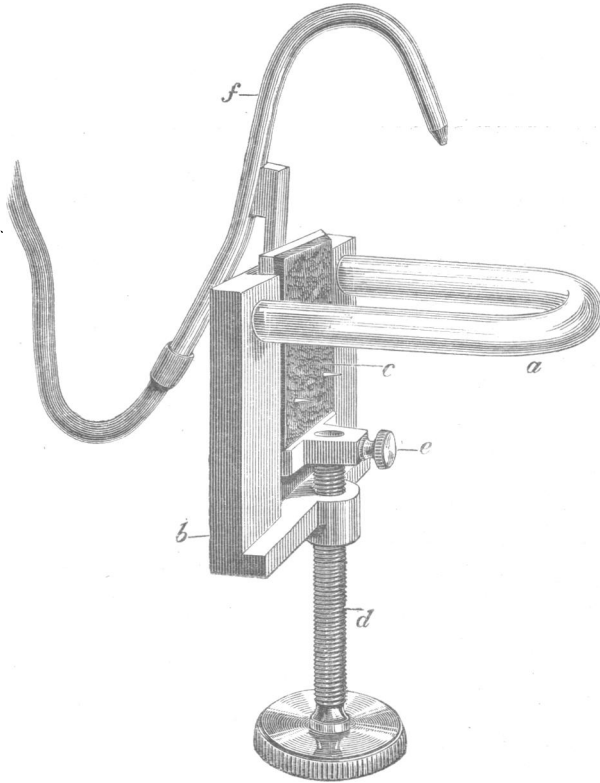


A NEW MICROTOME¹. BY CHARLES S. ROY, M.D.

WITH practice sections of hardened tissues sufficiently good for most purposes can be cut without the aid of a special instrument, while the increased accuracy attained by using a suitable microtome is often more than counterbalanced by the expenditure of time and trouble required when sections are cut with its help. This is more especially felt when, as is often the case in pathological work, a few sections are required from each of several different specimens, or from different parts of the same specimen. Here the time wasted in fixing the tissue to be cut in the instrument, in waiting till the imbedding mass has hardened, &c., is very often more than can conveniently be afforded. On this account not a few of the best histologists have rejected the use of a microtome in any of the numerous forms which have been given to it. The waste of time which is so often connected with the use of a section-cutter is, I believe, in a great measure avoided in the case of the instrument which is described in the following pages. It presents nothing new in principle, consisting, like most section-cutters, of a support for the knife or razor which is used to cut the tissue, and of a screw arrangement for moving the latter forwards. The object aimed at in planning it was to combine the accuracy gained by the use of a good microtome with the simplicity and convenience with which sections can be cut with the unsupported razor. I have employed it exclusively during the last two years for cutting sections both of hardened and of frozen specimens, and have had every reason to be satisfied with its accuracy and convenience of application.

A glance at the woodcut, where it is represented (natural size), will make the description readily intelligible. The horse-shoe shaped piece of glass rod (*a*) is intended to support and guide the knife or razor which is used for cutting, and which glides on the surface turned, in the figure, towards the observer. This glass rod is firmly fixed by its two extremities in the brass plate (*b*). The smaller brass plate *c*, on the upper surface of which a thin layer of cork is cemented, can be moved forward or backward by the fine-threaded screw *d*, movement

¹ This instrument was made for me by Mr Gardner, Instrument maker, South Bridge, Edinburgh.



in any other direction being prevented by the form of the bed which has been cut in the larger plate for its reception. The small thumb-screw *e* serves to connect the moveable plate with the end of the larger screw *d*, and admits of the plate being removed when desired.

Fastened underneath the larger plate in such a way that it can be readily removed and replaced is the bent brass tube *f*, which is intended to admit of a few drops or of a constant flow of spirit being projected on the knife and specimen while sections are being cut. This tube is connected with a test-tube arranged after the principle of a Wolff's bottle, and which can conveniently be suspended by a thread from the button-hole. A caoutchouc tube, with a mouth-piece of glass attached to it, permits of air being blown into the test-tube, forcing out a part of the contained spirit or water by the tube *f*.

The method of using the instrument is exceedingly simple. The portion of tissue to be cut is imbedded in an appropriate imbedding

mass, and is then placed upon the moveable plate *c*. Upon this it is held fixed by the thumb of the left hand, the index and middle fingers of which pass under the plate *b* and exert a counter pressure. Both the specimen and the microtome are thus held in the same manner as one holds the specimen when no section cutter is employed. The plate and imbedded specimen are pushed gradually forward by turning the milled head of the screw *d*.

