THE MAJOR AND MINOR SULCI OF THE BRAIN OF THE SHEEP.

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INTRODUCTION.

A description of the constant and variable sulci of the cerebral hemispheres of the sheep brain is presented as a preliminary to the description of the cytoarchitecture. Owing to the lack of definite knowledge of the limits of cytoarchitectural zones the nomenclature of Krueg ('78) is followed. The same lack of knowledge makes it unsafe in many cases to name gyri and these have been omitted since a sulcus may lie on the border of a cell zone or within the zone. Krueg's excellent description covers a large series of ungulates indicating major, minor, and transient sulci as well as the order of appearance in embryonic stages along with a comparison with carnivores.

Krueg's paper does not include a large series of any one type and a description of a larger series of the sheep brain is needed in order to refer the description of the cytoarchitecture of a particular brain to the type or variations of the type. Fifty brains have been examined giving one hundred cases since the ordinary variations are as frequent on two hemispheres of the same brain as on the hemispheres of two different brains. For details of the insular area the papers and bibliographies of Clark ('96) and Holl ('00) should be consulted. The nomenclature of fissures, however, follows that of Krueg rather than that of Holl.

THE DORSAL SURFACE.

(Fig 1)

The dorsal surface, aside from the f. longitudinalis, presents one tranverse fissure, the Sylvian, one transverse sulcus, ansatus (cruciatus), and five longitudinal sulci, coronalis, lateralis, entolateralis, ectolateralis and suprasylvius and one diagonal sulcus, the diagonal. The ansate and coronal sulci are described in detail under the rostral surface.

Of the four longitudinal sulci on the caudal surface of the hemisphere, two, the lateral (Fig. 1, L) and the suprasylvian (Figs. 1, S. S. A, S. S. M., S. S. P.), are constant as to their depth but somewhat variable as to their position. The s. entolateralis (Fig. 1, Enl.) (medialis Burkholder '04) and s. ectolateralis (Fig. 1, Ecl.) (lateralis Burkholder '04) are shallow and vary both in length and position. A good deal of variation exists in the names of sulci associated with s. lateralis. The name of s. lateralis follows the description of Krueg ('78) and the suggestion of Kappers ('21, p. 1152) that the s. lateralis is the deepest sulcus on the caudal portion of the dorsal surface.

The s. entolateralis (Fig. 1, Enl.) is shallow and quite variable in length but never entirely absent although it may be represented by detached depressions. When best developed it lies next to the f. longitudinalis parallel to s. lateralis. Its rostral end may join the s. lateralis or turn medially and end on the medial border of the hemisphere. Its caudal end usually extends to and sometimes completely around the caudal border of the hemisphere where it may bifurcate over the dorsal end of ramus horizontalis posterior. When not present as a continuous sulcus, the slight depressions occupying its position are too variable to describe.

The s. lateralis (Fig. 1, L.) (intermedius, Burkholder '04) is not more pronounced on superficial examination than entolateral and ectolateral but if it is examined in transverse sections or if it is opened it is found to be a deep sulcus with convoluted walls throughout the caudal two-thirds of its length while the lateral wall of the sulcus forms a well defined operculum over the medial wall. It penetrates the brain wall in a ventrolateral direction.

The s. lateralis is fairly constant in its position with reference to the f. longitudinalis, i. e., in its distance from the median border of the hemisphere and in the fact that its caudal end extends except in rare cases (one in one hundred) around the caudal border of the hemisphere where it may join or be continued as the r. occipitotemporalis (Fig. 3, Oct.). In the case mentioned the caudal end of lateralis is separated from the caudal end of ectolateralis by a gyrus and ectolateralis extends beyond the caudal border of the hemisphere. Any reduction in the length or depth of s. lateralis is likely to be compensated by changes in ectolateralis. The rostral end of lateralis is more variable and shallower than the caudal two-thirds. It usually

extends to the middle of the hemisphere, shifting to a more medial position and may end on the dorsal surface or extend around the medial border of the hemisphere and appear on the medial surface (Fig. 5, L.).

The s. ectolateralis (Fig. 1, Ecl.) (lateralis, Burkholder) is shallow and quite variable as to length and tends to appear as a series of detached depressions. In its simplest form as a continuous sulcus it occupies a position midway between lateralis and suprasylvius with its rostral end bounded by the gyrus just caudal to s. ansatus. In some brains its rostral end bifurcates, the medial branch ending at or near the medial border of the hemisphere or even appearing on the medial surface. It does not join suprasylvius or lateralis in its rostral portion.

