ated as total are the hippocampal (Fig. 755), calcarine (Fig. 760), and collateral (Fig. 755); the Sylvian may

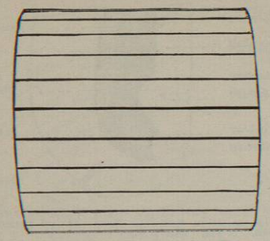

FIG. 763.—Diagram Illustrating the Effect of the Convexity of the Cerebral Surfaces upon the Apparent Width of the Gyres. Upon a cylinder were drawn parallel lines at the uniform distance of 1 cm.; one side of the cylinder was then photographed, and the figure is a reproduction of the photograph, reduced one-half. The reduction of the intervals according to the distance of the lines from the part nearest the eye illustrates the fact, not always distinctly recognized, that the fissures near the periphery of a cerebral convexity always appear to be nearer together than they really are; the intervening gyres consequently appear of less than their actual width; see, for example, the superfrontal gyre in Figs. 762 and 764.

possibly be correlated with the caudatum (Fig. 716); the callosal and occipital are total fissures in the fetus (Figs.

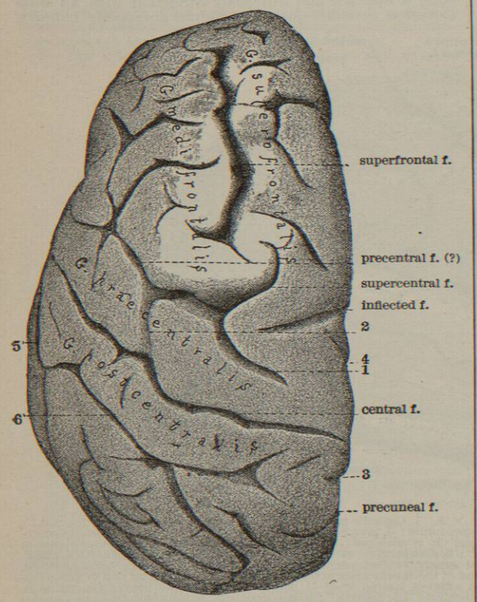

FIG. 764.—Dorso-Cephalic Aspect of the Left Hemicerebrum of a Mulatto; 322. ×.8. 1, Caudal radius of the triradiate supercentral fissure; 2, strait between the central and supercentral fissures; 3, caudal end of paracentral fissure (see Fig. 766); 4, cephalic end of the same (?); 5, Sylvian fissure; 6, postcentral fissure. See § 264.

734 and 761), and the ental correlative of the latter is sometimes recognizable in the adult (Fig. 744).

§ 259. *Fig. 759 illustrates:* A. The mesal wall of the postcornu presents a ridge, the calcar, and the mesal surface of the occipital lobe a furrow, the calcarine fissure; as seen in Figs. 760 and 761, the ectal depression and the ental elevation are obviously correlated.

B. The precornu presents an ental elevation, the caudatum, and a depression nearly opposite, the Sylvian fissure. But the correlation of the two is not quite clear and the conditions are complicated by the formation of the intrafissural (or intergyral) elevation called *insula*.

C. Here, as in the postcornu, there is no doubt respecting the correlation of the ental elevation or colliculus, the

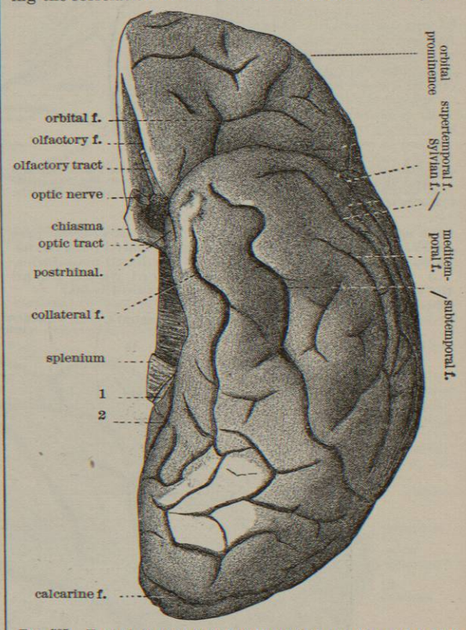

FIG. 765.—Ventral Aspect of the Left Hemicerebrum of an Adult Male Mulatto; 322. ×.8. 1, Ridge ventrad of the splenium, representing, perhaps, one of the gyres described by A. Retzius, British Association Proceedings, 1885; 2, stem of the occipital and calcarine fissures. See § 265.

Preparation.—See Fig. 757. The olfactory bulb has been removed.

hippocamp, and the ectal furrow, the hippocampal fissure; in addition, the proper nervous parietes are abrogated along a line, the rima, and the paraplexus is formed by the intrusion of the pial process covered by the endyma; the margins of the rima are specialized and become the fimbria and tenia; on the figure the tenia is not indicated as separate from the caudatum (Fig. 730).

§ 260. *Classification of the Permanent Fissures.*—The following grouping of the fissures is approximately natural and has been found convenient by me; at the best, however, any such arrangements are provisional:*

* Whatever may be desirable in theory, or eventually practicable, at present nothing seems to be gained by attempting to classify cerebral depressions as fissures and sulci, and in this article all are designated as *fissures*.