The imbedding mass which I have mostly employed is the well-known mixture of white wax and olive oil (equal parts by weight for warm weather, with a larger proportion of oil during the winter months). Instead of the paper boxes, which are so often used for imbedding with this mixture, I prefer to employ small oblong moulds of zinc without bottoms. These, which are supplied along with the instrument, have the convenience of giving a cast suited to the size of the plate on which it is to rest. Into each of these moulds, of which a number corresponding with that of the specimens to be cut are placed upon the table, is poured a small quantity of the imbedding mixture, so as to form in each a layer some three or four millimeters in thickness. The wax and oil mixture should only be warmed up to the melting-point, or as little as possible above it. On this layer having hardened sufficiently, which takes place in one or two minutes, the specimens to be cut are placed upon it, one in each mould, and near one of its ends. More of the imbedding mixture is then poured in so that the tissue is covered by four or five millimeters of it. When hard, the cast, which is readily loosened by gently pressing together two opposite edges of the mould, is removed and placed on the moveable plate of the microtome, the end which contains the specimen (and which had been marked before the mixture hardened) being turned so as to lie between the parallel sides of the horse-shoe guide. It is usually advisable to cut away a part of the imbedding mass from one end of the mould, leaving only sufficient to support the tissue. In cutting, the edge of the razor must not, of course, be pushed so far as to come in contact with the cork plate on which the mould rests.

Whether a microtome be used or not, it is necessary, in order to obtain good sections, that the cutting instrument be sharp. I have used, and seen used, knives of many different shapes, but have never found any which, for ordinary daily work, could compare with a good razor; and the "*hollow ground army razor*," which was recommended to me by Dr Klein, possesses advantages over any others with which I am acquainted. It seems pretty generally believed that, when a microtome

is used, it is necessary to employ a straight knife whose edge and back run parallel. I have not found that this is by any means the case, the only precautions which are required with a razor being, that the position in which it is held must be as nearly as possible the same as each section is cut, and that the part of the edge of the razor which is used to cut, remain the same with every successive section. The form of knife used is, however, very much a matter of personal opinion or of practice, and the only reason why I prefer the razor to other knives is, that it can easily be kept sharp, or replaced at little cost, should anything happen to it.

In using some microtomes, more especially that of Stirling (modified by Rutherford), it is a by no means uncommon habit to press the knife against the brass plate with as much force as possible while sections are being cut. This is done under the impression that the knife is thereby held more steadily. The reason why such strong pressure on the knife has been found advantageous by some, apparently is, that too hard an imbedding mass has been employed, so that the blade of the knife, instead of being guided by the flat surface of the brass plate, or, in the case of my own instrument, of the parallel glass rods, was apt to be raised somewhat by the resistance of the wax and oil, or paraffin. I am convinced that, in order to obtain the maximum of steadiness and equality of pressure of the knife or razor while sections are being cut, it is advisable to maintain as light a pressure as possible—no more than is required to keep the edge and back in contact with the guide—and to avoid using too hard an imbedding mass. With the above-described microtome I have found it best, as already mentioned, to cut away with a scalpel as much of the imbedding mass lying above and at the sides of the specimen as can be dispensed with, without risk of making the imbedded tissue insecure. When sections are cut without a microtome, it is best that the imbedding mass be as nearly as possible of the same consistence as the imbedded tissue, since the former serves to support the knife somewhat as well as to fix the specimen. With a section-cutter it is different, all that is required of the imbedding medium being that it should be sufficiently firm to hold the specimen in the given position, and, this requirement being fulfilled, the softer it is the better, seeing that it is the less likely to turn aside the edge of the knife. It need scarcely be added, that with this microtome while imbedding is decidedly advantageous, giving, as it does, greater accuracy, it is by no means necessary any more than it is when no section-cutter is

employed. When the specimen is not imbedded, a tablet of wax, or of wax and oil is placed between the tissue and the cork plate, so that the edge of the razor may not come in contact with the latter.

This microtome is only fitted to give sections up to a given size, from one to one and a half centimeters square, which, it need scarcely be added, is as large as is usually required. When larger sections are desired, as is sometimes the case with the brain, it is necessary to employ a larger-sized microtome. For ordinary purposes the size represented in the figure is however more convenient.

When it is desired to cut sections of frozen tissues with this microtome several methods may be employed. With such specimens as are not affected seriously by ether, as with pulmonary tissue, skin, mucous membrane, &c., &c., ether spray may be conveniently used. A layer of elder pith having been gummed upon the cork plate, and the tissue to be cut placed upon it with a drop of thick mucilage, a stream of ether spray is directed upon it, the razor being also so placed, or held, that it also is cooled at the same time. In cold weather, and with a reasonably small portion of tissue, the freezing is sufficiently complete for cutting in a minute or a minute and a half, and it remains hard long enough, even in warm weather, to admit of three or more sections being cut. In cold weather and with good ether, I have often found that ten or fifteen sections may be obtained without its being necessary to apply the spray for a second time.

Another method, which is also convenient, and which is, moreover, applicable to all soft tissues, is to place the microtome along with the specimen, arranged in the way above described, in a freezing mixture, the instrument being contained in the metal box which usually holds it. When the specimen is sufficiently frozen, the microtome is removed from the box and a few sections rapidly cut.

With either of these methods sections of fresh tissues may be rapidly and conveniently obtained.

It is too often assumed that freezing does not seriously affect the appearance of the tissue elements. I have not found this to be the case even with such tissues as are usually considered best suited for the freezing method, *e.g.* mucous membrane, skin, &c., and prefer to place the specimen for twenty-four hours beforehand in 4 per cent. bichromate of ammonia, or $\frac{1}{4}$ per cent. chromic acid solution. After this the tissue is better able to resist the freezing.