The caudal third of s. ectolateralis, even its simplest form, varies greatly. It may reach the caudal pole of the hemisphere rarely, but is likely to be limited by a gyrus dorsal or medial to a ramus of s. suprasylvius (Fig. 4, S. S., 6) or be replaced by a series of shallow depressions quite variable in position. The simple form of the sulcus just described is in 50% of brains examined, replaced by a series of shallow depressions of which only the rostral portions have any degree of constancy. In no cases examined have two parallel depressions appeared representing s. ectolateralis. Even detached depressions indicate roughly the position of the simple form.

The s. suprasylvius (Figs. 1 and 4, S. S. A., S. S. M., S. S. P.) is a constant deep sulcus with convoluted walls and lies near the lateral border of the hemisphere forming an arch in its rostral third over the dorsal ramus of the f. of Sylvius and a gentler curve throughout its caudal two-thirds. It penetrates the brain wall in a ventromedial direction. In the rostral third of its extent it usually, just dorsal to the f. of Sylvius, gives off a shallow dorsal ramus (Figs. 1, S. S. 2) approaching or even joining s. ansatus and delimiting a triangular gyrus rostral to which it curves laterally (ventrally) around the lateral portion of s. ansatus beyond which it again curves medially usually ending in a bifurcation just caudal to s. diagonalis. Two rather frequent variations occur in this region. One due to the buried condition of the gyrus at the lateral border of s. ansatus which gives the appearance of a union of s. suprasylvius with the lateral border of s. ansatus and the other the continuation through a shallow groove of the rostral end of s. suprasylvius

(Figs. 1, S. S. 1) parallel with s. diagonalis. A connection between these two sulci is present in at least 50% of the brains examined but when present it is so shallow as not to alter the validity of Krueg's ('78) description of a constant s. diagonalis in the ungulates and invalidates Brodman's description (Kappers, p. 1187) of the s. diagonalis as an extension of the anterior ramus of s. suprasylvius in ungulates.

The s. suprasylvius presents a constant ventral ramus (Figs. 1 and 4, S. S. 5) varying in depth and sometimes connected by a shallow depression with the s. posticus. This ventral branch of s. suprasylvius varies in length and apparently in depth depending on the extent and depth of a dorsal ramus of s. posticus which lies when present just caudal to it. There is constantly present between this ramus and the f. of Sylvius a shallow depression (Fig. 1). The caudal end of the s. suprasylvius rarely reaches the caudal pole of the hemisphere. It usually ends in a bifurcation on the dorsolateral surface, the dorsal ramus of which may join the caudal end of the s. ectolateralis, the ventral branch usually joining the caudal end of the s. posticus. Any change in the bifurcation of the caudal end of the s. suprasylvius or the absence of fusions with s. ectolateralis and s. posticus are likely to be replaced by slight depressions of variable shape and depth.

The Rostral Surface.

(Fig. 2).

The constant sulci appearing on the rostral surface are the transverse sulci, ansatus (cruciatus) and splenialis, the horizontal sulci, coronalis, presylvius, diagonalis and the olfactory sulcus visible on depressing or detaching the olfactory bulb and tract.

The sulcus ansatus (Fig. 1 and 2 An.) is a deep sulcus with convoluted walls extending from the fissura longitudinalis, where it is visible on the median surface of the hemisphere, laterally nearly to sulcus suprasylvius from which it is separated by a curved gyrus which is sometimes buried giving the ansate sulcus the appearance of joining the sulcus suprasylvius. The s. ansatus penetrates the brain wall in a ventrocaudal direction so that the caudal wall forms an operculum over the rostral wall.

The sulcus splenialis (cruciatus? Krueg) described under the medial surface (Figs. 1 and 2 spl.) is quite constant and deep

varying only slightly in the degree to which it extends laterally from the longitudinal fissure.

The sulcus coronalis (Figs. 1 and 2 Co.) is the deepest sulcus on the rostral surface. Both medial and lateral walls are convoluted and the sulcus penetrates the brain wall in a ventrolateral direction, the lateral wall forming an operculum over the median wall. It begins caudally at the sulcus ansatus from which it extends rostrally sometimes bifurcating into lateral and medial rami but in most brains having only the lateral ramus, the medial ramus when absent is usually represented by a slight notch at the point of bifurcation. When the median arm is absent its position is sometimes indicated by a slight indentation (Figs. 1 and 2 Co. 1). The lateral ramus is always present and usually lies parallel with the rostral end of the presylvian sulcus. The walls of these rami both medial when present and lateral are convoluted.

The presylvian sulcus (Figs. 1 and 2 Prs.) is constant with convoluted walls and is nearly as deep as coronalis. It penetrates the brain wall in a dorsomedial direction. It ends between the rostral rami of coronalis when both are present or medial to the lateral ramus when the medial ramus is absent. The dorsal end of presylvius may sometimes join the lateral ramus of coronalis.

