

As a fair illustration of the good results of the operation we give the following case, in the words of the patient, premising, however, that at the time of the operation he was completely disabled, laid up at home, and unable to walk on account of the excessive tenderness of the parts. The toes were very much enlarged and club-shaped. The disease completely covered the edges of the nails at their sides and ends, from under which pus was constantly oozing. As in all bad cases, it was simply impossible to pass lint or even a probe under any part of either of the nails. Both sides of the great toes were thus affected, and both were operated on at the same time. The portions removed were quite an inch in length, three quarters in width, and half an inch in thickness. The tendency to bleed from the cut surfaces was considerable, owing to the inflamed state of the parts, but this was readily controlled by a compress of lint and a narrow roller bandage, the whole being covered with oiled silk.

The patient in a recent letter writes as follows: "I was troubled with ingrowing toe nails three years previous to the operation, and had tried all kinds of methods of cure, but without success. At first lint under the nails, then caustic; after that all kinds of salve were tried. These failing, large pieces of the nails were removed repeatedly, with the after-application, at times, of something to burn the diseased flesh. This last would temporarily ease me; but as soon as the nails commenced to grow again they would become more painful than before. Dr. Cotting's operation was performed in March, 1873, and since that time I have felt no return of my old trouble. My toes healed in about three weeks, and are now perfectly natural in appearance."

The distinguishing feature of this operation is that as the wound heals the cicatrix contracts and draws the tissues away from the nail, leaving its edge free (as at *b*, Figure 1), so that it is hardly possible for it to become infleshed, or buried in the soft parts, in the future.

This operation has been performed many times at the Boston City Hospital; in fact, it is about the only one for this affection that has been done there for several years, and so far we have never seen a failure, nor a case in which the cure was not complete, permanent, and satisfactory.

THE USE OF THE FREEZING MICROTOME.

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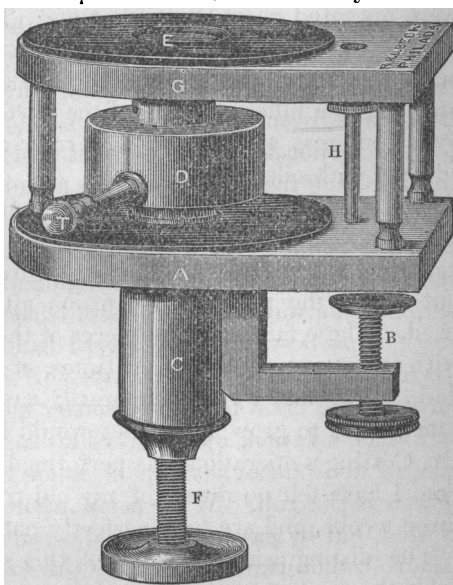
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THE subject of freezing microtomes is not a new one, but the instrument or apparatus which I am now using presents some advantages which I have found lacking in the previous inventions, so that a description of it may prove interesting. Nothing needs to be said of the great

utility in this method of preparing sections of tissues for microscopical examination since the appearance of the numerous journal articles on the subject by Rutherford, Bevan Lewis, Hughes, and others during the last few years. I am, however, making a further use of it in cutting sections of already hardened tissues, merely freezing them fast to the plate of the instrument, thus saving the labor of embedding them in paraffine or wax, and the manipulation necessary to freeing the sections from the embedding material before mounting them.

The instrument has four essential parts: first, an ordinary microtome, such as can be firmly fastened to a table; second, a chamber into which the spray is injected and condensed, and on the upper surface of which the tissue is placed to be frozen; third, a section-plate, arranged above the condensing chamber; and, fourth, a hand-ball atomizer with metal tubes (Codman and Shurtleff's).

