elongated as required. With the apparatus in rectilinear position (Fig. 1), it is possible to put the limb in extension, and to exercise upon it graduated traction with counter-pressure upon the ischium—as may also be obtained, of course, with other apparatus. For flexion, the appliance has an articulation corresponding to the knee-joint in such a manner that it may be easily transformed into a double-inclined plane (Fig. 2). The distance from the tuberosity of the ischium to the popliteal hollow becomes appreciably longer as the leg passes from the position of extension to that of flexion. In the medical literature of such appliances this fact has, so far as I am aware, not yet been noted, when it is necessary to accommodate the length of the appliance to the varying distance of the tuberosity of the ischium from the popliteal hollow.

The lateral splints supporting the femur and the leg, under the knee, are each semi-elliptically curved back below, and at the point of their lower junction is placed the axis around which the bending movement in adaptation to the knee-joint is produced. By means of this arrangement an elongation of the femoral part of the apparatus follows automatically the process of flexion.

When, as a consequence of flexion, the upper posterior arc, on being lowered, loses contact with its point of pressure upon the ischium, it is necessary, in order to maintain this contact, that the upper support of the apparatus should be capable of being either lengthened or shortened, at will, according to the degree of flexion. Of course, in case of fractures necessitating the abduction of the limb the apparatus must be placed in this position. By transverse tractors attached to the splints, it is possible to modify, when required, the position of the fragments.

If when the limb is in flexion traction is to be exercised upon the femur, another arc may be added to the apparatus, securely fixed in axial prolongation on the two femoral splints (Fig. 3). In applying elastic traction (dynamometer), which in the flexed position of the limb can be moderated, the counter-pressure is always upon the tuberosity of the ischium. Different tractions can also be simultaneously applied on the leg. With this apparatus it is possible to treat fractures in suspension and in different positions of the limb. Free access to wounds and adjacent regions is given; movement of the knee and massage of soft parts are also possible, the fracture remaining fixed. Removal of the patient also is rendered easier. For longer journeys a better immobilization can be obtained by applying a long splint from the armpit to the foot, and by securing the splint to the apparatus and to the thorax.

The application of this apparatus is not possible when there are lesions in the region of the ischium.

GLYCERINE AND ANTISEPTICS.

BY

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AN interesting note in the BRITISH MEDICAL JOURNAL of May 5th, pointing out the possibility of using substitutes for glycerine for some purposes, in view of the great scarcity of this drug, makes it desirable to publish some of my recent experimental results, which show that its presence more or less completely destroys the antiseptic power of such useful substances as thymol, phenol, boracic acid, mercuric chloride, etc., in aqueous solution.

It is a well-known fact that many antiseptics, inorganic as well as organic, are much more soluble in glycerine than in water.

Approximate Solubility at Ordinary Temperatures.

Thymol: 0.06 per cent. in water; 0.526 per cent. in glycerine.

Phenol: 7.7 per cent. in water; 350 per cent. in glycerine.

Mercuric chloride: 5.26 per cent. in water; 61.5 per cent. in glycerine.

Boracic acid: 4 per cent. in water; 25 per cent. in glycerine.

There is therefore no doubt that in a mixture of water and glycerine more of the above substances will dissolve than in pure water; for example, in a mixture of equal volumes of water and glycerine about five times as much thymol will dissolve as in pure water. However, the

resulting solution has no better antiseptic power than the aqueous solution containing only a fraction of the amount of thymol, as already recorded in my recent paper on mouth-washes. The same is the case with boracic acid: a saturated solution in water will kill all the organisms in a thin film of *Staphylococcus pyogenes aureus* in just over one hour, whereas a saturated solution in water and glycerine containing more than four times as much boracic acid requires about six hours.

Hitherto it appears to have been assumed by pharmacologists that solutions in glycerine were necessarily more antiseptic than the more dilute aqueous solution, and further, statements such as the following, are liable to be misleading: "Glycerine is largely used in pharmaceutical preparations as a solvent, and, being an antiseptic, it also acts as a preservative." (Squire, 1916, p. 658.) It was Sternberg who included glycerine, up to 1 in 4 dilutions, among feeble antiseptics, but, as shown below, even water compares well in disinfecting power with 50 per cent. glycerine. Pure glycerine easily kills protozoa and other animals, but here it acts by osmosis, for it is well known to extract water from tissues. Many bacteria are much less susceptible to fatal effects from drying, and may consequently remain alive in glycerine for hours. Dilute solutions are not even preservative; in fact, up to 8 per cent., glycerine is so beneficial to certain bacteria as to be added to media for growing them.

The experiments mentioned below were carried out in the same way as those described in my recent paper in this JOURNAL (April 14th), but with a standard culture of *S. pyogenes aureus*. The glycerine used was in the liquid form (specific gravity 1.26), pure and perfectly sterile.

