vented the irreversibility of hemorrhagic shock by ingenious cross perfusion of the liver(9). It is not our purpose to attempt to evaluate the factors involved in the development of spastic paralysis or irreversible shock, but rather to make another practical use of the fact that tissue damage due to arterial hypotension is related to the product of the degree of hypotension and the time that it persists.

In this instance one can by an inexpensive, readily procurable tube, which can be fashioned into the desired form at the operating table, make a temporary channel to divert blood into a temporarily hypotensive and anoxic area. Although such a small shunt does not return the deprived circulation to normal it enables one to bargain for the time necessary to accomplish a definitive procedure.

The use of similar devices to provide for diversion around smaller essential vessels, such as the coeliac, superior mesenteric or common femoral or hepatic artery, which are undergoing reconstruction might be indicated.

Conclusions. A small polythene shunt used to divert a portion of the blood around the cross-clamped thoracic aorta will temporarily prevent mechanical shock in dogs.

9. Fine, Jacob, Seligman, Arnold M., and Frank, Howard A., *Ann. Surg.*, 1947, v126, 1002.

Received May 18, 1950. P.S.E.B.M., 1950, v74.

Use of a Glass Edge in Thin Sectioning for Electron Microscopy.* (17931)

HARRISON LATTA† AND J. FRANCIS HARTMANN‡

From the Department of Biology, Massachusetts Institute of Technology, Cambridge, Mass.

The use of a steel microtome knife in cutting sections for electron microscopy has certain disadvantages, especially in the achievement and maintenance of a sufficiently sharp edge, which involve a considerable expenditure of time. The search for a knife material having homogeneity and hardness without excessive brittleness led to the development of a glass cutting edge. With it, we have been able to cut thin sections more consistently, easily, and rapidly than with steel microtome knives. Since the glass "knives" are obtained simply by breaking them from a strip of glass, the tedious and uncertain sharpening procedures necessary with steel knives are eliminated. Inspection with the light microscope reveals a smoother and, we believe, sharper edge. Fewer grooves or scratches are found on the face of a block of tissue after it has been cut with the glass edge. The glass knives are also quite inexpensive. The knives are made by breaking a strip 1½" wide and about 12" long from a sheet of plate glass approximately 3/8" thick. Since the edges thus produced will form clearance facets, this fracture should be as smooth and straight as possible. A series of straight parallel scorings at 45° to the long axis are then made on each strip, 1" apart, and on the opposite surface from the first scoring. The parallelograms thus outlined are broken off, producing a set of glass blocks, each of which has two cutting edges 3/8" long, formed by faces meeting at a 45° angle (Fig. 1,A). Any competent glass cutter with standard equipment can produce these knives from stock plate glass for something less than 25 cents each. Straighter edges, however, can be more regularly secured with a diamond-point scriber having constant spring tension (designed by Robert C. Jackson of the Department of Biology Machine Shop), utilizing a controllable pressure device, such as an arbor press, to break off the knives.

The knife holder, as shown in Fig. 1, was

* This investigation was supported in part by a research grant from the Division of Research Grants and Fellowships of the National Institutes of Health, United States Public Health Service.

† Postdoctorate Research Fellow of the National Cancer Institute, National Institutes of Health.

‡ Visiting Fellow in Biology, on leave from the Department of Anatomy, University of Minnesota.

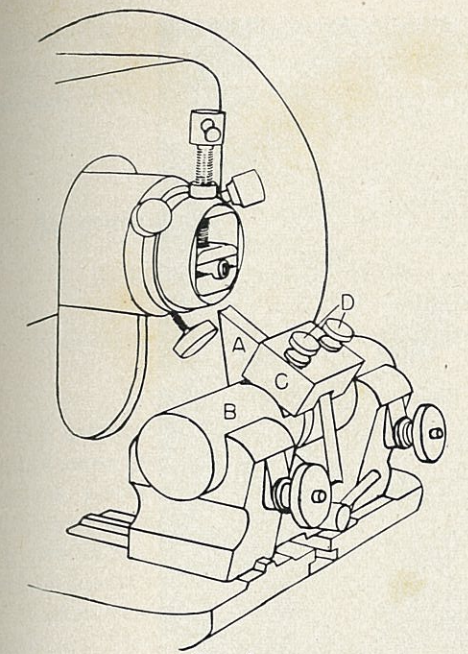


FIG. 1.

constructed to fit the knife clamp assembly of the Spencer microtome, but it can easily be modified to fit other microtomes. It seems desirable to retain the rotatable feature so that any desired clearance angle may be obtained. The holder consists simply of a steel rod (B) of the proper diameter to replace the clamps in the knife clamp assembly. At its midpoint the holder presents a slot, milled at right angles to the long axis of the rod, about 7/8″ deep and just wide enough to accommodate the thickness of the glass used. A yoke (C) with a shallow slot is held in alignment with the slot in the rod by a pair of thumb screws (D). The glass knife is placed in the slot with the facet produced by the first fracture facing the object holder. After it is clamped by screwing the yoke in position, the clearance angle is adjusted by rotating the holder in the knife clamp assembly of the microtome. A clearance angle of about 10° has been found suitable for sectioning material embedded in polymerized butyl methacrylate(1,2). If desired, a water trough to float sections off the edge of the knife(3) may be made from a piece of light cardboard, waterproofed and attached with paraffin or common plastic cement.