The olfactory sulcus (Fig. 2 Olf.) is visible on the rostral area when the olfactory bulb and tract are depressed or removed. It is a shallow sulcus in which the olfactory tract lies and is quite constant.

The sulcus rostralis (paraolfactorius, Burkholder) sometimes appears on the medial border of the hemisphere as a notch in f. longitudinalis about midway between ansatus and the rostral end of the brain.

The sulcus diagonalis (Figs. 1 and 2, D. A., D. 1.) lying on the lateral portion of the rostral area is always present but is quite variable in form. It is deep and its walls are usually convoluted. It penetrates the brain wall in a slightly ventromedial direction. Its simplest and most constant form is a nearly straight line beginning near the pars dorsalis of the Sylvian fissure and extending forward dorsally and medially nearly to the s. coronalis. It is usually separated from Sylvius and always from coronalis by well defined gyri. It is rarely continuous with suprasylvius as in some ungulates (Brodmann and Kappers ('21)). Continuity of these two sulci is some-

times indicated by a slight depression formed by a blood vessel. A more complicated form of diagonalis is represented by the presence of a ventral ramus (Figs. 1 and 2, D. 1.). This ventral ramus when present is almost as deep as the diagonal portion. When absent the ventral ramus is replaced by a detached sulcus. Sometimes the ventral ramus is continuous with a dorsal ramus (Figs. 4, S. A. 1.) of pars anterior of Sylvius or may even be replaced by it.

The Lateral Surface.

On the lateral surface of the brain all the constant depressions except the vertically placed f. of Sylvius have a general horizontal direction and even the f. of Sylvius has pronounced caudal and rostral rami lying horizontally.

The s. rhinalis (Figs. 3 and 4, R.) is quite constant in position and begins rostrally at the attachment of the olfactory tract to the ventral surface of the brain, extending caudally as a shallow groove to the level of the dorsal ramus of the f. of Sylvius where it becomes deep with convoluted walls and appears on the caudal surface of the hemisphere (Fig. 3, R.) extending sometimes almost to the dorsal border of the caudal surface.

The fissure of Sylvius (Figs. 4, S. D., S. A., S. P. 1) presents three constant portions. The terminology of Krueg ('78) and Kappers ('21) is adopted rather than that of Holl ('00). The pars dorsalis (Fig. 4, S. D.) (processus acuminis Krueg) extends almost to the dorsal border of the hemisphere. Its lateral walls are always deeply convoluted and sometimes show short depressions in the lateral walls running parallel with the floor of the main fissure. The caudal wall overlaps the rostral wall to some extent forming a slight operculum. The dorsal extremity of pars dorsalis occasionally bifurcates. Two additional anterior rami are sometimes found extending from the dorsal ramus of the f. of Sylvius. The more dorsal (Fig. 4, S. D. 1) may join the ventral ramus of the bifurcated s. suprasylvius and the more ventral ramus (Fig. 4, S. D. 2) may join the caudal end of the s. diagonalis.

The pars anterior is not only deep except at its anterior end but is much convoluted on both dorsal and ventral walls. This ramus penetrates the brain wall in a ventro-medial direction so that the buried portion of the dorsal wall is concealed by the ventral wall. The rostral end of this ramus usually

bifurcates and the ventral ramus (Fig. 4, S. A. 2) may be continuous by a shallow depression with the s. presylvius, while the dorsal ramus (Fig. 4, S. A. 1) sometimes joins the ventral ramus of s. diagonalis or replaces it. It is sometimes connected also with the presylvian sulcus by a shallow depression (Fig. 4, S. A. 3) at the level of the bifurcation.

The pars posterior of the f. of Sylvius is short, but deep with convoluted walls and presents two rami a caudal and a ventral both of which are constant, the ventral ramus (Fig. 4, S. P. 2) (transinsular fissure of Clark '96) joining rhinalis. This ventral ramus is the only deep sulcus reaching s. rhinalis. Other transverse depressions rostral to it are either quite shallow or simply depressions caused by blood vessels.

Holl ('00) who has made a study of the insula of the ungulate brain includes the ventral wall of the posterior ramus of the fissure of Sylvius and the gyrus lying ventral to the anterior ramus of the fissure of sylvius (gyrus orbitalis Burkholder) in the insula (gyrus arcuatus 1 Holl). The gyrus surrounding pars dorsalis is labeled (arcuatus II Holl). This gyrus is bounded dorsally by s. suprasylvius. It extends rostrally to the middle of the s. diagonalis and caudally to the caudal ramus of the s. suprasylvius and includes the gyri surrounding the s. posticus.

