*Pharmacology Biochemistry & Behavior*, Vol. 10, pp. 429–431. Printed in the U.S.A.

# An Electrode-Cannula Unit for Intracerebral Electrical Stimulation, EEG Recording and Drug Administration in Small Animals

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(Received 11 December 1978)

LAIRD II, H. E., J. E. HERMANSEN AND R. J. HUXTABLE. *An electrode-cannula unit for intracerebral electrical stimulation, EEG recording and drug administration in small animals.* PHARMAC. BIOCHEM. BEHAV. **10**(3) 429–431, 1979.—An inexpensive and reliable method for administering chemicals into the brain substance while simultaneously monitoring EEG activity and/or electrically stimulating the brain has many applications. Such an electrode-cannula unit can be easily made from readily available components.

Electrode-cannula  Intracerebral electrical stimulation  Drug administration  EEG recording

MANY ASPECTS of biomedical research presently require an inexpensive and reliable method for repeated administration of chemicals into selected regions of the CNS while simultaneously recording EEG activity and/or electrically stimulating the same area.

We now report such an electrode-cannula unit, which we have used for several years [3,7].

## DESIGN AND CONSTRUCTION

The electrode-cannula system is shown in Fig. 1. It consists of the following components (Fig. 2):

1. *The Cannula* (Fig. 2A) is prepared from a 22 ga one-inch disposable stainless steel needle (Monoject® 250, Sherwood Medical Industries, Inc.) with plastic hub. The plastic hub is removed leaving the aluminum well attached to the stainless steel needle. The aluminum well is filed down until it is flush with the opening of the needle. This detail allows easier entry of the injection needle into the cannula. The length of the cannula is determined by the brain region into which it is to be placed. Once this has been determined (in our experiments, we use an 18 mm cannula) appropriate cannula length is obtained by carefully filing the pointed end of the needle using a very fine texture Arkansas stone. The resulting cannula is a rounded-end unit with a patent opening through which an injection needle (30 ga needle—see below) may be inserted.

2. *The Bipolar Stimulating Electrode* (Fig. 2A) is made from appropriate lengths (for our units we used two 64 mm lengths) of teflon-coated stainless steel wire (30 ga Medwire Corp., Mt. Vernon, New York). To one end of each wire is soldered a connector pin (Amphenol No. 220-PO2). The electrode wires are placed side by side and tightly wrapped onto the cannula beginning at the aluminum well end. The wrapping of the wire is started approximately 25 mm from the connector pins. When the electrodes are securely wrapped onto the cannula, the tips of the electrodes are separated so that the cannula opening is between the poles of the electrodes. Further, the poles extend 0.5 mm beyond the cannula and are separated from each other by a distance of no more than 1 mm. At this point the shaft of the electrode-cannula unit is covered with a polystyrene wire insulating (Polystyrene Q-Dope, GC Electronics) material. Each electrode is tested for continuity from tip to connector by using a voltmeter.

3. *The Injection Needle* (Fig. 2B) is fashioned from 30 ga stainless steel disposable dental needles (Monoject 400, 30 GA short, Sherwood Medical Industries Inc., Delano, Florida). Each injection needle is prepared, by filing, so that it extends 0.5 mm beyond the opening of the cannula. A variable length of appropriate diameter polyethylene tubing is attached to the injector needle for drug or chemical administration.

4. *Cannula Stylets* (Fig. 2C) are also prepared from 30 ga stainless steel dental needles (see injection needles above). The stylets differ from the injection needles in that a cut is made at the aluminum well about 2–3 mm above the needle sealing the tube. Each stylet extends 0.5 mm below the cannula opening (see Fig. 1). These devices provide a barrier to the movement of fluids and particles in the cannula and help protect the brain substance from infection.

