A STEREOTACTIC INSTRUMENT FOR USE WITH DOGS

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In recent years we have come to depend more and more on a stereotactic technique for studies of the central nervous system. By now improvements [2, 3, 6, 9, 10, 11, 15, 16] have appeared over the first stereotactic instrument [12] described for use with monkeys, cats, and small laboratory animals.

In design the trend has been toward the development of universal devices which can be used for various species, and to perfection of micromanipulation to enable damage to be inflicted in different parts of the brain; reliable head-holders have been produced ensuring maintenance of an accurate head position. However the principles underlying modern devices have remained unchanged since the first model was produced.

Different stages of achievement have been reviewed in extensive review articles [6-9, 17]. We need note only that until recently no models were available for experiments on dogs. The reason was largely due to difficulties associated with the anatomy of the skull: it is very variable in size and shape from one breed to another and it was therefore difficult to draw up the appropriate topographical atlases, and therefore difficult to apply stereotactic instruments. In recent years devices have been made for dogs, and each one has special constructional features. Several authors [6, 13] have used x-ray control. Special atlases of canine brains have also been published [1, 14] enabling coordinates to be drawn up for any particular part. Some models, for example, that of Hume and Ganong and Mogilevskii, have special electric drills for trepanning the skull. Mogilevskii's device [6] is distinguished by its simplicity of design and ease of construction. It should however be noted that there is some difficulty in head fixation and certain inconveniences with respect to the coordinates.

Many other devices, for example the model of Lim, Lin Chan-nao and Moffitt have a special form of improved head-holder: the device proposed by Traczyk [18] enables the head to be rotated around a sagittal axis or about the axis joining the two ears. One such model is the universal stereotactic instrument for dogs designed by R. M. Mesherskii [5].

Since 1953 in our laboratory we have carried out many investigations in a study of the function of various cerebral structures (nucleus caudatus, thalamic and cerebellar nuclei) in dogs. The work has led us to the production of a stereotactic instrument and it is suitable for use with dogs. For this purpose E. A. Romanovskaya and L. S. Goncharova drew up a specification for the apparatus, which was then designed by S. L. Startsev in 1954 and intended for experiments on dogs, cats, or rabbits. Several years' use has shown that it is simple and convenient, and that the design has satisfactorily solved such problems as head fixation; there is an upper precision frame and micromanipulator enabling electrical, mechanical, thermal, or chemical damage to be inflicted.

The device shown in Fig. 1 consists of two parts: a base to which a lower frame constituting a head-holder is attached, and which enables the head of the animal to be orientated in accordance with the zero coordinate plane of the Horsley-Clarke system, and an upper precision frame carrying the micromanipulator (Fig. 2, A, B).

The head of the dog is fixed to the device by means of ear bars (see Fig. 1) introduced into the external auditory meatuses; the upper jaw is fixed by a clamp applied to the ridge of the nose from above, and by an elastic clamp consisting of a wire and pulley. The clamp enables correct orientation of the head to be maintained in a midsagittal line. The elastic clamp enables the upper jaw not only of dogs but also of cats and rabbits to be fixed in position. The ear rods have removable tips which may be changed according to the species of animal in use. The head-holder carries an angular scale which enables the head to be fixed at any required angle to the horizontal up to 90°.