The presylvian sulcus (Fig. 4, Prs.) is constant and deep with convoluted walls, the dorsal wall forming an operculum over the ventral wall. The sulcus penetrates the brain in a ventro-medial direction. It begins usually just ventral to the rostral end of the anterior ramus of the f. of Sylvius. It may be connected as mentioned above by a shallow depression with the ventral branch of the bifurcated f. of Sylvius but is usually quite detached from it. It may appear sometimes to be connected also with f. of Sylvius more caudally at the level of the bifurcation but this connection (Fig. 4, S. A. 3) is quite inconsistent and shallow and is caused by a blood vessel. This sulcus (Figs. 1 and 2, Prs.) extends around the rostral pole of the hemisphere and ends on the rostral surface between the bifurcated branches of s. coronalis or when the medial ramus is absent, which frequently happens, at the extreme rostral tip of the hemisphere lying parallel with the lateral ramus of s. coronalis.

The suprasylvian or arcuate sulcus is the most extensive sulcus on the lateral surface. It is quite deep with convoluted

walls. This sulcus penetrates the brain in a slightly ventro-medial direction especially in the pars media so that the ventral wall overlies the dorsal wall to some extent. It extends from just rostral to the pars dorsalis of the f. of Sylvius, in the form of an arch, almost to the caudal pole of the hemisphere. It is usually divided into a pars anterior (Figs. 1 and 4, S. S. A.) a pars media (Figs. 1 and 4, S. S. M.), a pars posterior (Figs. 1 and 4, S. S. P.) portions. The terminations of the anterior and posterior portions which are shallower than the pars media, being more variable in arrangement.

The pars media is the most constant and usually presents one shallow dorsal ramus, (Figs. 3 and 4, S. S. 2) directly dorsal to the end of the f. of Sylvius. As mentioned in describing the dorsal surface, the rostral portion of pars media (Fig. 4, S. S. C.) seems sometimes to be continuous with the lateral end of the s. ansatus owing to the depressing of the gyrus at the lateral termination of that sulcus.

The variations of pars anterior depend upon the form of the s. diagonalis. The pars anterior usually bifurcates into an anterior ramus (Fig. 4, S. S. 3) and a ventral ramus (Fig. 4, S. S. 4). Both rami are deep at the point of bifurcation and gradually become shallower toward their terminations. The anterior ramus rarely joins s. diagonalis and when this occurs it is by a shallow depression. In four cases, however, out of one hundred examined the depression was pronounced. The short ventral ramus (Fig. 4, S. S. 4) of the bifurcated rostral end may occasionally join and sometimes be replaced by a ramus from the f. of Sylvius (Fig. 4, S. D. 1) in the same relative position.

The caudal border of the pars media of s. suprasylvius is indicated by a constant and fairly deep ventral ramus (Fig. 4, S. S. 5). It is never entirely absent but varies in length and depth depending on the depth and form of s. posticus. From this ventral ramus the pars posterior forms a gentle curve maintaining its depth and convoluted wall almost to the caudal border of the hemisphere. The caudal portion of this sulcus is quite variable but usually bifurcates into a dorsal ramus (Fig. 4, S. S. 6) which frequently reaches the caudal border and is connected sometimes with the caudal end of s. ectolateralis (Fig. 4, Ecl.) or with detached depressions in the usual position of the caudal end of that sulcus. The ventral ramus (Fig. 4, S. S. 7) is still more variable but rarely absent and may be

connected with the caudal ramus of s. posticus and when absent be replaced by a branch from s. posticus.

The s. diagonalis (Fig. 4, D. A., D. P.) is a constant deep sulcus and penetrates the brain in a ventromedial direction. In 75% of the brains examined it is a simple diagonal depression beginning caudally near the middle of pars dorsalis of the f. of Sylvius and extending diagonally, rostrally and medially nearly to the middle of s. coronalis with which it never forms a junction. The caudal end of the sulcus is occasionally continuous with the f. of Sylvius by a transient anterior ramus of that fissure (Fig. 4, S. D. 2). This simple form of the diagonal sulcus is always accompanied by slight depressions both ventral and dorsal to the main sulcus. Owing to the presence of a ventral ramus in 25% of the cases examined the anterior and posterior halves are indicated as ramus anterior (Fig. 4, D. A.) and ramus posterior (Fig. 4, D. P.) respectively. In 25% of the brains examined there is a ventral ramus (Figs. 1, 2 and 4, D. 1) arising near the middle of the s. diagonalis and extending ventral and cephalad sometimes joining the anterior ramus (Fig. 4, S. A. 1) of the Sylvian fissure. This ramus is not as deep as the anterior and posterior rami and when absent is replaced by the slight depression mentioned above. The slight dorsal depression (Fig. 4, D. 2) mentioned above is sometimes continuous with the anterior ramus of diagonalis.