To destroy all the organisms on a cover-slip film pure glycerine required approximately eight hours; mixed with water in equal volume it required more than twenty-four hours, after these hours giving considerably more growth than the control which had been in tap-water for the same time. For the following experiments a stock solution of the antiseptic was made in water, and this was diluted as required with an equal volume of water or glycerine:

Times required to Destroy all the Individuals from a Standard Culture of S. pyogenes aureus Contained on a Thin Film on a Coverglass.

Phenol:

3.3 per cent. solution in water required less than $\frac{1}{4}$ minute.
3.3 per cent. solution in water and glycerine required more than 1 minute (between 1 and 5).

Mercuric Chloride:

0.005 per cent. solution in water required approximately $\frac{1}{4}$ minute.
0.005 per cent. solution in water and glycerine required more than $\frac{1}{4}$ minute.

Boracic Acid:

A saturated solution (4 per cent.) in water required approximately 65 minutes.
A half-saturated solution (2 per cent.) in water required approximately 285 minutes.
A 2 per cent. solution in water and glycerine required more than 480 minutes.

Thymol:

A saturated solution (0.06 per cent.) in water required $\frac{1}{4}$ minute.
A half-saturated solution (0.03 per cent.) in water required 12 $\frac{1}{2}$ minutes.
A 0.03 per cent. solution in water and glycerine required more than 300 minutes.

In the case of thymol and *S. pyogenes aureus* the value of the constant in the logarithmic relation existing between the time required for disinfection and concentration, as given by H. E. Watson, is 5.6. This is almost exactly the same as that for phenol and *S. pyogenes aureus*, calculated from H. Chick's results, obtained in an entirely different way. However, the discussion of methods, etc., must be deferred and published with the graphs representing the variations in times required for disinfection with concentrations of these antiseptics; especially interesting are those showing the interference of glycerine and other solvents.

The theory underlying the action of glycerine is most interesting; possibly the glycerine merely acts as oil is supposed to act in the case of carbolic acid—that is, being a better solvent for the antiseptic, the latter does not diffuse so easily from the solution into the watery protoplasm. However, in some ways this explanation is unsatisfactory, and the fact that glycerine diminishes the

action of aqueous mercury perchloride solutions suggests that, like alcohol, it does so by diminishing dissociation. There seems to be some difference of opinion about the dielectric constant of glycerine, but probably it is less than that of alcohol (25), so that it would as a solvent have even less dissociating power. As far as I know, it is not generally considered, in the case of such substances as phenol with small dissociation constants, that the antiseptic properties of the solutions rest in the ions; but that such is the case is the most likely explanation which I can at present bring forward to account for the above results.

Whatever the theoretical explanation, however, it is quite clear that in practice it is more than useless to waste glycerine by using it as a solvent for antiseptics, and surely such preparations as glycerine of phenol and glycerine of boric acid should be omitted from the *British Pharmacopoeia*. Probably, in any cases where thymol solutions have been found to be unsatisfactory as mouth-washes, the failure is due to the presence of glycerine in them, as in many proprietary mouth-washes in common use.

COLLOIDS IN SYPHILIS.

BY

J. E. R. McDONAGH, F.R.C.S.

BEFORE a drug can exert its full therapeutic action it is necessary for it to become converted into the colloidal state. What this means precisely can be explained best in the following way: When a disease such as syphilis attacks the human body it always meets with a certain amount of resistance on the part of the host, whose main protective substance—or antibody as it is called—is the protein in the serum. The protein in the serum is in a colloidal state—that is to say, it appears in the form of particles, which possess Brownian movement and resemble bacteria when examined under the ultramicroscope. These colloidal protein particles kill the parasites by a surface action in which oxidation and reduction play a part. When a drug is prescribed it does not exist in the serum in the state in which it was injected; it first becomes converted into the colloidal state, in which form only can it be taken up by the colloidal protein particles. When adsorbed the drug stimulates and accelerates the destructive action of the protein particles. It can readily be understood that if a drug is administered in the colloidal form no energy is wasted in converting it into the colloidal state; that relatively and actually very much larger quantities can be adsorbed, whereby the therapeutic action is enormously enhanced; and that the chances of storage in the system are minimized, with the result that toxic action is practically done away with.

