Durham¹² showed that the saccharose-splitting variety of the *B. coli*—the *B. coli communior*—may be agglutinated by the serum of an animal immunized against a strain of the *B. coli communis*, whilst the serum may have no action on other strains of the *B. coli*, even although they are culturally identical with the one used to produce the serum. Torrey¹³ also found, in his study of dysentery bacilli, that organisms acting in a different manner on the various sugars might have an agglutinable substance which was identical. Twort¹⁴ and Penfold¹⁵ have also shown that when the *B. typhosus* has been made to ferment lactose, no alteration in its agglutinable properties occurs.

The other fermentative characters of this bacillus were as follows:

At 37° C. mannite and maltose were fermented with the production of acid and a small amount of gas, whilst salicin, saccharose, and glucose showed acid formation alone. At 22° C., with mannite, maltose and salicin, acid and much gas were produced, with glucose and saccharose acid only. In the case of lactose gas was formed only at the end of eight days. Glucose neutral red agar shake cultures showed no fluorescence and no gas formation. In the fermentation experiments Durham's tubes were at first used, but in many cases the amount of gas formed was too small to be detected by their use. Agar and gelatine shake cultures were then used. We may state that typhoid serum had no action on this bacillus, and its homologous serum had no action on the *B. typhosus*.

To sum up, then, we have a bacillus which was isolated from a former typhoid carrier, and which formed acid but no gas in glucose media, and which fermented lactose at 22° C. but not at 37° C. In not developing gas in glucose media but forming some from mannite it resembles certain colon bacilli of the "anaerogenes" class previously described by me,¹⁶ and which form connecting links between the *B. coli* and the *B. typhosus* group of micro-organisms.

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THE THERAPEUTIC ADVANTAGES OF USING MERCURY IN THE COLLOID FORM.

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For a long time mercury has held a very important place in the list of drugs. So valuable has it been in the treatment of syphilitic disorders that it has been recognized till quite recently as the specific drug *par excellence*.

The only difference of opinion with regard to mercury seems to be not as to its value, but as to the best method of administering it.

There are many methods of using the drug—such as inunction, fumigation, baths, endermically (by dusting), hypodermically, inhalations, and per rectum—and the mere fact that so many methods have been tried is evidence not only of a praiseworthy determination, but also that each method has some unfortunate disadvantage.

To introduce a method that diminishes the disadvantages, but at the same time destroys the value of the drug, is waste of time; but if one can suggest a form of administering the drug which possesses advantages over all the others, and at the same time is *minus* most, if not all, their disadvantages, one is, I venture to think, justified in making it public.

The form of mercury that is, in my opinion, worthy of such justification is hydrargyrum colloidalis, or colloid mercury.

The subject of colloids is one that has become of great interest during the last few years, and is one that is worthy of great attention and much study.

In the *Practitioner* for September of this year I made an attempt to point out the part played by colloids in physiology and pathology, and, imperfect and incomplete as is that attempt, it is sufficient, I think, to show how great are the possibilities of the subject.

The term "colloid" was first suggested by Graham

about 1861, but is employed now in a sense somewhat different from that in which he used it. At present the term "colloid" refers not so much to a certain class of substances, but rather to a condition which a large number of chemical compounds may assume more or less readily.

One great characteristic of colloids is that the substance forming the "solution" is unable to pass through an animal or vegetable membrane—that is, a dialyser.

Colloids are classified as reversible and irreversible. By reversible we mean those colloids whose solutions leave a residue soluble in water when desiccated at the ordinary temperature, and by irreversible those that yield an insoluble residue.

As examples of reversible we have dextrin, gum arabic, many albumens, isinglass, etc.; whilst the colloidal metals are irreversible. If solutions of reversible are added to those of irreversible colloids the latter may become reversible, in which case they are often protected against precipitation by salts.

In this way is explained the great value of adding gum arabic or barley water to milk in order to prevent the coagulation of casein—at least, in huge masses.

Colloid mercury, therefore, comes under the heading of "irreversible colloids."

Colloidal solutions of the heavy metals are prepared by passing a suitable electric current through water in which the metal is suspended, when particles of the metal are torn off in such a fine state of division that they do not subside on standing for months.

The solution appears homogeneous under the microscope, though the presence of the particles are readily demonstrated by means of the ultra-microscope. The metallic solution passes through filter paper, but has no osmotic pressure; the freezing and boiling points are those of water.