The s. posticus is a deep sulcus present in all brains examined and usually presents an anterior, a posterior and a somewhat inconstant and shallower dorsal ramus and a similar ventral ramus. In a few cases the anterior and posterior portions are detached from each other and the detached portions with the dorsal and ventral rami form a stellate figure. The anterior and posterior rami are the deepest and most constant portions. The anterior ramus (Fig. 4, P. A.) extends rostrally nearly to the f. of Sylvius which, however, it never joins. It usually ends just ventral to the ventral ramus (Fig. 4, S. S. 5) at the caudal border of pars media of s. suprasylvius. The caudal ramus extends nearly to the caudal border of the hemisphere and frequently bifurcates, its dorsal ramus sometimes joining s. suprasylvius (Fig. 4, S. S. 7). When the caudal ramus is short its caudal portion is replaced by a detached shallow depression. The dorsal and ventral rami (P. D., P. V.) are more variable than the anterior and posterior rami. The dorsal ramus is rarely absent, is short and deep and is

situated more cephalad than the ventral ramus. The ventral ramus (Fig. 4, P. P.) is sometimes absent and is replaced by a detached depression occupying the same relative position.

The Medial and Caudal Surfaces.
(Figs. 3 and 5).

The caudal and concealed portions of the medial surfaces of the hemisphere are exposed by a transverse incision and removal of the brain stem at the level of the mammillary body.

On the buried medial surface of the hemisphere two depressions, the hippocampal fissure and fimbriodentate sulcus appear constantly. Both are shallow even the hippocampal fissure cannot be readily opened.

The fimbriodentate sulcus (Fig. 5, Fd.) lies rostral to the hippocampal fissure between the fimbria and the gyrus dentatus and extends throughout the whole arch of the buried portion of the hemisphere appearing on the flat medial surface in front of the more anterior of two prominent elevations of gray matter ventral to and slightly rostral to the splenium of the corpus callosum.

The hippocampal fissure (Fig. 5, H.) lies caudal to the fimbrio-dentate sulcus between the gyrus dentatus and the gyrus hippocampi and extends throughout the whole arch of the buried medial surface of the hemisphere. It appears on the flat medial surface of the hemisphere when a median longitudinal section of the brain is made and is visible between the two small gray elevations mentioned above. These two gray elevations are usually labeled in the text books as fasciola cinerea. The anterior of these two gray masses is the dorsal limit of the gyrus dentatus and the posterior elevation is a continuation of the gyrus hippocampi.

On the flat medial surface of the hemisphere four sulci are always present with slight variations to be mentioned later with the addition of transient sulci belonging to the dorsal surface of the hemisphere.

The sulcus corporis callosi (Fig. 4, C.) is constant but shallow and extends throughout the length of the dorsal border of the corpus callosum and well around both genu and splenium.

The rostral area of the medial surface presents two constant moderately deep sulci: the s. genualis (Fig. 5, G.) of Krueg and Kappers (s. cinguli Burkholder) and the more rostral s.

rostralis (Fig. 5, Ro.) of Krueg and Kappers (parolfactorius Burkholder).

The sulcus genualis (Fig. 5, G.) begins cephalad ventral to the genu of the corpus callosum and arching around the corpus callosum extends to the middle of that structure. It is sometimes quite simple in structure but often presents a well defined dorsal ramus (Fig. 5, G. 1) just rostral to the anterior end of s. splenialis and sometimes a ventral ramus (Fig. 5, G. 2). This dorsal ramus may be absent or represented by a slight depression and may occasionally be situated more rostral and invade the area usually occupied by s. rostralis.

The s. rostralis (Fig. 5, Ro.) is more variable than genualis. In its most regular form it parallels the course of s. genualis lying nearer the rostral border of the hemisphere forming an arch beginning ventral to the rostral end of s. genualis and arching around extends caudally to the gyrus just rostral to the s. splenialis where it may reach the edge of the hemisphere. Its variations consist in its appearing as two detached depressions in some cases and occasionally in the detached portions being separated by a ramus of s. genualis.

A constant sulcus (Fig. 5, Pc.) appears caudal to the splenium of the corpus callosum occupying the same relation to the splenium that s. genualis occupies with reference to the genu. It is a short sulcus and varies both in depth and length and when least pronounced is represented by a slight depression. It is not named in any description of the sheep brain. It is indicated in many ungulate brains by Krueg ('78) and occupies the position of the subparietoccipital fissure of the anthropoids. Since the sulcus is always present it is named from its position sulcus post callosus, since the term retrosplenialis is preempted. Its position indicates that it is in an olfactory area (regio retrosplenialis of Campbell).

