromine, iodine, sodium, chloride, calcium and magnesium.

Cases of arthritis associated with pelvic conditions derive great benefit. A local application in the shape of the "mother lye" obtained from the well is employed with marked success in the treatment of various female chronic pelvic inflammations.

Only example : WOODHALL SPA.

#### GENERAL CONSIDERATIONS.

In the selection of a spa the question of situation and altitude is often of equal importance to the actual composition of the waters. The physiological effects of an immersion or massage douche bath are vastly different when taken at say, 50 ft. above sea level as compared with 1,000 ft. Temporarily the effect of a climate can be accurately reproduced by a bath, and in the same manner the sedative or stimulating effects of a bath can be increased or diminished by the atmospheric conditions under which it is given. Stimulating baths in a highly bracing atmosphere are apt to be followed by a greater reaction than would be expected from similar baths under more relaxing conditions.

The British spas can be divided into three categories :—

- (1) Those of a frankly tonic or bracing character, such as Buxton and Harrogate ; (2) those whose action is mainly sedative, which would include Bath, Cheltenham, Leamington and Droitwich ; (3) those which to some extent partake of the character of each, as exemplified by Strathspeffer, Lltadrindod, Trefriw and Woodhall Spa.

The great majority of patients who frequent spas are either of middle or beyond it, and their recuperative powers are a diminishing quantity. Although the course of treatment as usually prescribed at the more bracing or "tonic" spas is a powerful stimulant to the general bodily metabolism, a stimulus of this kind can quite well be overdone.

Over-exhaustion in young people with resilient blood-vessels is quickly recovered from, but it is a very different story where older people with hardening arteries are concerned.

The resumption of the ordinary habits of life on the part of, say, a business man who has undergone three to four weeks' treatment at one of the more stimulating spas, is apt to be followed by a period of exhaustion and complaints that no benefit has accrued, particularly when the resumption of ordinary habits has been too sudden. For this reason an "after cure" is generally recommended, and as the main feature of the after cure is rest, it matters little whether it takes place in the spa where the chief part of the treatment has been undergone or elsewhere.

In conclusion, it must be remembered that the concept of the unity or "wholeness" of the living organism, human or otherwise, is of paramount importance. The ideal of spa treatment should be the promotion of that unity, and it can best be attained by a combination of all methods of treatment which, by improving the environment, will favour the restoration of normal functioning.

## POST-GRADUATE NEWS.

SEVERAL courses have been arranged to be held during May at the various general and special hospitals associated with the Fellowship of Medicine.

Special attention is drawn to the M.R.C.P. Evening Course which begins on May 13 and continues until July 4. The complete syllabus of this course was printed in last month's issue of this Journal. The course will consist of seventeen lectures on Diseases of the Brain, Nervous System, Heart, Blood, Kidneys, Alimentary System, Spleen and Bio-chemical Methods. Well-known authorities will be participating in the course, and the fees are 10s. 6d. per lecture, or £6 6s. for the series of seventeen lectures. In addition to the lectures, two demonstrations of the Fundus Oculi (classes limited) will be given, fees 10s. 6d. each demonstration.

From May 5 to May 31, an afternoon and evening course will be given at the London School of Dermatology (St. John's Hospital). This course consists of Clinical Instruction in the Out-patient Department with lectures on certain days in the week, for which the fee is £1 1s. A course in Practical Pathology can be arranged at the fee of £4 4s.

From May 12 to May 24 a course in Diseases of the Heart and Lungs will be given at the City of London Hospital, Victoria Park. Fee for this course is £2 2s.

A four weeks' afternoon course in Ophthalmology will take place at the Central London Ophthalmic Hospital from May 19. Lecture-demonstrations will be given daily, in addition to the clinical practice of the hospital. Fee £3 3s.

A comprehensive morning course will be undertaken by the Staff at the Hospital for Sick Children, from May 26 to June 7. The minimum entry for the course is twelve,