A. Total fissures, representing a corrugation of the entire paracelian parietes; *e.g.*, calcarine.

B. Partial fissures with some structural correlative; *e.g.*, olfactory.

C. Partial fissures, nearly or quite constant, and demarcating recognized gyres; *e.g.*, subfrontal.

D. Inconstant, intragyral fissures; *e.g.*, medifrontal.

§ 261. *Fig. 761,* in addition to A and B, specified under Fig. 727, *illustrates:* A. The contiguity of the two margins of the rima, excepting for the intruded paraplexus.

B. The concomitant, absolute exclusion of the thalamus from the paracelian floor.

C. The depth and peculiar form of the lambdoidal fissure (Fig. 750).

§ 262. *Fig. 762 illustrates:* A. The form of this adult, mulatto, left hemicerebrum, unaltered save from alcoholic shrinkage.

B. The general aspect of the gyres, comparable with the appearance in the cerebrum of the philosopher, Chauncey Wright (Fig. 788).

C. A simple, almost typical condition of certain fissures, *e.g.*, central and Sylvian, in a large part of their course, combined with great and unusual peculiarities of the same or other fissures.

D. The visibility of the insula (see Figs. 767 and 788).

E. The presence of a vertical branch of the presylvian fissure, which, however, does not extend through the thickness of the operculum.

F. The union of the subfrontal with the precentral and with two of the fissures crossing the medifrontal gyre.

G. The apparent narrowness of the superfrontal gyre, which nevertheless, as seen from the dorsal aspect, is of considerable width; in fact the narrowest portion of the superfrontal is just as wide as is the subfrontal measured in line with the stem of the presylvian fissure; this is a forcible exemplification of what is explained under Figs. 763 and 764.

H. The great length of the supertemporal fissure, and its apparent dorsal branching in four directions; its true and deep continuation is cephalad between 5 and 10.

I. The continuation of the calcarine fissure around the margin of the hemicerebrum so as to appear upon the caudo-lateral aspect as an undivided end (15); the calcarine is believed to be continuous commonly with a bifurcated postcalcarine, and the condition in this brain seems to be unusual; see also Fig. 785.

J. The superficial connection of the central and precentral fissures.

K. The partial appearance of the subtemporal fissure on the lateral aspect; see, however, Fig. 765.

L. The forking of the Sylvian into an episylvian fissure, near 4, and a hyposylvian near 5.

§ 263. The apparent width of gyres upon convex surfaces of the cerebrum is affected by the point of view. Compare, *e.g.*, the superfrontal gyre of the mulatto as shown in Figs. 762 and 764. The conditions are schematically illustrated in Fig. 763.

§ 264. *Fig. 764 illustrates:* A. The length and independence of the superfrontal fissure, and its close parallelism with the hemicerebral margin.

B. The width of the supercentral gyre when viewed directly as compared with the oblique view shown in Fig. 762 (see § 262, G).

C. The triradiate form of the supercentral and its relation to the inflected.

D. The continuity of the supercentral with the precentral and central; in each case, however, there is a vadum or shallow.

§ 265. *Fig. 765 illustrates:* A. The presence of a distinct though rounded orbital prominence between the frontal and the lateral portions of the outlines, but the absence of any such boundary between the lateral outline and the occipital.

B. The narrowness of the olfactory gyre, between the olfactory fissure and the mesal margin of the frontal lobe.

C. The distinctly zygal form of the orbital fissure.

D. The length and distinctness of the subtemporal fissure.

E. The extension of the calcarine fissure upon the occipital end of the hemicerebrum.

F. The presence of a fissure (orbito-frontal?) on the orbital surface cephalad of the orbital fissure.

§ 266. LIST OF PARTIAL FISSURES, CONSTANT OR NEARLY SO, AND DEMARCATING GYRES.

Fissures.	Aspect.	Gyres separated by them.
1. Basisylvian....	Ventral	Orbital. Temporal.
2. Central	Lateral	Precentral. Postcentral.
3. Circuminsular.	Lateral	Insular. Adjoining.
4. Inflected.....	Lateral	Superfrontal. Precentral.
5. Insular.....	Lateral	Insular.
6. Olfactory.....	Ventral	Orbital. G. rectus.
7. Orbital.....	Ventral	Subfrontal. Orbital.
8. Orbito-frontal..	Lateral	Superfrontal. Orbital.
9. Paracentral....	Mesal	Paracentral. Precuneus, etc.
10. Parietal.....	Lateral	Parietal. Subparietal.
11. Paroccipital...	Lateral	Paroccipital. Subparietal.
12. Postcentral....	Lateral	Postcentral. Parietal.
13. Postrhinal.....	Mesal	Uncus Temporal
14. Precentral.....	Lateral	Precentral. Medifrontal.
15. Presylvian	Lateral	Operculum. Preoperculum.
16. Subcentral	Lateral	Postcentral. Parietal.
17. Subfrontal	Lateral	Subfrontal. Medifrontal.
18. Subsylvian....	Lateral	Preoperculum. Suboperculum.
19. Supercallosal..	Mesal	Callosal. Fronto-marginal.
20. Supercentral...	Lateral	Precentral. Super- and medifrontal.
21. Superfrontal...	Lateral	Medifrontal. Superfrontal.
22. Supertemporal.	Lateral	Supertemporal. Meditemporal.
23. Transinsular...	Lateral	Preinsula. Postinsula.