The sulcus splenialis (Fig. 5, Spl.) is the most extensive and deepest sulcus on the medial surface of the hemisphere and is much convoluted in its caudal half. It has a well defined diagonal direction ventrolaterally as it penetrates the hemisphere so that its ventral wall forms an operculum over its dorsal wall. It begins rostrally on the dorsal surface of the hemisphere (Figs. 1 and 3, Spl.) just in front of the s. ansatus and extends in an arch below the dorsal border of the hemisphere to the caudal border where it bifurcates into a dorsal and ventral ramus, the ventral ramus (Figs. 3 and 5, R. S.) being the sulcus

retrosplenialis of Kappers and the dorsal ramus (Figs. 3 and 5, H. P.), which is frequently shorter and shallower, being the ramus horizontalis posterior of Kappers. These two rami are never absent in the brains examined but vary somewhat in length and depth. A rather common variation in the rostral portion of s. splenialis is the presence of a dorsal ramus (Fig. 5, Spl. 1) frequently reaching the dorsal border of the hemisphere and lying just caudal to the s. ansatus (Fig. 5, An.) and between that sulcus and the s. lateralis when it reaches the medial border of the hemisphere.

On the caudal surface of the hemisphere the s. rhinalis (Figs. 3 and 5, R.) is always present. Sometimes it ends well toward the lateral surface of the caudal area and may be continuous with the caudal end of s. suprasylvius. In other cases it lies more medial and is in one brain continuous with the caudal end of s. lateralis of the dorsal surface. These variations seem to be correlated with the form and extent of a third sulcus which Kappers ('21 p. 1126) calls the occipito-temporal sulcus. This is sometimes a detached sulcus in the sheep but is frequently represented by the caudal extension of s. lateralis. The modeling of the caudal surface is usually determined by the length and depth of the ramus horizontalis posterior, s. lateralis and s. rhinalis. When the simpler arrangements are not present, that is, well pronounced caudal extensions of splenialis, lateralis and rhinalis detached depressions occur. The s. occipitotemporalis is best defined when lateralis is short and does not appear on the caudal surface of the hemisphere. This indicates a close relation between occipito-temporalis when present and s. lateralis. When occipito-temporalis is best defined it lies parallel and between retro-splenialis (Fig. 3, Rs.) and rhinalis (Fig. 3, R.).

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EXPLANATION OF PLATES.

In all figures primary or deep sulci and fissures are indicated by heavy lines, shallow sulci are indicated by fine lines, transient sulci are indicated by broken lines. A shallow sulcus is likely to be transient, but when it is of value as a landmark in localization it is sometimes indicated by a fine line and its transient character is noted in text.

PLATE I.

Fig. 1. Dorsal surface × 1.75.

Fig. 2. Rostral surface × 1.5.

Fig. 3. Caudal surface × 1.5. Fig. 3, in order to show the relation of sulci on the caudal surface to sulci on other surfaces includes more than the area in contact with the cerebellum which is taken as the caudal surface. The sulci shown in Fig. 3 are visible after the removal of the cerebellum.

PLATE II.

Fig. 4. Lateral surface × 1.75.

Fig. 5. Medial surface × 1.75. The brain stem was removed by a transverse incision at the level of the mammillary body.