5. *The Implantation* of the electrode-cannula unit on the animal is similar to that reported by other workers for cannulae and electrodes [1, 2, 5, 8]. The unit is attached to the

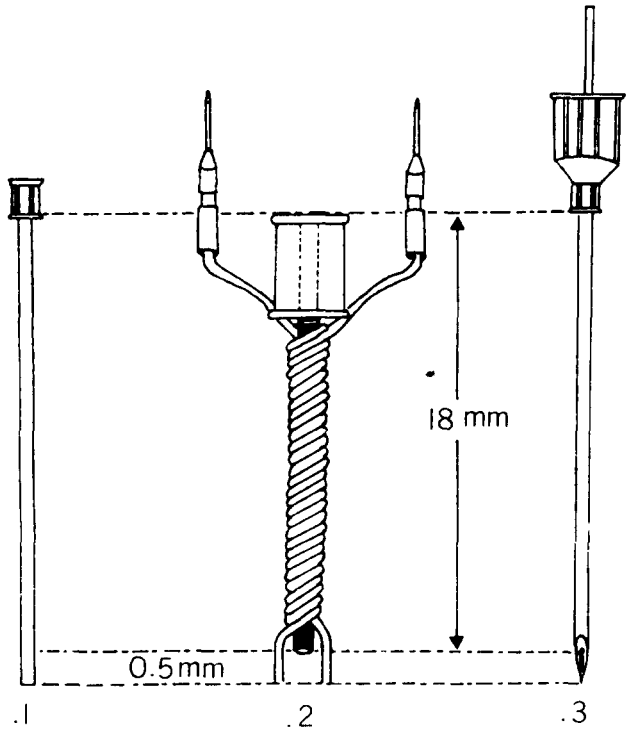


FIG. 1. Diagram of electrode-cannula system: (1) cannula stylet; (2) electrode-cannula unit; (3) injection needle.

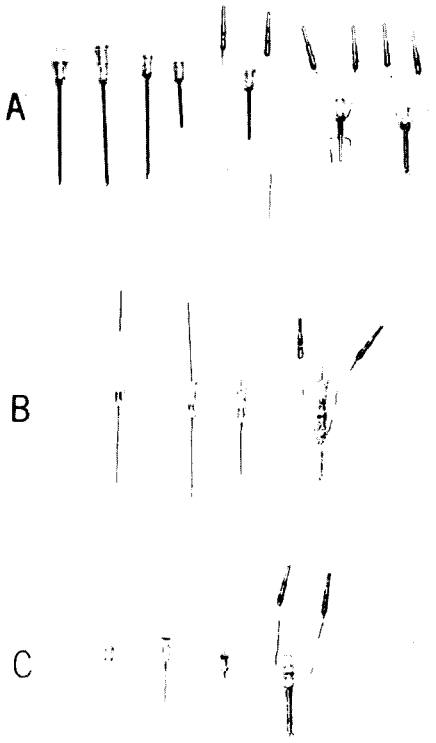


FIG. 2. Steps in the construction of the electrode-cannula system See text for details.

skull with dental acrylic and stainless steel anchor screws. The pins from the electrode are inserted into the appropriate housing of a connector unit (Amphenol No. 223–1509, Bunker Ramo). The connector unit is mounted rostral to the electrode-cannulae units (see Fig. 3).

## RESULTS AND DISCUSSION

The electrode-cannula has been used in our laboratory to determine intracerebral electroshock thresholds in rats that are genetically seizure susceptible or resistant [4,6]. In addition, the unit has been used to elucidate the anticonvulsant action of taurine after intracerebral injection [3,7]. Recently, we have utilized this unit to record modifications of the EEG following electrical stimulation of the brain or intracerebral injections of drugs.

Our experience with the electrode-cannula unit shows the unit to be simple and inexpensive to make. The administration of the test substance directly between the stimulating-recording bipolar electrodes allows for the effect of the compound to be localized to the brain substance being excited or monitored. The size of the electrode-cannula unit can be adjusted by the investigator by changes in the gauge of the needles used to make the cannula.

## ACKNOWLEDGEMENT

This Project was supported by USPHS Grants HL 19394, HL 20087 and NS 14405.

FIG. 3. Electrode-cannula unit in place on a rat. The electrode-cannula unit is behind the connector unit.

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