§ 267.—LIST OF INCONSTANT FISSURES, WITH THE GYRES IN WHICH THEY OCCUR.

Fissures.	Gyres.
1. Adoccipital	Precuneus.
2. Episylvian	Subparietal.
3. Exoccipital	Occipital (?).
4. Fronto-marginal	Fronto-marginal.
5. Hyposylvian	Supertemporal.
6. Intermedial	Subparietal.
7. Intraparacentral	Paracentral.
8. Medifrontal	Medifrontal.
9. Postcalcarine	Occipital (?).
10. Postcuneal	Occipital (?).
11. Postoccipital fovea	Occipital (?).
12. Postparoccipital	Paroccipital.
13. Precuneal	Precuneus.

14. Preoccipital fovea ..... Subtemporal.
15. Preparoccipital ..... Paroccipital.
16. Rostral ..... Callosal.
17. Suboccipital ..... Occipital (?).
18. Subtemporal ..... Medi- and subtemporal.
19. Transtemporal ..... Meditemporal.

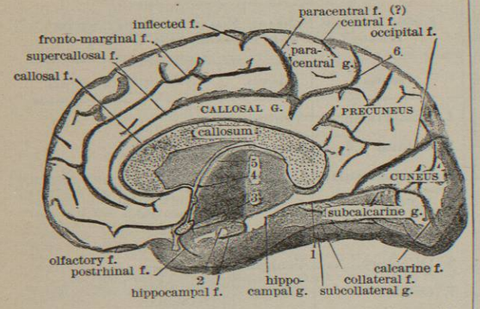

FIG. 766.—Mesal Aspect of the Left (Reversed So as to Appear the Right) Hemicerebrum of an Adult Male Mulatto; 322. × .5. 1, The common stem of the occipital and calcarine; 2, uncus; 3, optic tract, divided obliquely; 4, fornix; 5, retreating ventral surface of the fornix; 6, paracentral fissure. There can be no doubt that 6 is the caudal or main portion of the paracentral, but the cephalic portion so named is thought by E. A. Spitzka to represent the intraparacentral, the true cephalic limb being absent. Mr. Spitzka concludes (1900) that the inflected, like the central, typically indents the margin of the paracentral gyre. Unfortunately, at this time, I cannot determine the point by re-examination of the specimen; but the need of doing so exemplifies the remark in § 253.
Preparation.—See Fig. 757.
Defects.—Most of the fissure lines are too faint; the emargination of the ventral outline just cephalad of the optic nerve is too decided.

§ 268. *Fig. 766 illustrates:* A. The existence and unusual extent of the fronto-marginal fissure.
B. The complexity of the precuneal fissure.
C. The length of the collateral fissure.

FIG. 767.—Lateral Aspect of the Left Hemicerebrum of an Adult Swedish Carpenter, Presenting an Unusual Degree of Fissuration; 318. × .6.—*Preparation.*—The hemicerebrum was hardened resting upon the mesal surface, and apparently with little change in form. The right was likewise numerously fissured. Of the unidentified fissures the only ones that seem to call for comment here are 9 and 10, which are transtemporal fissures, and 16, a well-marked hyposylvian. See § 275.

D. The distinctness of the postrhinal fissure.
E. An apparent peculiarity of the paracentral fissure as stated briefly in the description; the subject is discussed by E. A. Spitzka, 1900.

§ 269. *Pre-Eminent Importance of the Central Fissure.*—Taking all things into account, the central fissure demands first and fullest consideration; there is, indeed, no fact concerning it that is not worth recording or that may not prove significant morphologically or practically valuable. The order in which the following topics are presented is far from perfect, but it may serve to indicate the many-sidedness of these cerebral features. To save space the pronoun *it* will commonly designate the central fissure.*

§ 270. *The Name.*—It has been called, to use the Latin forms, *fissura*, *scissura*, and *sulcus*, with the qualifying adjectives *centralis*, *Rolandica*, and *postero-parietalis*, all these having, of course, appropriate equivalents in the various modern languages. My doubts as to the utility of discriminating, at present, between fissures and sulci have been expressed in § 260, *note*. My reasons for preferring *central* to *Rolandic* have been stated upon several occasions since 1882; but as the former name has now been adopted by the Association of American Anatomists and the Anatomische Gesellschaft it will probably supersede the latter with anatomists of other nations.

§ 271. *General Location and Direction.*—On the dorso-lateral aspect of the cerebrum, at about the middle of its length; from a point at or near the dorsi-mesal margin, it extends latero-cephalad at an angle of about 70 degrees with the meson, or about 140 degrees with its opposite.

§ 272. *Dimensions.*—Among adult hemicerebrums in the museum of Cornell University the length of the fissure, measured in a straight line between the two ends, varies from 8 to 10.5 cm., the usual length being about 9.5 cm., or about one-fourth of the entire circumference of a cerebrum as measured in a dorso-ventral plane intersecting the fissure at about the middle of its length. If measured along the sinuosities, as if the fissure were straightened out, the length may be one-seventh greater than if measured across the curves. The greatest depth varies from 10 to 15 mm.