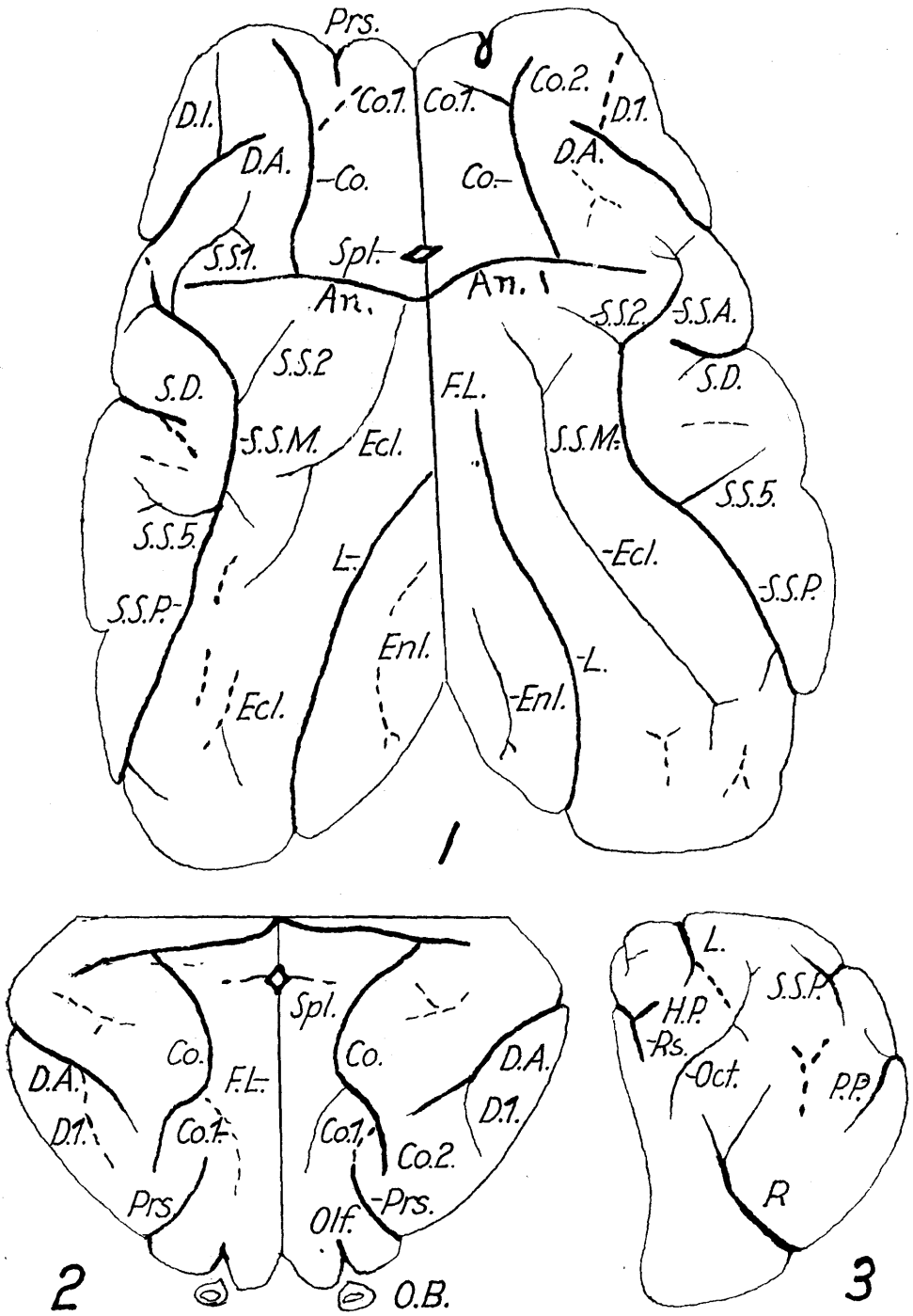
NOTE.—The determination of the relative depth of sulci on formalin fixed material is easily accomplished by immersing brains in tap water for some time, when the hemisphere wall becomes flexible and gyri are easily opened.

ABBREVIATIONS.

An.	sulcus ansatus (cruciatus?).
C.	sulcus corporis callosi.
C. A.	commissura anterior.
C. C.	corpus callosum.
C. O.	sulcus coronalis.
C. O. 1.	sulcus coronalis, ramus medialis.
C. O. 2.	sulcus coronalis, ramus lateralis.
D. A.	sulcus diagonalis, ramus anterior.
D. P.	sulcus diagonalis, ramus posterior.
D. 1.	sulcus diagonalis, ramus ventralis.
D. 2.	sulcus diagonalis, ramus dorsalis.
Ecl.	sulcus ectolateralis.
Enl.	sulcus entolateralis.
Fd.	sulcus fimbriodentatus.
F. L.	fissura longitudinalis.
For.	fornix.
G.	sulcus genualis (cinguli).
G. 1.	sulcus genualis, ramus dorsalis.
G. 2.	sulcus ganualis, ramus ventralis.
H.	fissura hippocampi.
H. P.	sulcus splenialis, ramus horizontalis posterior.
L.	sulcus lateralis.
M.	massa intermedia.
O. B.	bulbus olfactorius.
Oct.	sulcus occipitotemporalis.
Olf.	sulcus olfactorius.
P. A.	sulcus posticus, ramus anterior.
Pc.	sulcus postcallosus.
P. P.	sulcus posticus, ramus posterior.
P. D.	sulcus posticus, ramus dorsalis.
P. V.	sulcus posticus, ramus ventralis.
Prs.	sulcus presylvius.
R.	sulcus rhinalis.
Ro.	sulcus rostralis (paraolfactorius).
Rs.	sulcus retrosplenialis.
S.	septum pellucidum
S. A.	fissura Sylvii, pars anterior.
S. A. 1.	fissura Sylvii, pars anterior, ramus dorsalis.
S. A. 2.	fissura Sylvii, pars anterior, ramus medialis.
S. A. 3.	fissura Sylvii, pars anterior, ramus ventralis.
S. D.	fissura Sylvii, pars dorsalis.
S. D. 1.	fissura Sylvii, pars dorsalis, ramus dorsalis.
S. D. 2.	fissura Sylvii, pars dorsalis, ramus ventralis.
S. P. 1.	fissura Sylvii, pars posterior.
S. P. 2.	fissura Sylvii, pars posterior, ramus ventralis.
Spl.	sulcus splenialis.
Spl. 1.	sulcus splenialis, ramus dorsalis.
S. S. A.	sulcus suprasylvius, pars anterior.
S. S. 1.	sulcus suprasylvius, pars anterior, ramus anterior.
S. S. 3.	sulcus suprasylvius, pars anterior, ramus medialis.
S. S. 4.	sulcus suprasylvius, pars anterior, ramus ventralis.
S. S. M.	sulcus suprasylvius, pars media.
S. S. 5.	sulcus suprasylvius, pars media, ramus ventralis.
S. S. 2.	sulcus suprasylvius, pars media, ramus dorsalis.
S. S. P.	sulcus suprasylvius, pars posterior.
S. S. 6.	sulcus suprasylvius, pars posterior, ramus dorsalis.
S. S. 7.	sulcus suprasylvius, pars posterior, ramus ventralis.

