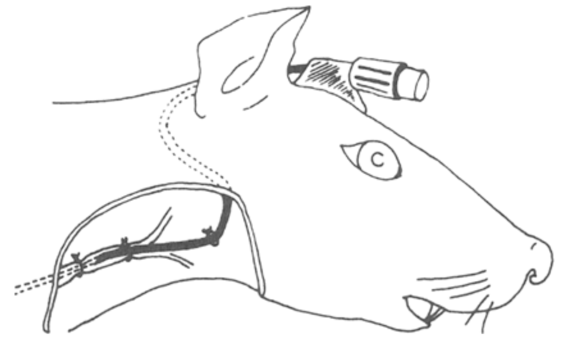

Fig. 2. Diagram of catheter placement.

in the throat. This is easily accomplished by using a convenient length of hypodermic tubing with an inside diameter large enough to accommodate the catheter. Expose about 10 mm of the vein, completely separating it from the surrounding tissue by blunt dissection. The jugular is ligated rostrally to the point of insertion, with the "tails" of the 3-0 suture left about 6 cm long. Another length of suture is placed around the vein, caudal to the point of insertion ready to be drawn tightly after the catheter is in place. The lumen of the vein is cut into on a diagonal, rostral to caudal, with iris scissors. The catheter is gently guided down the vein (about 2 cm) until resistance is felt, the tip being at the junction of the superior and inferior vena cavae. If properly in place, some blood will flow back up the catheter. Draw tight the caudal suture, and, using the "tails" of suture from the rostral ligation, tie the catheter down. It is then held in the appropriate attitude following the normal course of the vein. An additional knot should be loosely tied, to avoid necrosis, binding the sternomastoideus muscle and catheter at the point of inflection. A topical antiseptic (Neosporin R) before closure and 50,000 units IM of procaine penicillin G seem sufficient to control infection. Clean procedure is indicated throughout with catheters and instruments being soaked in a 1:750 tincture of benzalkonium chloride solution. Following surgery, and every day thereafter, the catheter should be flushed with 0.10 cc of a 1,000-unit solution of Liquiamin R.

Figure 2 illustrates a catheter in place. The "S"-shaped path from head to vein is important as it seems to absorb movement and shock, thus decreasing failures.

This technique has limitations. Catheters usually are patent for only about 2 months, after which failure rate rapidly increases due to cell packing or clotting. Mature rats should be used, as growth tends to dislodge the catheter. Withdrawal of blood samples greater than 0.10 cc is not reliable. A method of aortic cannulization has been described (Weeks, 1967), and certain features of the technique are adaptable if larger samples are required.

The advantages of this technique arise from the low cost in time and material. In addition, the animal is free of encumbrances. Injection is simple in an animal restrained only by hand, as a syringe can be easily inserted in the uncorked needle hub.

REFERENCES

Chute, D. L., & Wright, D. C. Retrograde state dependent learning. Science, 1973, in press.

Draper, D. O., & Venator, E. R. Chronic attachment of a connector to a rat's skull without screws. Physiology & Behavior, 1972, 9, 113.

Steffens, A. B. A method for frequent sampling of blood and continuous infusion of fluids in the rat without disturbing the animal. Physiology & Behavior, 1969, 4, 833-836.

Still, J. W., & Whitcomb, E. R. Technique for permanent long-term intubation of rat aorta. Journal of Laboratory & Clinical Medicine, 1956, 48, 152-154.

Weeks, J. R., & Davis, J. D. Chronic intravenous cannulas for rats. Journal of Applied Physiology, 1964, 19, 540-541.

Weeks, J. R. Cardiovascular techniques using unanesthetized and freely moving rats. Pharmacology Research, The Upjohn Company, Kalamazoo, Michigan, 1967.

(Received for publication March 9, 1973; accepted March 14, 1973.)

A 1½ stereotactic instrument

GUY C. SHEATZ

Department of Experimental Psychophysiology
Walter Reed Army Institute of Research
Walter Reed Army Medical Center, Washington, D.C. 20012

Stereotactic instruments are a means of locating specific brain areas of an organism, using a knowledge of the relationship between anatomical aspects of the animal's skull and deep structures. Characteristically, a set of coordinants of a deep structure are derived from a stereotactic atlas. These coordinants are used to position an electrode carrier precisely. Most instruments use an electrode carrier that is movable along a sequence of calibrated rails in the ventral, lateral, or anterior coordinants.