§ 273. *Relation to Ental Elevations.*—There is no evidence of any special collocation between it and any ental elevation, in man or any other mammal; hence, though so deep, it is not a total but a partial fissure (§ 258, A).

§ 274. *Constancy.*—The only case of absence of the central fissure known to me is that described by Sir William Turner (*Jour. Anat. and Physiol.*, xxv., 327–348). The subject was an epileptic, twenty-six years old, and the entire (alcoholic) brain weighed 1,107 gm. (39¾ ounces);

* The central fissure is quite fully discussed by Cunningham (1892, chap. iii.).

the left hemicerebrum 530 gm., the right 437. The left fissures are stated to have had a normal development and arrangement, but on the right the Sylvian fissure was wide open so as to expose the insula largely; *the central fissure was wholly absent*, together with the precentral and postcentral; the lateral surface presented three arched fissures, demarcating four arched gyres about the Sylvian fissure, a condition analogous to that in the dog and many other carnivora. The interest and importance attaching to this case would have warranted a larger number of better figures, and a representation of the left hemicerebrum.

§ 275. *Fig. 767 illustrates:* A. The unusual number of minor fissures, especially of the slight depressions which I have called *fossulæ*.
B. The three cephalic curves of the central fissure, and their decided character.
C. The extent of the supertemporal fissure.
D. The continuity of the postcentral, parietal, and paroccipital fissures.
E. The length of the dorsal branch of the presylvian.
F. The two dorsal branches of the Sylvian, and the distinct hyposylvian branch (16).
G. The crossing of the temporal lobe ventrad of the supertemporal fissure by two transtemporal fissures.
H. The non-union of the subfrontal with the precentral; this last is not named but is the ventral continuation of the supercentral, beginning about opposite the subfrontal.
I. The continuity of the postcentral, subcentral, parietal, and paroccipital, constituting what has been called the "intraparietal complex"; § 306.

§ 276. *Topographical Importance.*—This is well indicated in the following vigorous declarations of Wagner and Ecker: "*Man muss sie immer zuerst aufsuchen, um sich von da in dem scheinbaren Chaos der Hirnwindungen. . . .*" "*Bildet sie die den sichersten Ausgangspunkt für die Aufsuchung der Windungen. . . .*"

§ 277. *Form, or Course in Detail.*—According to Broca it normally presents two cephalic convexities with an intermediate caudal convexity. In most adults it is certainly more or less serpentine or tortuous, and the regular curves are sometimes distinct; but three cephalic convexities have been observed in sufficient number to show the need of careful observation and tabulation.

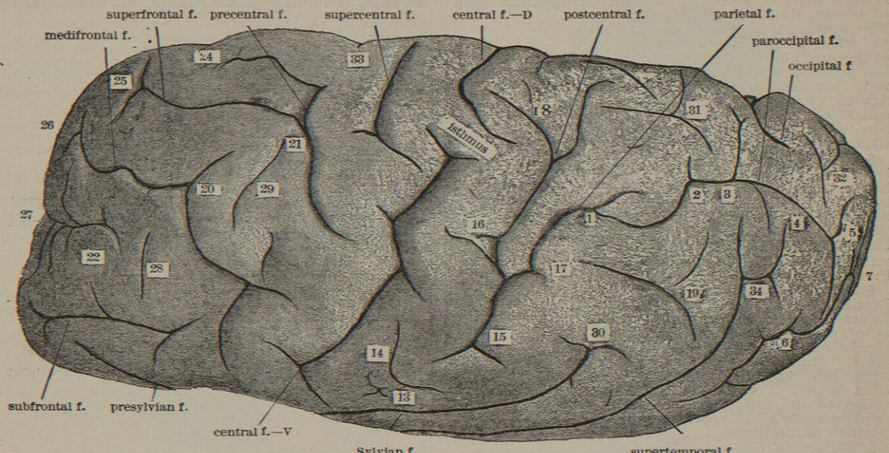

FIG. 768.—The Left Hemicerebrum of a Philosopher (Chauncey Wright), from the Dorso-Lateral Aspect. × .9.
Preparation.—See Fig. 788. The figure is based upon a photograph taken as nearly as possible at an angle of 45° with the meson, so as to present the dorso-lateral aspect. The line connecting the superfrontal and medifrontal fissures was made inadvertently.
The numerals 1 to 22 are at the same points as in Fig. 788; on that figure 23 designated the central isthmus, which here has the word printed upon it; 33 is just at the end of the short inflected fissure.

§ 278. *Branches.*—Offshoots from the central are usually rather short and straight, starting at the summits of the curves; but in the brain presenting the most decided curvatures (Fig. 767) there is scarcely any branching.

§ 279. *Fig. 768 illustrates:* A. The unfamiliar appearance of a hemicerebrum when viewed from this oblique aspect.
B. The distinctness of the angles between the cephalic and the dorsal and ventral outlines; this was commented upon by the first describer of this brain, Prof. Thomas Dwight, and appears in Fig. 788, though less markedly.
C. The completeness and width of the isthmus between the dorsal and ventral portions of the central fissure; in Fig. 788 this is marked 23, but is so much foreshortened as to be hardly visible.
D. The simple, curved form of the dorsal part of the central fissure, with no bifurcation such as exists at both ends of the ventral portion.
E. The independence of the supercentral fissure.
F. The presence of a medifrontal fissure subdividing the large area between the subfrontal and superfrontal fissures.
G. The junction of the subcentral fissure with the parietal, and the continuity of the parietal with the paroccipital; whether this junction occurs at 1 or at 2 cannot be determined at present.
H. The great length of the supertemporal fissure and the complexity of its dorsal end.
I. The presence of a long and curved fissure, 6–7, on the lateral aspect of the occipital lobe.
J. The presence of an unusual crescentic fissure (14) ventrad of the subcentral (15).

