

ON THE INJECTION OF LYMPHATICS BY PRUSSIAN BLUE.

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THE following communication on the injection of lymphatics is confined to a statement of our own experience of the method of Gerota and certain modifications of the method which have been useful to us.

Gerota's Method.—Gerota injected Prussian blue, cinnabar, and absolute black by means of a small syringe (*Rekordspritze*) fitted with a glass needle. The formula given for the preparation of the Prussian blue mass is:—

Prussian blue oil colour in tubes	2 parts.
Spirit of turpentine	3 „
Ether	15 „

The blue and the turpentine are ground together in a china mortar, and the ether is added. The mass is filtered through double linen.

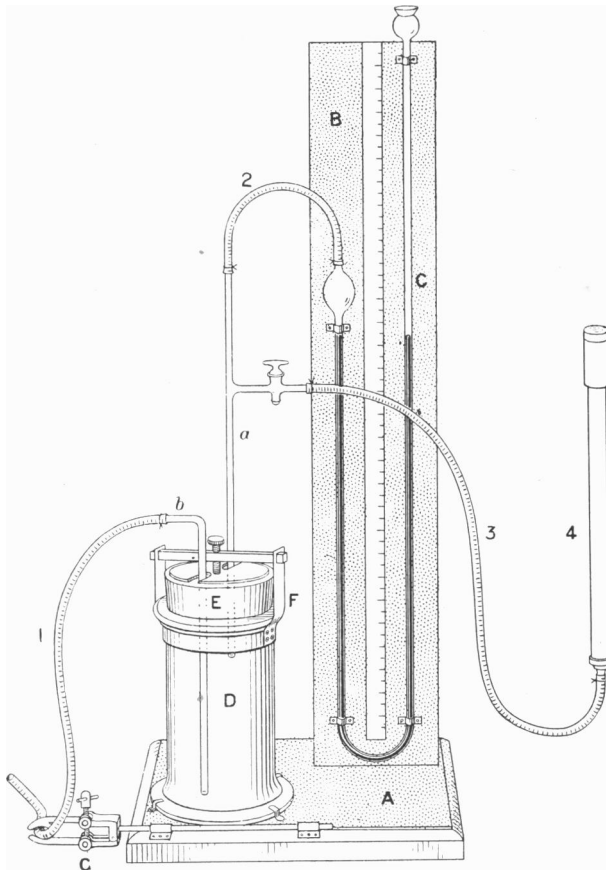
The Injection Mass.—We have used a large number of colours, but as none of them are as good as Prussian blue and as one colour is sufficient for purposes of research, we have not persisted in the use of the others. The substances which promised the best results are the oil-colours, oil-black, oil-scarlet, etc. In the preparation of the blue mass, methylated ether is used, and the proportion of 15 parts to 2 of blue may be reduced or increased according as the specimen takes the injection well or badly.

The mass is most easily made by shaking the ingredients together in a bottle for a few minutes and filtering it through a plug of cotton wool in the neck of a glass funnel: the mortar appears to us to be quite unnecessary. If it is intended that the injection shall travel far, as in injecting the thoracic duct of a foetus from the testicle, the proportion of turpentine is increased with advantage.

Needle.—The glass needle was discarded very shortly after we began to prepare specimens. There does not seem, after careful comparison of results, to be any point in which it is better than a metal needle. The metal needle has saved us much trouble, time, and material. We use the platino-iridium variety.

Pump.—A syringe, however well made, has many drawbacks. It monopolises and tires one hand in a long injection; it requires constant refilling; it is often difficult to insert the needle in the required direction;

and it is difficult if not impossible to maintain the pressure which is best suited to the specimen. Its most important drawback is that the sediment of the injection mass collects in the nozzle of the syringe and blocks the needle. Blocking of the needle is the most irritating and time-wasting



Injection of lymphatics.

A, wooden base 9 in. by 5 in.; B, wooden upright 30 in. by 4 in.; C, mercurial manometer; D, glass jar 6 in. or 7 in. high, 3 in. inside diameter; E, india-rubber plug; F, brass clamp with plate and screw; G, clamp for needle tube; a, glass tube with T-piece and stopcock; b, glass outlet tube; 1, 2, 3, pressure tubing; 4, any kind of air-pump.

difficulty with which we have to contend in the injection of lymphatics, and since we gave up using a syringe we have not only saved a vast amount of time, but the process is altogether more satisfactory.

