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BRIEF COMMUNICATION

Rat Brain Slicer. A Simple Device for Rapidly Obtaining Serial Slabs of Fresh Brain

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HENRY, J. L. AND K. YASHPAL. *Rat Brain Slicer. A simple device for rapidly obtaining serial slabs of fresh brain.* BRAIN RES BULL **13**(1) 195–197, 1984.—A simple, two-part device is described which has been used to provide rapid serial sectioning of fresh rat brain in experiments in which identifiable brain regions were microdissected for biochemical analysis. This device is easily constructed at low cost, and offers several advantages over other devices and techniques.

Rat brain slicer   Microdissection of fresh brain nuclei

STUDIES on the central distribution of endogenous and exogenously administered neuroactive agents as well as of enzymes have given rise to a number of techniques for the removal of discrete nuclei or regions from fresh brain tissue. The labile nature of many of the chemicals assayed has added the further requirement for the rapid preparation of fresh, unfrozen brain tissue suitable for microdissection. After trying a number of earlier devices and techniques, and finding them to be unsatisfactory for our needs, we designed a simple two-part plastic device which we could use to rapidly provide serial slabs of tissue from fresh, unfrozen brains of rats. It is the speed and simplicity of the use of our device as well as the very low cost of its construction which prompted this brief communication.

A drawing of this device is presented in Fig. 1. It is a two-part device made out of plastic. The lower piece consists of a base, a raised central platform and two metal posts, one at either end. The upper part has three holes in it, two to accommodate the two posts and the other one to accommodate the platform of the base, which extends part way into its respective hole. The platform and posts and their respective holes are such as to provide a close fit in each case.

The platform and its hole were made to accomodate the fresh brain of a 250 g rat, and were shaped to such a brain with attached cerebellum, and brain stem as far down as the caudal medulla.

With the two pieces fit together, a series of 0.1 mm-wide cuts were made with a fine saw blade, leaving slits oriented transversely to the long axis of the device (i.e., to provide transverse slabs of brain), and leaving 1.2 mm between slits. As cut, then, this device yields slabs of brain tissue, 1.3 mm in thickness. The depth of the cuts is such as to encroach 1.3 mm into the base platform. The remaining detailed dimensions of the device are presented in the schematic diagrams in Fig. 2.

Preparation of brain slabs is done in the following manner. With the top fitted tightly onto the lower piece the brain is inserted into the central chamber, dorsal side up, until it sits snugly on the base platform. A fine stainless steel wire, 0.08 mm in diameter, is then slipped into the rostral-most slit and drawn down through the brain with a lateral or diagonal cutting motion. The lateral movement of the wire optimally cover a distance of 5–10 cm. This motion is continued until the wire has been passed completely through the brain and it lies in the respective groove in the base platform below the brain. The wire is then pulled laterally through this groove so that it does not pass again through the brain. For optimal cutting the wire should be held taught, it should fit snugly in the slit and the cutting motion should be done quickly. Occasionally, after extensive use, a wire may begin to curl; to avoid the curl from digging into the tissue as it is pulled from the holder, a new, straight piece of wire should be used.

This first slicing should yield the rostral-most transverse slab of brain tissue. The wire is then passed, as above, sequentially through the remaining slits. As the wire must be inserted at the same time into the slit on the two sides of the upper piece, we have found that colour coding the plastic pieces between the slits facilitates matching the wire to the appropriate slits on the two sides of the chamber.

Once slicing has been completed, the top piece is removed, leaving the sliced brain resting on the platform. The slabs may be rapidly placed sequentially on the medium for

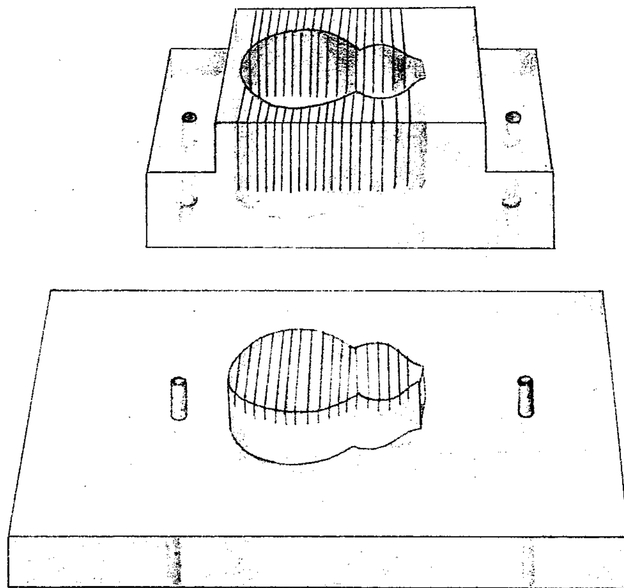

FIG. 1. Drawing of rat brain slicer. The upper piece is slipped straight down to fit tightly onto the lower piece.

microdissection. (In our case the rats were decapitated and the slabs were cut in a coldroom at 4°C and placed on a pre-cooled 1–2 mm-thick layer of paraffin wax in a glass Petrie dish. This layer of paraffin wax provided support for the tissue but also a soft background for penetration by the cutting edges of the dissection instruments, thereby yielding cleaner and more precise cuts in the tissue. Microdissection was done under microscopic control using a Zeiss binocular stereomicroscope, with transillumination from a fibre optics illuminator providing cold light. Dissected structures were placed on their respective pre-labelled microscope slides which were resting on ice. Upon reconstitution of each structure from its respective slabs, it was weighed and assayed for the particular compound under study. Our procedure has been found to be suitable for assaying labelled tyrosine and catecholamines as well as the opioid peptides Met-enkephalin, beta-endorphin and dynorphin.)