§ 280. *Junctions.*—So far as I am aware, connections between the central and other fissures (excepting the intercerebral, § 236) are rare, and incomplete or shallow

when they occur; *e.g.*, in Fig. 762, where the concealed vadum between the central branch and the supercentral nearly reaches the surface, and in Fig. 767, where there is also a nearly invisible vadum just at the apparent union of the supercentral with the central. The occasional confluence of the central with the Sylvian over the margin of the operculum is commonly shallow, but sometimes quite deep, as in the right hemicerebrum of James Burk, figured by Mills (*Journal of Nervous and Mental Disease*, vol. xiii., September, 1886). The depth of such straits should always be stated.

§ 281. *Bifurcation.*—Terminal division of the central fissure at either end is rare; among the few cases known to me the ventral end is bifurcated on the right in a supposed insane person (385) and the ventral on the left of Chauncey Wright (Fig. 768); the dorsal end is bifurcated on both sides in Professor Oliver (Fig. 664).

§ 282. *Relation to the Mesal Aspect.*—Cunningham found (1892, 162) that the fissure indented the dorsal margin so as to appear on the mesal aspect (as in Fig. 757) in sixty per cent. of the hemispheres examined. My own observations would make the proportion somewhat larger. For the final determination of the ratio there should be employed only adult specimens retaining their natural form.

§ 283. *Special Location.*—About midway between a line coinciding with the precentral and supercentral fissures cephalad, and a line coinciding with the postcentral and subcentral caudad.

§ 284. *How to Distinguish from Adjoining Fissures.**—When the precentral is separate from the supercentral, and the postcentral from the subcentral, the central is notably longer than either. When these two pairs of fissures unite, however, it is the middle of the group of three fissures at about the middle of the hemicerebrum having a general dorso-ventral direction. The following characters should be noted in case of doubt: its greater depth and length; its location relatively to the entire length of the cerebrum, and the angle it forms with the margin; its more complete independence; the usual absence of terminal forks; particularly its extension to or across the dorsal margin just cephalad of the paracentral, thus indenting the paracentral gyre (Fig. 769).

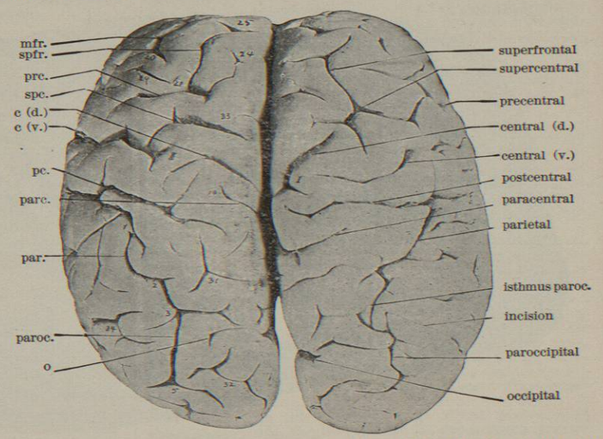

FIG. 770.—Dorsum of the Cerebrum of Chauncey Wright, a Philosophic Writer, Critic, and Mathematician (see description of Fig. 788). × .8. When photographed the cerebrum was inadvertently tilted a little to the left. I, Central isthmus on either side; the numbers correspond to those on Figs. 768, 779, and 788.

FIG. 769.—Right and Left Paracentral Regions of an Adult; 3,132. × .5. Each piece was cut from the dorso-mesal region of the hemicerebrum by an incision at about 45° with the meson; the pieces rest upon the oblique cut surfaces and the dorso-mesal margins correspond approximately to lines between the two Ds and the two Ms. 1, Dorsal outcrop of the cephalic end of the paracentral, which is also continuous with the supercallosal; 2, a crescentic fissure which, in the foreshortened position of the parts, appears to join the paracentral, but is really separated from it by a vadum barely below the surface; 3, a similar fissure on the right, separated by a complete isthmus from the paracentral, which latter has no dorsal outcrop, but is continuous with the supercallosal; in the light of E. A. Spitzka's observations 2 and 3 may be the inflected fissures.

§ 285. *Alleged Duplication.*—Calori and Giacomini have each described (1884) a brain which they interpreted as having two central fissures nearly parallel and separated by an "intercentral" gyre. The conditions in an educated suicide (3129) were similarly interpreted by me (1894, *a*); but a later comparison with a larger number of brains leads me to conclude rather (1900, *a*) that the supposed second or caudal central is really an unusually long resultant of the union of the postcentral and subcentral, caudad of which is the parietal. The bifurcated dorsal end of the postcentral has the usual relation with the paracentral as it crosses the meson (see Fig. 769).*

§ 286. *Fig. 769 illustrates:* A. The more usual relation of the central fissure to the dorsal margin, crossing it so as to appear on the mesal aspect.