When a colloid such as colloid mercury has separated out, it is quite impossible to restore it to the original condition by any mechanical means (as one does with suspensions), because the separation is due to an irreversible change which is described as coagulation.

In order to convert this separated mass into the colloid form again one must employ chemical or electrical energy, and naturally when coagulation occurs energy in the form of heat is given off. The importance of this statement is very great, as it means that the energy in the case of colloids is kinetic, whence the value of such a drug as colloid mercury.

The kinetic energy of a drug such as colloid mercury is closely associated with the surface tension of its ultra-microscopic particles. On the surface of a round body like a blood corpuscle floating in a liquid there is a practically constant surface tension which is necessary for its life, and any interference with that surface tension interferes with the life not only of the corpuscle, but also of the whole body.

The same remark applies to the various micro-organisms, which have their own special surface tensions, and require such pabulum as is consistent with the maintenance of that surface tension.

Around the ultramicroscopic particles of a colloid solution is a certain definite surface tension, and the introduction of electrical

energy has the effect of increasing the surface tension by diminishing the size of the particles, but at the same time increasing the surface area. The mixing of two colloids may have the effect of causing such a great interference with the surface tensions of the particles of both as to cause coagulation.

The meeting of colloids with, say, cocci or corpuscles has exactly the same effect

—namely, an alteration of the surface tension—and consequently the life of the cocci or corpuscles is affected.

To appreciate this statement to the full one is helped by a glance at the diagram, where *c* and *p* represent the relative sizes of cocci and ultramicroscopic particles.

Like as the faintest suspicion of a touch destroys a bubble, so does the presence of these minute particles affect the surface of the cocci, with perhaps not quite so dramatic a result.

Disease affects the colloidal contents of the blood serum, rendering it possible for the micro-organisms to thrive by adapting their life or surface tension to the new conditions, and the object of giving drugs is so to alter the colloidal state or surface tension of the serum as to make it incompatible for the micro-organisms or the inimical enzymes to survive.

En passant one may remark that the enzymes are all colloidal.

The value of the calcium salts, such as the chloride, iodide or permanganate, is due to the fact that they stimulate the leucocytes to increased work in the form of phagocytic action, a result produced by altering or affecting the surface tension.

With the object of testing the effect of colloidal mercury on micro-organisms, some experiments were carried out for me at the laboratory of Mr. Seyler, county analyst for Glamorgan, and it was found that 1 in 1,000 of a 1 per cent. solution of colloidal mercury supplied by Merck stopped the growth of the *Bacillus coli communis* on agar, which means that 1 in 100,000 of the drug was effective.

In colloidal mercury we have, therefore, a very powerful antiseptic. A 1 per cent. solution of hydrargyrum colloidalis is a greenish-brown transparent liquid, without any smell, but has a faint metallic taste. It is non-irritant, non-corrosive, and relatively non-toxic. As a drug it can be used both externally and internally. Externally it has a very good cleansing effect on wounds, when applied in solutions of $\frac{1}{2}$ to $\frac{1}{4}$ per cent.

In ringworm of both the large and small spored varieties, as well as in two cases of alopecia areata, colloidal mercury has been very beneficial.

In these cases my rule has been to remove the grease on the scalp with petrol before applying the drug, otherwise it has no opportunity of coming into close enough contact with the disease.

As a mouth wash mercury in this form is very effective in very filthy states of the mouth, whilst as a spray its effect has been extremely good. In typical diphtheria cases a few applications of the spray have produced an effect almost as rapid and satisfactory as that following the injection of antitoxin. For tonsillar patches of all sorts it is of extreme value, though for mere redness or inflammation of the tonsils and pharynx it is not quite so effective.

Administered internally it is of value in acute gastritis, either of babies, children, or adults. I usually prescribe for babies 3 minims of the 1 per cent. solution to a drachm of water, and for adults 20 to 30 minims. The ease of administration compares favourably with that of, say, grey powder.

It is in syphilitic cases, however, that the great advantage of colloidal mercury is seen. I have not seen any unpleasant symptoms, such as salivation, sickness, or distaste for food, but in one patient who was taking 6 drachms daily the bowels were evacuated too freely until the dose was reduced by half.