The wood-cut shows the ordinary microtome with screw clamp for fastening it to a table; above it is the section-plate resting on three legs and fastened firmly to the microtome by a binding screw. The top of the section-plate is provided with a glass plate having a round hole, through which the tube of the condensing chamber passes when advanced by the micrometer-screw. The tube of the condensing chamber is provided with a small aperture made in the side of it (not shown in the wood-cut), and just below the surface of the brass cap which closes the upper end of the tube. The nozzle of the atomizer is introduced into the aperture of the tube, and the spray produced by using the hand-ball. Ether may be used, but I have confined myself to rhigolene entirely, the applicability of which to freezing by



A. The section-plate of the microtome. B. The clamp for fastening the instrument to a table. C. Embedding chamber. D. Freezing and condensing chamber, screwed fast to the plug in the embedding chamber. E. The top of the tube or cylinder of the condensing chamber on which the tissue is placed to be frozen. The condensing chamber is raised and lowered by the micrometer screw, F. G. The section-plate for the freezing microtome, resting on three legs, and fastened firmly to the microtome by the binding screw, H. This section-plate has a circular opening, through which the tube of the freezing chamber moves. T. Escape tube to draw off the condensed rhigolene or ether. The opening in the tube or cylinder of the condensing chamber into which the nozzle of the atomizer is introduced is not shown in the figure, being concealed by the section-plate, G.

means of the spray apparatus being first described in the JOURNAL for 1866.

The tissue which is to be cut is placed on the brass plate closing the end of the tube of the condensing chamber. I have found an advantage in using a drop or two of gum water, or, better still, the fluid recommended by Rutherford as an embedding substance in his freezing microtome. It consists of gum arabic five ounces, water nine ounces, and spirits of camphor two fluid ounces, the camphor making the mixture when frozen less brittle, and keeping it about the consistence of cheese. The advantage of using the gum solution is that the tissue is made to adhere better to the smooth brass, and is not so liable to be broken off from it when making the section should the tissue become too much frozen.

The section knife can be kept cold by placing it on a block of ice or by directing the spray from the atomizer upon it for a moment or two. It is necessary that the blade should be cold when making sections in summer or in a very warm room, because the sections melt very rapidly and become rolled into a mass difficult to unfold. During the winter, even in the warmed laboratory, I have not found it necessary to use ice for this purpose, and only rarely do I cool the blade with the spray.

As the sections are cut I transfer them from the blade of the knife, or from the brass plate where they fall, to small cups containing an appropriate solution, by means of a needle mounted in a holder. Usually the sections as cut roll up in small rolls; the thinner the section the closer is the roll. With some tissues the rolls are with difficulty unfolded, but by passing the needle through the centre or hollow axis of the roll, then transferring it to the solution in the cup by gentle manipulation, the thin section uncoils and floats out smoothly. Frequently air bubbles become entangled in the roll when dropped into the solution, and cause the section to float; as soon, however, as the uncoiling is effected the tissue sinks. Many tissues, however, and especially those which have been previously slightly hardened by reagents, unfold themselves as soon as they are placed in the cup, and require no further manipulation.

The sections obtained by this means can be made of the greatest thinness and perfectly even; their areas are limited only by the size of the brass plate closing the tube of the condensing chamber. The instruments as now made by Mr. William H. Walmsley, the manager for R. and J. Beck, in Philadelphia, have brass plates either one inch or one and a half inches in diameter.¹

¹ Mr. Walmsley has been very kind in carrying out my suggestions in making this instrument (perfect, as I believe it to be) as modified from the one used at the West Riding Asylum, England, and described by Mr. Bevan Lewis in the Journal of Anatomy and Physiology. Mr. Walmsley, 921 Chestnut Street, Philadelphia, has kindly furnished the cut for illustration.