An inconvenience arises in the use of the standard stereotactic instrument for modern multielectrode implantation. It is necessary to purchase "zeroing" plates to align additional electrodes once the animal's head is fixed in the instrument. The present instrument solves this problem in another way and introduces other innovations. An example of the latter is the simple method of establishing three-dimensional coordinates. The manner in which this is ordinarily accomplished is responsible for a large part of the cost of manufacturing such instruments. The following operational outline should set these innovations in functional perspective with common stereotactic procedures.

Panel meter terminology is used to abbreviate the title. The full meaning appears with a description of the instrument having an electrode alignment matrix in addition to an implantation matrix (see Fig. 1). By lifting the spring-set plunger at A, the electrode complex can be alternated between the alignment and implantation matrices, each fixed precisely by detents. B identifies the intersection of the two horizontal

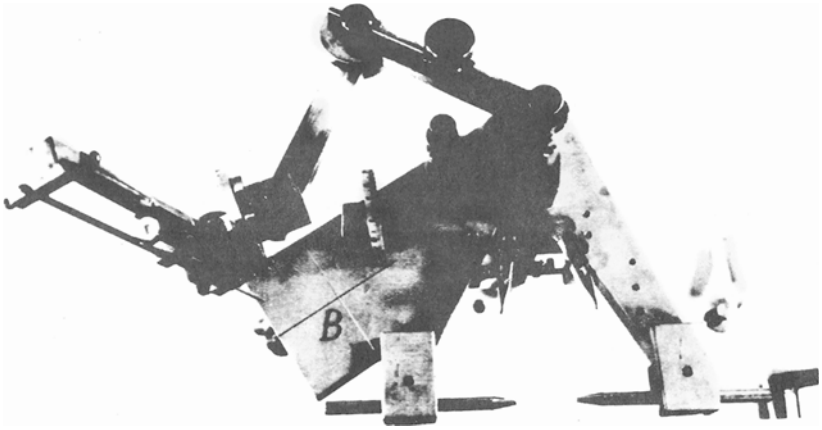

Fig. 1. Fifteen-degree off-vertical view of the instrument. (A) Spring detent and plunger arm for the alignment and implantation sites. (B) Intersection of the two horizontal axes at the alignment site. (C) Two-dimensional fixation mechanism. (D) Vertical dimension locator.

dimensions at the alignment site. In practice, a millimeter grid of graph paper should be affixed, using the scribed lines to coincide with the axes of the graph paper. The vertical scale indicated by D should be positioned so that the corner will describe the chosen horizontal locus of the brain area to be impaled. Note that the scale begins 1.0 cm above the surface. The horizontal surface is the Frankfort plane and the vertical zero is the Horsley-Clark plane. The third or vertical dimension should be set by positioning the electrode tip at the reading on the vertical scale and the electrode-advancement brake set at that point. The three-dimensional locus is automatically transferred to the implantation site. The tips of the ear bars are at the Frankfort surface, and the scribed rings on the ear bars permit centering of the animal at the two horizontal dimension intersection.

Another unique feature of this Horsley-Clark instrument is shown at C. This single knob simultaneously loosens or tightens both horizontal dimensions: the two-dimensional horizontal coordinate is set by one operation.

Precision tracking of the electrode is obtained simply by two-rail mechanism in combination with a screw and slide device which may be alternated for fine control over a 4-in. advancement. Any point may be approached from any spherical angle by means of the three-jointed electrode carrier base. The whole is mounted by a telescoping column (which permits further vertical electrode manipulation) to a ½-in.-thick Plexiglas platform. The latter has positional holddowns for leg thongs. Eye and jaw fixation is accomplished by a versatile mechanism accommodating cat or monkey formats.

The transformation from software to hardware was aided in many details by engineering technicians William Blumberg and Gordon F. Plitt of the Division of Instrumentation of WRAIR.

Detailed construction data may be obtained by request to the author.

(Received for publication December 21, 1972; accepted March 3, 1973.)