B. The constant relation of the central fissure to the paracentral, the former directed at the concavity of the latter.

C. The usual relations of the paracentral and postcentral fissures, the former directed at the reentrant angle formed by the bifurcation of the latter.

D. The not unusual bifurcation of the supercentral (upper precentral) fissures.

E. The asymmetry of the paracentral in respect to a dorsal outcrop of the cephalic end.

F. The danger of depending upon appearances in respect to the independent fissures 2 and 3.

§ 287. *Interruption.*—As shown in Figs. 770 and 771, the central fissure is completely interrupted on both sides of the brain of Chauncey Wright, the isthmus* being fully on a level with the adjacent gyres. The brain of Dr. Fuchs, figured by Wagner, exhibited a like peculiarity, and the complete interruption has now been recorded for perhaps fifteen hemicerebrums, a very small proportion of the enormous number examined. The left central is completely interrupted in the educated suicide (3,129) referred to in § 285; but the right is continuous.

§ 288. *Fig. 770 illustrates:* A. The unusual squareness of the frontal outline.

B. The unusual length of the region caudad of the central fissures, and concomitantly that of the parietal fissure.

C. The width and simplicity of most of the gyres, especially as compared with those of Professor Oliver (Fig. 664).

D. The complete interruption of both central fissures by an isthmus, (Fig. 771).

E. The lack of symmetry of the central fissures in respect to (*a*) distance of the isthmus from the meson, (*b*) difference in form of the dorsal portions; (*c*) unlike dorsal terminations of the ventral portions.

F. The unusual depth of both paracentral fissures and their non-oppositeness.

G. The unusually caudal location of the right paracentral so as to embrace the dorsal end of the postcentral as if the latter were the central.

H. The asymmetric condition of many other fissures.

I. The unequal depths of the occipitals; the right extends barely beyond the rounded cerebral margin; the left is at least three times as deep; this fact has been ascertained since the publication of the diagram of the paroccipital region in the Proceedings of the Ass'n Amer. Anatomists, 1895.

J. The details of the paroccipital region are considered under Fig. 779. In certain respects this brain is unique and merits extended monographic treatment; but this also will be easier and more instructive when a normal standard has been more nearly obtained.†

§ 289. *Partial Interruption.* — Several writers have called attention to the not infrequent presence of a vadum or shallow in the depths of the central fissure, commonly nearer the dorsal end; among 1,087 hemicerebrums examined, Heschl found in 152 (about fourteen per cent.) an elevation (vadum) rising from one-sixth to five-sixths of the entire depth of the fissure, and suggests that the rare cases of complete interruption result from the greater development of this feature. In view of these observations the vadum should always be looked for.*

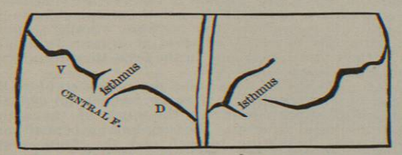

FIG. 771.—Central Region of the Dorsum of the Cerebrum of Chauncey Wright (Fig. 770), showing only the interrupted central fissures and the isthmuses; on the left the two portions of the fissure are designated by V and D respectively. × 5.

* The macroscopic methods here enumerated might require confirmation from the histology of the region in question, as indicated in the discussion of my paper, 1900, *a*, by Donaldson, Spiller, and Mayer (Jour. Nerv. and Mental Disease, October, 1900, 540).

* After the above paragraph was in type the kindness of Dr. D. S. Lamb enabled me to obtain a transcript of the "Nota preventiva" of C. Leggiardi-Laura (Archiv di Psich. Sci. Penol. ed Antrop. Crimin., Torino, 1899, p. 421), "Duplicita della scissura di Rolando nei criminali." It is there claimed that among thirty-seven female brains central reduplication occurred once, on the left, and among thirty males, twice on the left, once on the right, and once on both sides. In the absence of figures, especially photographs, and detailed descriptions, I must refer these to the same category as my own; see also the remark of Dr. C. K. Mills upon my paper (1900, *a*) in Jour. Nerv. and Mental Disease, October, 1900, pp. 537–541, and my later note on the subject, 1900, *x*.

* This term is equivalent to *pli de passage*, *annectent convolution*, and *bridging convolution*; the latter is misleading, for the interruption of a fissure has no analogy with a bridge, but rather with a dam, dike, or isthmus, absolute size being of no moment.

† The need of an improved standard for the study of fissures is clearly recognized by Mickle, 1895, opening paragraph.

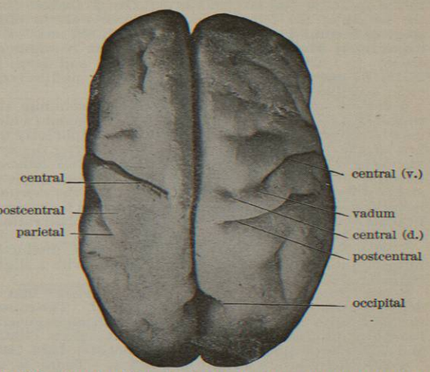

FIG. 772.—Dorsum of the Cerebrum of a Fetus Supposed to be Six Months Advanced; 2,972. × 1. One of twins, both males, stillborn.