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The majority of sections that I have made with the instrument are of fresh tissues, but I find a great convenience in the use of it for cutting tissues which have been partly or completely hardened, whether by aqueous solutions or alcoholic. When alcohol has been the hardening agent it is necessary to remove it by soaking the tissue in water for a short time before the specimen can be frozen. If the tissue is thoroughly hardened it is necessary merely to freeze it fast to the plate, which can be done almost instantly. I have found very great advantage from the use of the instrument in making sections of membranous tissues, such as the intestine, an arterial or venous wall, or a thickened pleura, or the peritoneum, — tissues ordinarily very difficult to embed. To get vertical sections of these tissues I first spread out a drop of the gum solution on the brass plate, then with two needles or pair of forceps hold the membrane so that its edge just touches the plate; in an instant the spray directed into the aperture of the tube freezes the gum solution and fixes the tissue in place; then, removing the nozzle of the atomizer tube from the aperture, I direct the spray directly on the tissue, taking care that the current is parallel to the length of the membrane; in almost as short a time as is required to fix the membrane to the plate the whole is frozen and stands erect in a vertical plane, provided that at the moment of freezing a slight tension is exerted by the needles or forceps. If the position in which the tissue becomes fixed is not satisfactory a warm breath relaxes it in a moment, and the adjustment can be corrected. In making sections of such delicate tissues or very small fragments it is essential that the blade of the knife should be kept cold.

Another and very important use which I have made of the instrument — and an employment destined to be more and more commonly made of it — is the examination of tissues from the living subject. The surgeon in excising new growths is desirous of carrying his scalpel through perfectly healthy tissues, and of removing all the surrounding parts which are becoming infiltrated with the malignant products. The determination of this question, and therefore the completeness of the operation, is often a difficult matter. It is not possible with the naked eye to be absolutely certain that all the affected parts have been removed, and how frequently it happens in examining with the microscope the periphery of tumors after removal, for example, tumors of the breast, that a deposit of malignant cells is found in the adipose tissue, often far from the growth in the gland. A small fragment of tissue, whether suspected or not, can be immediately frozen and cut, and the examination made before the wound of operation is closed. I have within the last six months made several such examinations during operations at the Pennsylvania Hospital. Recently, also, through the kindness of my friend Dr. L. A. Duhring, I have had the opportunity of using the instrument in making sections of diseased skin taken from

living patients. The sections were made and mounted ready for microscopic examination before the blood had ceased flowing from the small incision. The fragments of skin were in some cases not one fourth of an inch in length, and probably less than one eighth of an inch in breadth, — fragments so small that the attempt to harden them in reagents resulted in their complete disintegration and loss.

Recently, also, I have been able to obtain sections of the contents of cysts *in situ*, both from ovarian tumors and from cysts occurring in a fibro-cystic growth of the uterus.

Now that the method of freezing is so widely and generally used in making sections of tissues, it is not necessary to defend the process from the charges formerly made against it, namely, of cold producing alterations in the cells, etc. In fact, the tables are turning, and those who use the old hardening process and the tedious embedding of tissues are called upon to defend their methods against such charges.

One word more concerning the subsequent manipulation and mounting of sections made by the freezing process. As before related, I usually transfer the sections to cups containing appropriate solutions, but frequently the sections are placed directly on the slide and there stained, etc., and mounted. By this latter method nearly all the cells contained, in a section are retained, even if displaced from their original site.

In mounting the sections, which in the first place were transferred to a cup, I usually place them on the slide and perform all the manipulations necessary while they are on the slide. The advantage of this method is that the sections are saved from the danger of breaking or tearing to which unhardened tissues are necessarily peculiarly liable in the process of transference from one dish to another. By this method the section is always floating, and rarely needs to be touched by the needles; the disadvantage is the greater waste of reagents.

The difference in the appearance of tissues sectioned by freezing and those cut after hardening in alcohol, for example, a normal kidney prepared by the two methods, is very great. A normal kidney hardened in alcohol more nearly resembles a section of contracted kidney made by the freezing process. I do not find that sections of frozen tissues when treated with the alcohol, necessary to transferring them to oil of cloves and dammar, are much altered by this reagent, at least not nearly so much so as when hardened by it previously to sectioning. In this brief notice of the freezing microtome and the uses to which I have applied it, only a few of my experiments have been mentioned, and I have not considered it necessary to speak of the various solutions, reagents, and staining fluids which I commonly employ. Different tissues require different treatment by reagents and staining fluids, and each worker has his own peculiarities and favorites. To make this part of the subject complete, a catalogue of the various organs of the body would be necessary.