We feel that the design of this device offers several advantages over other techniques for obtaining slabs of fresh brain tissue. Freezing of the tissue, as is required for microtome sectioning (as in the case of Palkovits, [4] and for the "punch" technique of Eik-Nes and Brizzee [2]), can be avoided, and the rapidity of the slicing with our device obviates the need for freezing, except when studying very labile compounds. Furthermore we have found the wire to be

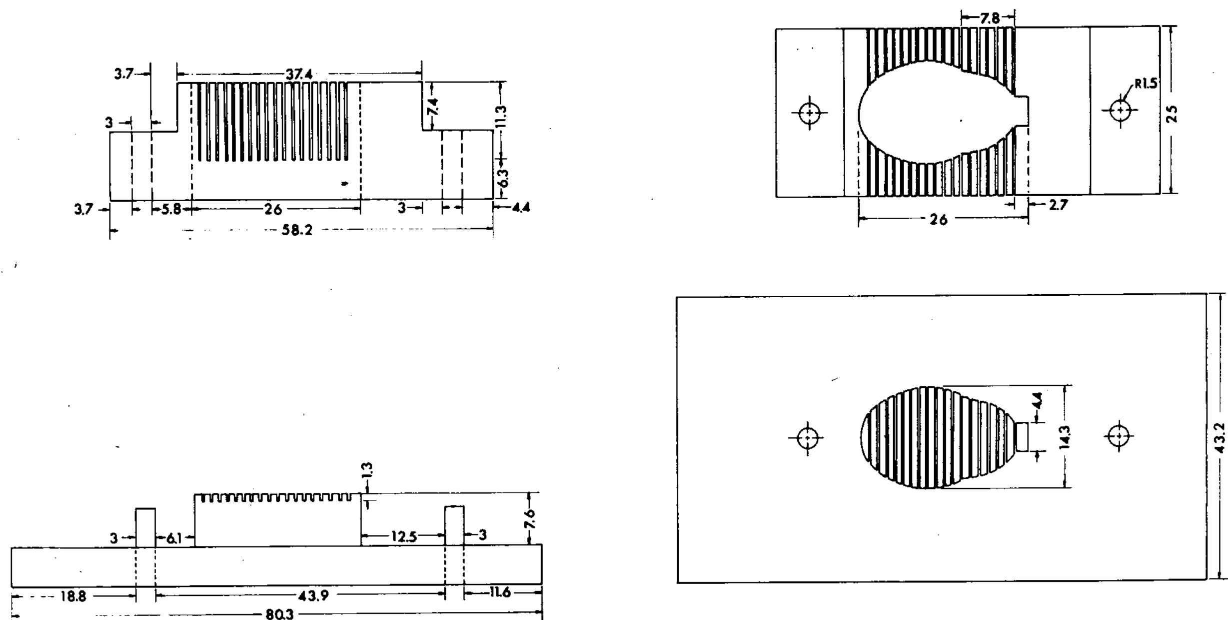

FIG. 2. Schematic diagram of rat brain slicer, showing dimensions.

better than a blade (as is used by Jacobowitz [3]) because the side of a blade sometimes sticks to the tissue, causing drag, and shearing of the tissue adjacent to the surface of each slab. In fact, the finer the cutting implement, the less the shearing of tissue, and wire is easily obtained which has a diameter less than the thickness of a blade. Additionally, with our device the cuts are made deep enough into the base that the wire may be passed completely through the brain, and pulled out through the groove in the base platform; this avoids the drag created by drawing the wire out either laterally or dorsally through the fresh tissue (as is also required when using a blade; e.g., Jacobowitz [3]). We also feel that the groove is superior to the several layers of masking tape suggested by Cuello and Carson [1]. Once the slabs have been cut it is important to have quick and easy access to them, and we have found that this was satisfactorily achieved by making our device in two parts, so that the top piece could be removed, leaving the sliced brain resting together on the base platform. This is an improvement over the single-piece device of Jacobowitz [3] with which removal of the slabs is cumbersome, and tissue damage may occur. The chamber was also cut to a size which would just accommodate a brain of the size we were studying so that the support of the walls on either side would reduce any squashing effect of the cutting wire. Finally, the very low cost of our device is due to its simplicity and the very small amount of labour required for its construction.

The major advantage of this device, however, is the speed with which the slicing can be done. We have found that the time between removal of the brain from the skull and the completion of slicing is less than 30 sec; we have found this to be considerably faster than using the McIlwain tissue chopper (Cuello and Carson [1] even suggest letting the brain stand for 3–5 min to allow the adhesive to set) and especially than the slower Vibroslice and Oxford Vibrotome (see [1]). In addition, the rapidity of the preparation of the slabs has enabled us to avoid the very cumbersome cooling of the brain *in situ* (as in [5], where the technique also requires that the rat must first be anaesthetized). For our purposes, slabs of 1.3 mm thickness were considered appropriate because they allowed enough differentiation of the structures required using transillumination without requiring any staining (as in [5]) and they provided enough specificity to ensure that the slabs containing the rostral and caudal poles of each structure included a minimum of extraneous tissue. Of course, thinner or thicker slabs can be made by decreasing or increasing the distance between the cuts in the plastic device. However, any increase in the number of slabs would increase the time required to complete the slicing. A corollary to this, though, is that in studies where structures are required from only a restricted rostro-caudal portion of the brain, the slicing time can be reduced dramatically by preparing the minimum number of slabs required.

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