§ 290. *Mode of Formation.*—In at least three specimens in the Cornell Museum, viz., 827 (Fig. 773), 2,278 (Fig. 752) and 2,972 (Fig. 772) there are evidences that the central begins in at least two portions, a dorsal and a ventral. Cunningham's views are summarized thus in 1897, *a*, 593:

"1. The typical mode of development is in two more or less distinct pieces. 2. Judging from the specimens in my possession this would likewise appear to be the more usual mode."† The cases of partial (by vadums) or total (by isthmuses) interruption in the adult may be regarded as retentions of the (usual or not infrequent) fetal condition.

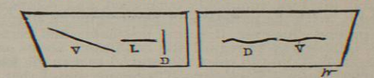

FIG. 773.—Diagrams of the Right and Left Central Fissure Regions of a Fetus, 56 cm. Long and Estimated at Twenty Weeks; 827. × 2.

§ 291. *Fig. 772 illustrates:* A. The unsymmetrical development of the central, postcentral, and parietal fissures.

B. The representation of the right central fissure by a longer ventral portion; a dorsal portion which is merely a dimple, but perfectly distinct; and an intervening vadum.

§ 292. *Fig. 773 illustrates:* A. The interrupted condition of both central fissures at their first formation.

B. The lack of symmetry; on the right are two parts, the right ventral (V) being 2 mm. deep at its middle and the dorsal (D) 2.5 mm.; on the left are three distinct divisions—the dorsal parallel with the meson, the lateral at right angles with it, and the ventral oblique.

§ 293. *Time of First Appearance.*—Nearly all writers

* The morphological and zoological significance of vadums is forcibly stated by Cunningham (1897, *a*, 593): "A close study of the memoir of Retzius (1897) has left on my mind the impression that he somewhat understates their morphological value. With Eberstaller I hold that they constitute one of the great and distinctive characters of the human brain."

† The distinction between "*typical*" and "*usual*" in a case like this is not apparent.

state that the central fissure is formed about the end of the fifth month, the twentieth week. The following observations show that there is probably some variation in this respect, or—as is perhaps equally probable—that the length of the fetus varies considerably at the same stage of fissural development. In fetuses 827 and 1,817, respectively 56 and 65 cm. long, the fissure is vague or absent; in 1,820, 61 cm. long, it is distinct and deep; in 2,278, 67 cm. long, it is well developed, and several other lateral fissures are visible.

§ 294. *Relative Order of Appearance.*—Excluding the transitory fissures (Fig. 748) and the lambdoidal (which may be transitory, Fig. 750), the central is apparently the first of the lateral fissures to be developed after the Sylvian (Fig. 751). But some of my preparations indicate that this order may not be invariable; in 2,081 the parietal and supertemporal are more advanced than the central; in 1,817 there is no trace of a central, although both superfrontals are distinct. Numerous and careful observations are needed on this point.

§ 295. *Form in the Fetus.*—When first distinctly formed, the fissure line is nearly straight, with a slight cephalic convexity (Fig. 751).

§ 296. *Proximate Cause.*—There is no evidence that it depends upon the pressure of a blood-vessel. The causation of fissures and of encephalic corrugations in general has been discussed by Jelgersma, Cunningham (1892), and A. J. Parker (1896), and briefly by Schäfer (1893, 162).

§ 297. *Relation to Primitive Fissures.*—There is no good reason for regarding either of the three radiating, presumably transitory, fissures shown in Fig. 746, as the direct precursor of the central.

§ 298. *Integrality.*—For the definition of *fissural integer* see § 305. The occasional complete interruption (§ 287), the not infrequent existence of a vadum (§ 289), and the mode of appearance in several cases (§ 290), suggest the possibility that the central consists really of two fissural integers, commonly connected, and comparable, perhaps, with the parietal and paroccipital (§ 306). For the present, however, it seems justifiable and certainly more convenient to regard the conditions above named as anomalous, and to treat the central as a single fissure.

§ 299. *Lateral Variation.*—Clevenger states that it is usually located farther caudad on the left side than on the right; its relations to motor areas would lead one to expect considerable lateral variation in position, direction, and shape.

§ 300. *Physiological and Surgical Relations.*—It is completely surrounded by important motor areas, and its exact relations to the cranium and surface of the scalp are of great pathological and surgical importance; these matters are considered in the articles *Brain, Surgery of the*, and *Brain: Functions of Cerebral Cortex.*

§ 301. *Psychological Relations.*—Clevenger has a suggestive paper (*Journal of Nervous and Mental Disease*, April, 1880) on the ratio between the location of this fissure and the intelligence of the individual or species; although unable to admit his identification with the cruciate fissure of Carnivora, or to accept all his conclusions, I regard the determination of the relative bulk of the precentral (frontal) region of the cerebrum and the postcentral (occipito-parieto-temporal) region as of great importance in connection with the comparison between individuals and species in respect to intellectual power and voluntary inhibition or self-control.

§ 302. *Condition in Other Primates.*—In the apes and in all the ordinary monkeys the fissure is readily recognized: *e.g.*, in the *Macacus*, Fig. 787.