The second fracture, *i.e.* the one produced when a knife is broken from the glass strip, will rarely fall on a plane at right angles to the original surface of the glass. As a result, the cutting edge will be either tilted a little from the horizontal, or curved. In either case, the edge seems to cut fully as well as, if not better than, the occasional straight and horizontal edges, possibly because of shearing action during the cutting stroke. The orientation of the leading and trailing edges of the tissue block with respect to the knife edge appears to be unimportant, but when the block edges are parallel and aligned with the knife edge, ribbons of sections may be formed.

Some results obtained with central and peripheral nerve tissue are illustrated in Figs. 2 and 3. The tissue was fixed in 10% formalin, followed by 2% osmic acid, then dehydrated and embedded in n-butyl methacrylate(1,2). Before study in the electron microscope, the methacrylate was removed from some sections with toluene and was allowed to remain in others.

The microtome feed may be adjusted for thin sectioning by the wedge method suggested by Baker and Pease(4) or by the thermal expansion technic of Newman, Borysko and Swerdlow(1,2). This latter procedure may be simplified by merely cooling the tissue block (clamped directly in the jaws of the object holder) with a stream of CO_2 from a tank just prior to cutting. With the microtome feed disengaged, the slow expansion of the tissue block will permit a number of thin sections to be cut before recooling is necessary. This avoids torque on the horizontal ways of the microtome due to the coupling of a high-pressure hose. Cooling also facilitates the cutting of softer blocks.

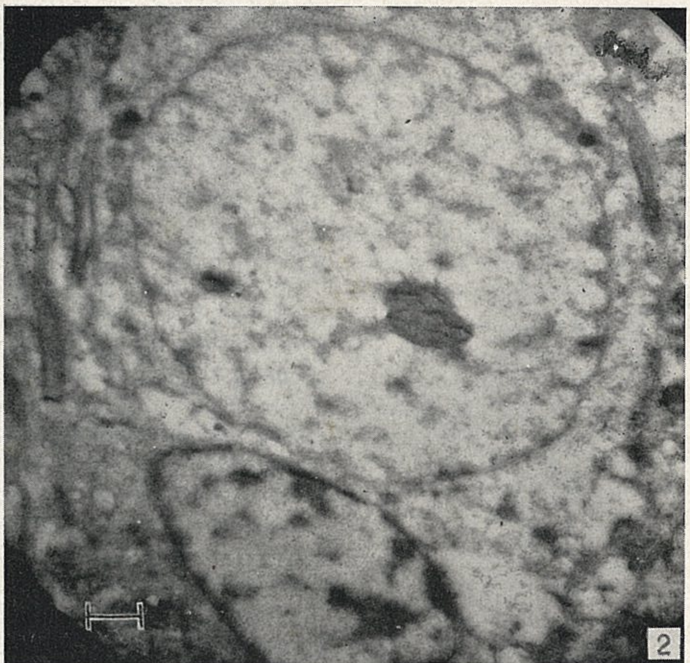
The useful life of the glass edge compares favorably with that of a freshly-sharpened