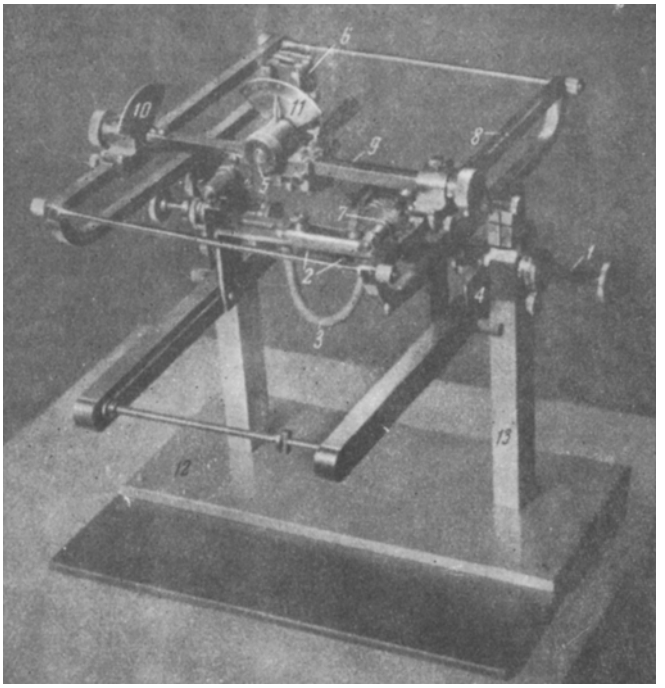

Fig. 1. General view of the stereotactic instrument. 1) Ear rods; 2) nose clamp; 3) elastic clamp for the upper jaw; 4) angular scale; 5) carriage carrying the micromanipulator; 6) micromanipulator; 7) pulley; 8) sagittal guide; 9) frontal guide; 10) scale showing angle of sagittal plane; 11) scale showing the angle of inclination of frontal plane; 12) base; 13) columns carrying the upper and lower frames.

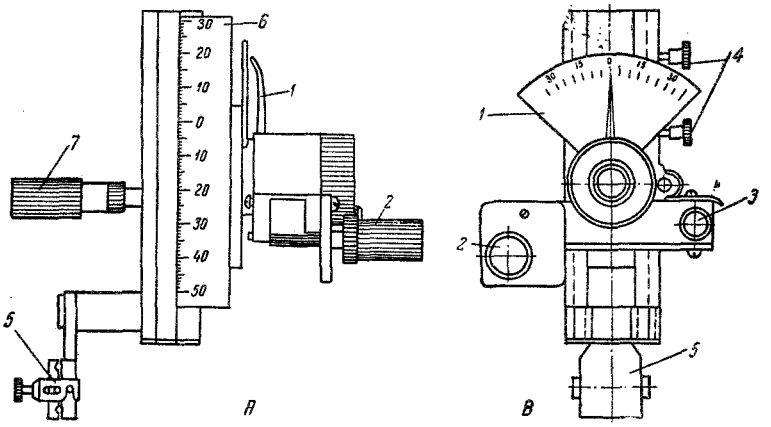

Fig. 2. Diagram of micromanipulator as seen in (A) side elevation, and (B) front elevation. 1) Scale showing inclination of frontal plane; 2) screw for movement in a frontal direction; 3) screw for fixation; 4) screw for fixation of block of micromanipulator; 5) replaceable electrode holder; 6) scale; 7) screw for micrometer movement of the block of the manipulator.

The upper removable part of the apparatus consists of a rectangular frame and a carriage on which is mounted the micromanipulator. The carriage may be moved in a frontal or sagittal direction, and in addition may be rotated through any angle around an axis in a sagittal or frontal plane, so that a setting may be made in terms of the axes

required for a given structure. The micromanipulator may also be inclined in a plane perpendicular to the angle of the carriage. In this way, while head fixation is maintained in terms of the principal coordinates an approach may be made to the required subcortical structure from any angle.

All possible movements and angles are indicated by appropriate scales. The angular divisions are of 1° and the distance intervals 1 mm.

In use there is no need to carry out any further calculations to find the "zero" of the device. Calibration of the precision frame is such that when the carriage is placed in the zero position of the frontal and sagittal axes the electrode lies midway between the ends of the ear rods.

The micrometer movement of the micromanipulator produces a smooth movement of the electrodes into the brain. The upper removable frame may be rotated through 180°, enabling manipulation of the caudal part of the brain to be carried out.

The constructional features of the apparatus are such as to recommend it for experimental work, especially because existing topographical maps will facilitate its utilization.

SUMMARY

This article describes a stereotactic apparatus for the infliction of injuries to various structures of the brain at any angle to the principal stereotactic planes. The apparatus is intended for use with dogs, cats, and rabbits; it is simple and convenient, and the reference point is set automatically. A demountable upper frame rotatable through 180° enables the apparatus to be used on the caudal part of the brain.

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