It has been shown that in syphilis the protein particles in the serum are more numerous and bigger than in other diseases; consequently, when a colloid is injected more of it is taken up, and this is why colloids have so great a therapeutic action in syphilis. The first effect of injecting a colloid is to break up the large protein particles into several small ones, an action which increases their activity, since the area exposed by several small particles is very much greater than the area exposed by one large particle. In syphilis there are many large particles to be broken up; hence the reason why any colloid is of therapeutic value in this disease. The injection of a colloid does more than merely break up the large protein particles; if it is a metallic colloid, it increases oxidation; if it is a non-metallic colloid, it increases reduction. As the oxidation process *in corpore* is regulated by iron, attempts have been made to prepare a colloidal iron compound to replace arsenic, which, being a metal not a normal constituent of the body cells, is apt to be toxic. The best colloidal iron compound so far prepared is ferric tri-para-amino sulphonate, ferric sulphanilate, or ferrivine. Although ferrivine is not so powerful as arseno-benzene, it has a greater effect on some lesions, and better results are obtainable when injections of different and not of the same oxidizing agent are used. Mercury, being a metal, behaves in the same way as iron and arsenic, but, like the latter, not being a normal constituent of the body cells, it is liable to be toxic. Comparing mercury and arsenic still further, we find that the toxic action of the former is less than that of the latter,

because mercury does not show such a great affinity for nerve tissue as does arsenic. As arseno-benzene is administered, namely, as a salt, it is not in the best colloidal form possible; consequently the occurrence of toxic symptoms following the injection of the organic preparations of arsenic now in use can never be entirely eliminated. Mercury can be prepared in a perfect colloidal state, in which form it can be injected intravenously and intramuscularly with impunity and with extraordinarily good results.

Colloidal mercury, ferrivine, and arseno-benzene give us three oxidizing agents, and thus help us to diminish the amount of arsenic. As oxidation and reduction go hand in hand, it is necessary to combine drugs which have an oxidizing action with those which have a reducing action, as the continued use of one kind is detrimental to the patient; finally the deleterious action of an oxidizing agent can be overcome by the employment of a reducing agent. The two reducing agents I employ in syphilis are iodine and sulphur. In view of the importance of the colloidal state iodine can now be prescribed as a simple colloid intravenously and by the mouth. Collosol iodine is not only more powerful than any salt or organic compound, but it is practically never followed by iodism. Sulphur is now obtainable as a simple colloid and as a complex colloid, the activity of the latter being very much greater than that of the former. The complex sulphur colloid I use is di-ortho-amino-thio-benzene or intramine; it can be injected intravenously, intramuscularly, or taken internally; it has a very powerful therapeutic action in syphilis and in other chronic diseases; it is also a specific for mercurialism and arsenical poisoning, and its reducing action is much stronger than that of iodine.

Colloids are best injected intravenously, because means have not yet been found for entirely eliminating the pain which accompanies intramuscular injections. Injection for injection, the therapeutic action is greater when the intramuscular route is chosen, presumably because the drug can be converted *in loco* into the most suitable form to be adsorbed by the protein particles of the serum, without the latter having to be disturbed.

[We have received a report of observations by Professors W. J. Simpson and R. T. Hewlett in continuance of those published in the *JOURNAL* of May 5th, p. 585. Experiments were made with a fresh sterilized sample of collosol cocaine prepared in the Crookes Laboratories. The first experiment for toxicity was made upon a rabbit weighing 2,050 grams; the amount of the solution, 1 per cent. injected intravenously, was 19.5 c.cm. No toxic effect was produced. Two tests for anaesthesia were made. In the first 0.5 c.cm. was injected subcutaneously in a rabbit at 2.36 p.m. Two minutes later the area of injection was slightly insensitive; at 2.39 it was quite insensitive, and so continued until 2.55; sensation was returning at 3 p.m. and was completely restored by 3.30. In the second test 0.25 c.cm. was dropped in two equal parts into the eye of a rabbit at intervals of three minutes—at 2.37 and 2.40 p.m. From 2.44 to 2.55 the eye was quite insensitive. At 3 p.m. sensation was returning, and at 3.15 it was practically restored.]

Mr. Lewis Stroud, the Secretary of the Crookes Laboratories (50, Elgin Crescent, W.11) informs us that since the publication of our note upon it, the preparation of colloid quinine has been improved by increasing its stability and decreasing its toxicity. A combined colloidal antimony and quinine has also been prepared, and Professors Simpson and Hewlett have reported that the intravenous injection of 9 c.cm. into a rabbit produced no effect.]

At a recent meeting of the New York State Committee of American Physicians for Medical Preparedness resolutions were adopted that the committee should protect in every possible way the public posts and private practices of doctors who volunteer or are called up for military service during the present war.

At a meeting of the Society of Public Analysts on May 2nd a short paper on two cases of opium poisoning was read by Mr. John Webster, F.I.C. One was a case in which a single dose had been taken; the other was that of a confirmed drug-taker. Chemical analysis of the viscera from the first case gave strong reactions indicating the presence of morphine in fair quantity. In the second case the reactions were slight, or even doubtful.