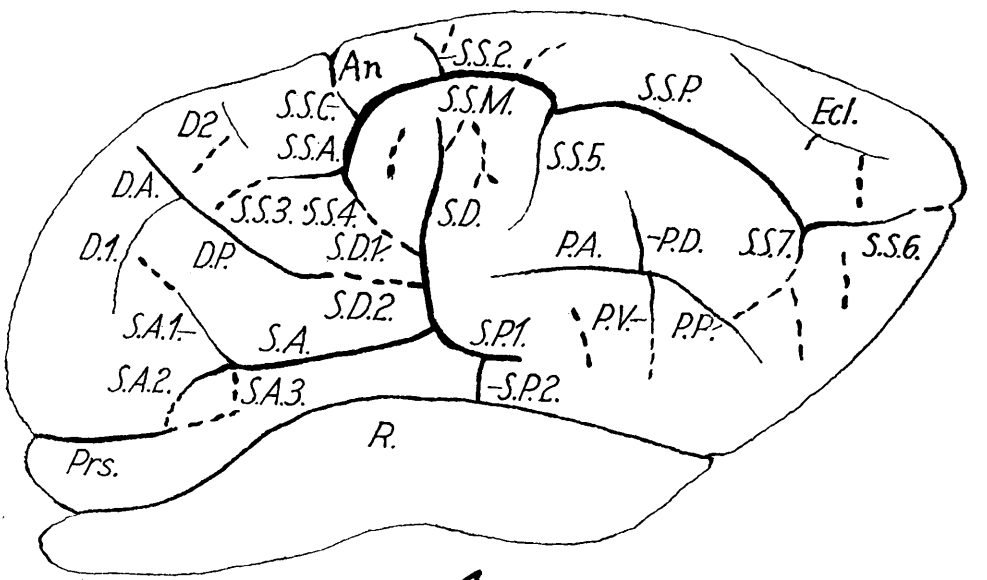
Sulci of the Brain of Sheep
F. L. Landacre

PLATE I.



Sulci of the Brain of Sheep
F. L. Landacre

PLATE II.



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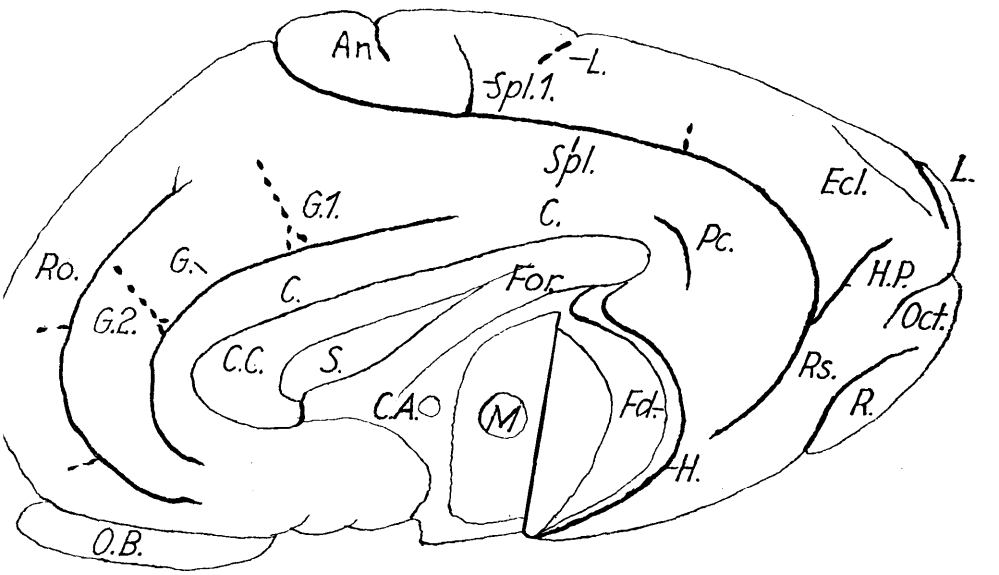

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