One patient who came to me in the first stage of the disease with a hard sore on the dorsum penis was able, after taking the drug for twelve months, to state a complete freedom from rashes or sore throat.

Patients with secondary rashes have responded well and readily to the treatment, but the best or most striking effects have been in cases generally reserved for the iodide of potassium or calcium.

A long-standing tertiary infiltration or inflammation of the scalp had resisted all attempts to remove it. Potassium iodide was impossible on account of the coryzal symptoms, and although calcium iodide was easily taken without any unpleasant effects, the result was not satisfactory. After four weeks' treatment with colloidal mercury the scalp and forehead began to clear rapidly, and at the end of ten weeks the patient was quite free.

In this case the dose was 6 drachms daily.

Another case was that of a soldier who had contracted the disease in India, and presented tertiary sores of a very troublesome and unpleasant nature. Colloid mercury was applied

locally and given internally, with rapid and very satisfactory results, although all other previous attempts had completely failed.

An interesting case of locomotor ataxia, seen also by a well-known brain specialist, who suggested the daily application of blue ointment to the spine, was placed by me on colloidal mercury, with a most satisfactory result. The bladder trouble has disappeared and the shooting pains down the legs are less severe and less frequent.

A case of spastic paraplegia, however, quite failed to take the drug even in the smallest doses, on account of the severe "depression" it produced.

Organic nervous lesions which fall into the category of syphilides respond to a certain degree to the internal administration of colloid mercury, but the other organic nervous lesions do not respond at all.

THE ETIOLOGY OF IRITIS.

BY

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In a leading article in the *BRITISH MEDICAL JOURNAL* of July 16th last, my opinion that rheumatic iritis is a very rare disease is referred to, and I am rightly quoted as holding an extreme view. Mr. C. W. Jennings, of Philadelphia, on the other hand, believes that it is a common disease. This divergence of opinion is probably due to a difference of diagnosis rather than to a difference in the incidence of the disease. It is extremely unlikely that certain forms of iritis are more prevalent, to any considerable extent, in some countries than they are in others, and it is much more probable that the explanation is to be found in the grouping and labelling—that is, in the personal equation. Critical inquiry in many cases will, I believe, show that the "rheumatism" which produces rheumatic iritis is not true rheumatism, but a gonococcal or other toxæmic infection. No one now, I suppose, believes in gonorrhoeal rheumatism, the vestigial term remains as a mere *façon de parler*; but we all accept the fact of a gonorrhoeal arthritis. We still make use of the antiquated term much in the same way as we still call our bronze ha'pence "coppers." We can, if we like, keep our strychnine in a sulphate of magnesia bottle, as long as we remember the fact. Nevertheless, there are manifest objections to doing so, and in like manner the sooner we get rid of the term "gonorrhoeal rheumatism" the better.

My views concerning the rareness of rheumatic iritis were published in the *BRITISH MEDICAL JOURNAL* (July, 1908), and I will not trouble you any further with them. With regard to the differential diagnosis of gonorrhoeal from other forms of toxæmic iritis, there is as yet no extensive literature, but the chief distinction seems to me to be that in the former the arthritic (or periartritic?) symptoms are more pronounced.

It has been, I think, too much the custom to classify all cases of iritis that are not obviously specific, or gonorrhoeal, or traumatic, or occurring in gouty patients, as rheumatic, including amongst them a number of cases due to various forms of toxæmic absorption. As time goes on we may expect a more limited definition of the term "acute rheumatism" than the present all-embracing one of a polyarticular synovitis with pyrexia; and when that time comes there will be a corresponding fission in the definition of rheumatic iritis.

From Mr. Kenneth Campbell's letter in the *BRITISH MEDICAL JOURNAL* of July 23rd, 1910, criticizing the leader above referred to, it is clear that he is not only a supporter of my view, but also that he goes a step further than I have ventured to go with regard to the existence of rheumatic iritis, for he excludes rheumatism absolutely as an etiological factor in iritis. In the present state of our knowledge I have not made this final renunciation, because careful observers say that they have seen cases as a result of chronic rheumatism, and cases are also reported as occurring in acute rheumatism. It is desirable that full details of all cases of iritis occurring during the acute stage of rheumatic fever should be recorded. It does not follow, because a patient has an intercurrent attack of iritis during rheumatic fever, that it is due to the same virus. Moreover, it may be that occasionally the arthritis is not rheumatic.