By the use of the apparatus, of which a drawing and specification are appended, the pressure is regulated and maintained at the point best suited

to the specimen; the needle on the end of a long tube is inserted with ease in any direction; the hands are free to manipulate and massage the specimen; there is a large reservoir of injection mass; *and the sediment collecting on the bottom of the jar rarely blocks the needle.* Although some of our best specimens were injected by a syringe, and in the hands of others it has proved effective, we never use it now. The results with the apparatus cannot be said to be better, but are obtained much more quickly, and with far less trouble; and in the case of the great intestine we very much doubt whether with a syringe we could have injected the colon from end to end in a single specimen, as was often done with the apparatus.

Material.—Full-time fetuses are sufficient as material for showing the somatic lymphatics and those of the respiratory tract and genito-urinary organs, but are not very satisfactory for the vessels and glands of the alimentary canal in the abdomen. Material drawn from young subjects is the best for museum specimens of any kind. Good specimens may be obtained from old subjects, but the percentage of failures is very large whereas in fetuses and young subjects some result should generally be obtained. On the bodies of lower animals good results are the rule, so that such material is extremely useful for preparations to show the arrangement of plexuses and the appearance of vessels and glands. Whatever material is used it should not be subjected to the action of any kind of preservative before the injection is made. “Fresh” should be translated “unpreserved,” because decomposition as far as the limits of nasal endurance facilitates the flow of the injected fluid. The stage of rigor mortis should be carefully avoided: if a specimen is at all stiff it should be placed in plain water for a day or two. If a specimen does not take the injection well it should be set aside for another trial on a subsequent day. We have several good specimens in which injection totally failed at the first attempt.

Preparation of Specimens.—On this point we do not presume to say more than that all vessels should be followed up to their termination in glands, otherwise many “primary” glands are apt to be missed. Dissection, especially in fetuses, is necessarily tedious. Formalin is used in preference to other preservatives, as the bleaching of the tissues causes the injected vessels and glands to show more clearly. The specimen is placed in the formalin solution immediately after injection, and fixed in the position which will best display the injected area. Specimens may be mounted in any manner, but it is necessary to note that Prussian blue is apt to become decolorised by reduction. The colour is easily restored by exposure to air, or by washing the specimen in a solution of peroxide of hydrogen. We do not know of any method by which the original appearance of a specimen can be kept unimpaired. The injector alone sees the specimen at its best,

when the rapidly spreading plexus, the distended beaded vessels, and the swelling glands form a fascinating picture. Though the picture cannot be preserved undimmed, it is always a reward for the trouble involved, and an important stimulus to further work.

Method of using the Apparatus.—1. Having filtered the “mass” into the jar, the indiarubber cork is pushed in until the fluid runs out at the outlet tube, which is thus cleared of air and clamped. The cork is then screwed down, and the needle inserted into the end of the tube. Undo the clamp for a moment to clear the needle of air, and to see that the fluid flows through the needle.

2. Insert the needle into the tissue. Open the clamp and pump in air until the pressure is raised to the point when the fluid runs most easily. Then turn stopcock.

3. As soon as the plexus appears in subserous injections, or the blue blush which marks success in skin injections, massage the injected area gently to drive the fluid into the collecting vessels, and stroke the vessels in the direction of the flow.

4. When there is too much extravasation let down the pressure. As a rule 30 cm. of mercury will be found a safe starting-point.

5. To make a fresh puncture grasp the tube firmly behind the barrel of the needle, withdraw the needle, and re-insert: this requires practice.

6. When the injection is finished let down the pressure, and clamp the tube before taking the needle out of the tissue.

Method of making the Puncture.—For cutaneous lymphatics the needle “eye” is buried *in the dermis*: deeper puncture leads usually to mere extravasation. For the vessels of the alimentary canal in the abdomen and other serous-covered hollow organs, the needle point is driven into the subserous and submucous coats. For the deep lymphatics of any solid organ the needle is plunged into its substance. Nothing but practice can enable one to determine how to insert the needle so as to bring about the best result.