ANATOMICAL CORRELATION BETWEEN SOME CORTICAL AND SUBCORTICAL BRAIN STRUCTURES

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A previous paper [1] described a study of anatomical relations between surface and deep brain structures undertaken on mongrel dogs which differed in body weight (from 1.6 to 36.0 kg) and in the length of the cranial part of the skull (from 60 to 130 mm).

More than 300 serial frontal sections through the brain of 30 dogs were investigated. The following fact discovered was of particular interest: Architectural stability, characteristic of the internal construction of the brain and expressed as strict constancy of mutual arrangement of its deep structures, can also exist in the relations between some surface (cortical) and deep (brain-stem) brain formations and, in particular, in the relations between the origin of the Sylvian fissure, i.e., the fossa Sylvii, and the commissura alba anterior.

A topographical correlation between formations was established by the fact that in the brain of all the investigated dogs, the frontal stereotaxic plane passing through the origin of the Sylvian fissure (the fossa Sylvii) perpendicular to two other stereotaxic planes — horizontal and sagittal — always passes through the commissura alba anterior (Figs. 1b and 2b).

It was postulated on the basis of this fact that the fossa Sylvii can be used for practical purposes as a guide during stereotaxic operations on deep brain structures. Dogs were particularly interesting from this point of view, for ever since the time of Horsley and Clarke, because of the extreme variability of the shape and size of their skull they have been regarded as unsuitable animals for research requiring precise insertion of electrodes into subcortical formations.

A method of using the fossa Sylvii as the origin in a system of rectangular coordinates forming the basis of the stereotoxic method was proposed by the writer previously [1]. It has also been worked out in detail in a stereotoxic atlas of the basal ganglia of the dog brain [2], compiled on the basis of topographical correlation between the fossa Sylvii and the commissura alba anterior. The suggested method has been successfully tested in stereotoxic operations on the basal ganglia of dogs.

It would be of undisputed theoretical and great practical importance to determine whether this correlation observed between the fossa Sylvii and commissura alba anterior is a species-specific feature of the dog brain or whether it is also characteristic of other animals and, a matter of particular importance, of man. An investigation of frontal sections of 10 cat and 20 human brains from this point of view showed that the stereotoxic Sylvian frontal plane in cats and in man, just as in dogs (Fig. 1), always passes through the commissura alba anterior (Fig. 2).

Topographical correlation between a superficial cortical formation (the fossa Sylvii) and a deep subcortical structure (the commissura alba anterior) of the brain is thus a feature not only of dogs but also of other higher animals including man.

This fact is undoubtedly of great practical importance for neurophysiological investigations of the brain of higher animals and also for neurosurgical operations in man, for it provides the experimenter and surgeon with a sufficiently accurate method of determining the stereotoxic coordinates of the deep brain structures relative to an accessible and, at the same time, a reliable reference point.

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Fig. 1. Lateral surface of cat (a), dog (b), and human (c) brains. White lines show zero horizontal on Sylvian frontal stereotaxic planes.

Fig. 2. Sylvian frontal section of cat (a), dog (b), and human (c) brains. Arrow indicates commissura alba anterior.