At the date of writing five mice in the experimental and four in the control series are still alive.

Thus an ether extract of DLB mammary tissue has not promoted mammary cancer in female mice of ordinary mixed stock. However, it is of considerable interest that a sarcoma has developed in one mouse at the site of injection. Sarcoma has thus been obtained in mice by injecting fatty material from DLB mammary tissue, from human breast cancer (Menke) and from the liver of a patient dead of cancer of the stomach (Schabad). In this institute sixteen sarcomas have been obtained in mice injected with fat fractions from the livers of Europeans who have died of cancer or from the livers of Bantu dead from causes other than cancer. This work is now published in the *American Journal of Cancer* (39: 496, 1940).

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SCIENTIFIC APPARATUS AND LABORATORY METHODS

A VIBRATING NEEDLE AS A MICROSURGICAL INSTRUMENT

GLASS needles and irredectomy scissors are almost universally employed for performing operations on embryos. These instruments leave much to be desired. Not only does their effective manipulation require considerable skill which is usually attained only after long practice, but certain limitations are inherent in the instruments themselves. Fine-pointed glass needles lack rigidity, are easily broken in use and, since they are necessarily cylindrical rather than knife-shaped, do not have true cutting edges. The tendency of cells to adhere to the blades of irredectomy scissors may result in excessive injury to delicate tissues and, when more than one layer of tissue is to be cut at the same time, the shearing action of the scissors may cause the adhesion of one layer to another. This is undesirable in some types of experiments. Moreover, neither of these instruments is well adapted for the performance of certain operations such as the removal of loose cells from the surfaces of explanted organs, the separation of layers of tissue from one another or the excavation of material overlying the structure to be transplanted or underlying the site of implantation in the host. All these operations may be accomplished more easily and rapidly with the new instrument to be described below.

The vibrating needle was designed primarily to serve as an aid in performing transplantations involving young amphibian larvae and embryos. It is believed, however, that it could also be used to advantage in other microsurgical techniques. The essential feature of the device is a fine steel needle, the tip of which has been converted into a very fine knife. This is set in vibration by means of an electromagnet energized by 60-cycle alternating current. In principle, the cutting action of the vibrating needle resembles that of a single-toothed jig-saw with a very small amplitude of vibration and, as in the case of the jig-saw, its operation is subject to more delicate control than that of knives or scissors. Furthermore, the rapid vibratory motion of the needle and the currents produced in the water by this motion are useful in performing the other operations mentioned above. The instrument is easily made and may be operated with proficiency after very little practice. The actual details of construction of the device may of course be varied in accordance with the nature of the material on which it is to be employed. The following (see Fig. 1) is a detailed description of a form of the instrument which has proven satisfactory for general purposes:

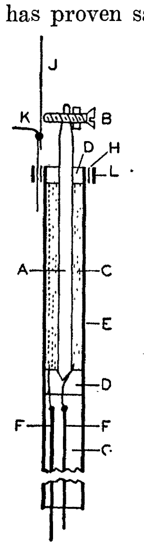

FIG. 1. Sectional diagram of instrument.

The core (A) of the magnet consists of an iron rod, 3″ long by $\frac{1}{8}$″ in diameter. It should preferably be made of soft iron, although a tenpenny finishing nail is satisfactory. One end of the rod is slightly flattened laterally by hammering and is drilled and tapped to receive a $\frac{1}{2}$″, 2–56 iron machine screw which, provided with a lock nut, serves as the adjustable pole (B) of the magnet. The coil (C) is wound between two cylinders of cork (D–D), each $\frac{1}{4}$″ in length and just a trifle larger than the inside diameter (7–8 mm) of the glass tube (E), which serves both as a protective casing and as a handle for the instrument. The coil is 2″ long and contains approximately 100 feet of 36-gauge enameled copper wire. (Used wire may be bought at almost any radio repair shop.) The wire should be wound as smoothly as possible and great care should be taken not to injure the insulation. The ends should be scraped free of enamel and fastened to strong but light, well-insulated wires (F). After the finished magnet has been carefully inserted into the lower end of the glass tube, the upper end of the tube is filled with melted pitch or paraffin (G). After solidifying, this material holds the lead wires firmly and also improves the balance of the instrument by raising the center of gravity. The lower end of the tube, to which the needle is to be clamped, should be wrapped with a single thickness of friction tape (H). This helps to hold the base of the needle firmly.

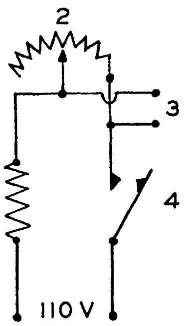

FIG. 2. Circuit diagram.

A simple circuit (Fig. 2) for use with 110-volt alternating current consists of a 60-watt lamp (1) in series with a 100 ohm rheostat (2) and a foot switch (4). The coil of the magnet is connected across the rheostat (at 3).

The cutting needle itself is a No. 12 "sharp" sewing needle (J). Since this type of needle is very short and is too fine to be handled with ease, it has been found advisable to cement two needles together with a drop of De Khotinsky's cement. The basal needle is first bent into the shape of an "L" with the shorter arm about ¼″ long. This shorter arm then forms a convenient handle (K) by means of which the cutting edge may be oriented with reference to the plane of vibration. The handle also makes it possible to hold the needle firmly during the grinding process.

The grinding should be done under a medium power objective of the dissecting microscope on a very hard oil stone of the same fineness of grain as those used to sharpen razors. Carborundum stones are too soft for this purpose. The compound needle should be held firmly in the hand with the thumb or the middle finger on the tip of the handle (which should be held in a horizontal position most of the time) and the tip of the index finger very close to the tip of the cutting needle. An attempt should be made to produce a fine, tapering point, elliptical in cross-section. Following this, the point should be converted into a very fine, two-edged blade with the cutting edges in approximately the same plane as the handle of the needle. A properly ground point should be much sharper and stronger than the finest usable glass needle. The oil used in grinding may be removed by rinsing the needle in xylol followed by absolute alcohol. The point should never be brought into contact with any object such as cloth, the fingers, glass dishes or operating platforms. Properly cared for, it should last for from 25 to 50 operations before needing resharpening. After use, it should be rinsed in pure water and dried in absolute alcohol.

The needle is loosely clamped to the side of the glass tube over the friction tape by a circular band of thin metal (L) which may be constricted by means of a small screw (not shown). After carefully orienting the needle so that the cutting edges lie in the plane of vibration, the clamp is tightened and the set screw of the magnet adjusted. When in operation, the needle should just strike the set screw so that a faint buzzing is heard.

It will be found that the amplitude of vibration is dependent both upon the adjustment of the set screw and upon the setting of the rheostat. In order to prevent overheating of the magnet, the set screw should be adjusted so that the minimum current is employed. It will then be possible to increase the amplitude of vibration considerably by changing the setting of the rheostat. Since both the rheostat and the magnet heat up with continued use, the foot switch should be opened whenever the instrument is not actually in use.

Incisions are made by touching the tip of the vibrating needle to the surface of the tissue, the instrument being held at a 45° angle. Layers of tissue may be separated by turning the instrument so that the plane of vibration corresponds to the plane in which the layers are joined. Excavations are carried out by increasing the amplitude of vibration so that the loose cells are literally washed out by the resulting water currents.

The water currents produced by the vibration of the needle are not strong enough to interfere with the manipulation of objects of the size and density of amphibian eggs or embryos. It is possible, however, that they may be strong enough to be objectionable in the case of very small objects or very light objects such as young chick embryos.

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