1. Newman, S. B., Borysko, E., and Swerdlow, M., *Science*, 1949, v110, 66.

2. Newman, S. B., Borysko, E., and Swerdlow, M., *J. Research Nat. Bureau of Standards*, 1949, v43, 183.

3. Gettner, M., and Hillier, J., *J. App. Phys.*, 1950, v21, 68, (abs.).

4. Baker, R. F., and Pease, D. C., *J. App. Phys.*, 1949, v20, 480.



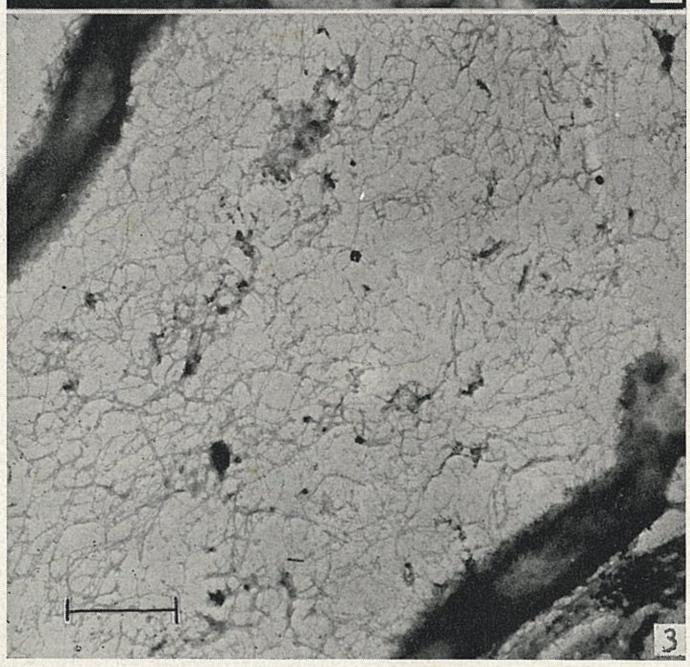


FIG. 2. Section of cerebral cortex of rat, with embedding medium left in. × 7,000.

FIG. 3. Longitudinal section of axone in sciatic nerve of rat Embedding medium removed. × 14,000.

steel edge. When a glass edge is dulled, it is discarded. It might be possible to obtain more durable edges from industrial diamonds or artificial sapphires when improved technics for polishing cutting facets are developed.

The authors wish to acknowledge with thanks the assistance of Mr. William Strovink of the Biology Machine Shop in developing the knife holder.

Received April 11, 1950. P.S.E.B.M., 1950, v74.

Absorption and Distribution of Vitamin A in X-Irradiated Rats.* (17932)

L. R. BENNETT, VERA C. BENNETT, ALPHA SHAVER, AND THERESA GRACHUS†
(Introduced by H. A. Blair)

From the Department of Radiation Biology, University of Rochester, School of Medicine and Dentistry, Rochester, N. Y.

The gastro-intestinal mucosa is one of the tissues most sensitive to ionizing irradiation. Various studies have indicated physiologic alterations in gastro-intestinal function following irradiation with impaired absorption of certain foods. In the comprehensive review of Warren and associates(1), several experiments are cited which indicate impaired absorption of sugars and fat. Studies on absorption in radiated rats indicated a diminished absorption of glucose at 24 and 40 hours following irradiation(2). This has been recently confirmed by Barron(3) in rats at 2 and 4 hours post-radiation. Impaired and altered fat absorption has also been described in human leukemia following irradiation(4). Studies on dogs receiving a moderately large dose of x-ray to a single loop of the bowel showed no fat in the lymphatics of the radiated loop after a test meal(5). Certain indirect evidence, however, suggested that the absorption defect following whole body irradiation in the mid-lethal range cannot be as large as those earlier experiments suggested. Dogs show little weight loss following irradiation with mid-lethal doses; and such weight losses as are observed can be nearly accounted for by anorexia which is frequently seen(6). It would seem reasonable that if absorption were more than minimally impaired, the difference in weight between the irradiated animals and pair fed controls would be much larger.

The findings in the present studies indicated that, after the first day, post-radiation absorption of vitamin A alcohol is essentially normal or increased; however, there is an abnormality in the tissue distribution.

Methods. In these studies young female rats of the Wistar strain were used. The rats were fed a standard Purina Fox Chow mixture ground into a fine granular form. The irradiated rats received 625 r whole body radiation which is an LD_{50} in our laboratory. Rats were studied at intervals from one hour post-radiation up to 7 days post-radiation. The test dose of vitamin A alcohol was administered to irradiated and control rats by stomach tube from a tuberculin syringe. During the test period, the animals were allowed water and food *ad libitum*. The animals were anesthetized with chloroform and exsanguinated from the vena cava at either 6 or 10 hours. At autopsy, the gastro-intestinal

* This paper is based on work performed under contract with the United States Atomic Energy Commission at the University of Rochester Atomic Energy Project, Rochester, N. Y.

† The authors extend their thanks to Dr. S. W. Clausen, Dr. H. A. Blair, and Dr. J. W. Howland for their helpful advice and criticism during the progress of this work, and to Dr. Augusta B. McCoord for her aid in the development and modification of the procedures used in the analysis of Vitamin A.

1. Warren, Shields, *et al.*, *Arch. Path.*, 1943, v34.
2. Buchwald, K. W., *J. Exp. Med.*, 1931, v53, 827.
3. Barron, E. S. G., Wolkowitz, W., and Muntz, J. A., MDDC 1241.
4. Dodds, E. C., and Webster, J. H. D., *Lancet*, 1942, v1, 533.
5. Martin, C. L., and Rogers, F. T., *Am. J. Roent.*, 1923, v10, 11; Martin, C. L., and Rogers, F. T., *Am. J. Roent.*, 1924, v11, 210.
6. Unpublished data from this laboratory.