§ 303. *Carnivoral Representative.*—By various authors it has been homologized with the following fissures of the cat and dog: superorbital, ansata, coronal, and cruciate. Notwithstanding the similar relations of the central and cruciate fissures to motor areas, the question of their homology (morphological identity) must be held as yet undetermined. A clue may be furnished by the observations of P. A. Fish (1899, 37) as to the collocation, in the seal (*Phoca*), of what seems to be the calcar with the ventral portion of the splenial fissure.

§ 304. *Fig. 774 illustrates:* A. The form of a perfect and typical paroccipital fissure, very symmetrical, and completely independent of the parietal, although its cephalic ramus and what seems to be an extension of the parietal overlap and approach very closely.

B. The peculiar appearance of the entire hemicerebrum and of the central fissure from this point of view. Other points are commented upon under Fig. 775.

§ 305. *Fissural Integer.*—This term was proposed by me (1886, *e*) to designate a fissure which is independent in

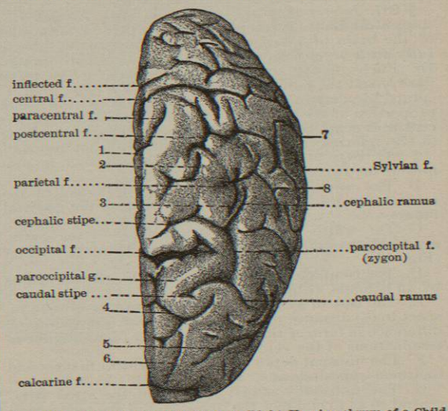

FIG. 774.—Dorso-Caudal Aspect of the Right Hemicerebrum of a Child at Birth; 478. × 1. This figure was published in the *Journal of Nervous and Mental Disease*, June, 1886. Other aspects of the same brain are shown in Figs. 663, 756, and 775.

some species or individuals, and deepest at or about the middle of its length, corresponding nearly with the place of its first appearance. Any marked and frequent shallowing of a supposed fissural integer is reason for questioning its integrality, and for seeking, in other individuals and in allied species, evidence that it really consists of two.

§ 306. *The "intraparietal* fissure"* of Turner probably represents two fissural integers, the parietal and the paroccipital, because (1) in nearly half the cases examined by me there are two fissures separated by an isthmus of greater or less width; (2) when the two are continuous there is often a vadum at the point corresponding to the isthmus; (3) each of the two portions, whether separate or continuous, is usually deepest at or near its middle; (4) at their first appearance in the fetus they are always completely independent.

§ 307. *The typical paroccipital fissure* consists of (*a*) the zygon or bar, the first part to be formed; (*b*) cephalic and caudal stipes continuing the curve of the zygon about the dorsal outcrop of the occipital; (*c*) cephalic and caudal rami, imparting to each end the characteristic form seen in Fig. 774. The paroccipital is a typical zygal fissure.

§ 308. *Fig. 775 illustrates*, in addition to points seen equally well in Figs. 756, 663, and 775), the greater depth of the paroccipital zygon at the middle of its length, a fact hardly compatible with the supposition that it is only a caudal extension of the parietal, or that the caudal stipe and ramus constitute an independent fissure, the "transverse occipital" of Ecker.

§ 309. *What Is the So-Called "Transverse Occipital Fissure"?*—Most writers seem disposed to adopt the view

* Often, but incorrectly, written interparietal.

of Ecker that the caudal stipe and ramus of the paroccipital represent a "sulcus occipitalis transversus" which unites with the longitudinal bar or zygon. None of the

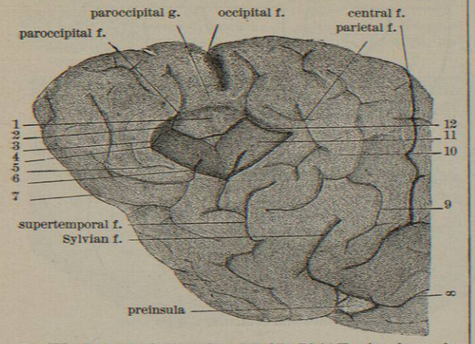

FIG. 775.—Dorso-Caudo-Lateral Aspect of the Right Hemicerebrum of a Child at Birth, Partly Dissected; 478. × 1. See the lateral and dorsal aspects (Figs. 663 and 774). 1, Lateral surface of the zygal part of the paroccipital gyre; this is, of course, pial, but the point of the V-shaped incision reaches a slightly lower level than the bottom of the fissure, occasioning the triangular cut area at the bottom; 2, line representing the junction of the zygon with its caudal stipe; 3, ectal line of the caudal ramus; 4, ental line of the same; 5, should have crossed the cut surface to the outcrop of the fissure marked 7 in Fig. 663; 6, the exoccipital fissure (?); 7, unidentified fissure; 8, presylvian fissure; 9, postcentral fissure; 10, gyre between the postcentral and the parietal fissures; 11, cephalic slope of the cut surface; 12, cephalic ramus.

Preparation.—By reference to the lateral aspect, Fig. 663, the paroccipital fissure will be seen to be indicated by the name itself, connected with the middle of the zygon. For the present figure a wedge-shaped piece was removed by two incisions, starting respectively at the tip of the raml and meeting at an obtuse angle at the exoccipital. The removal of this piece exposed the lateral aspect of the paroccipital gyre and of the gyres adjoining it cephalad and caudad; also the depth of the zygon and the two rami.

specimens examined by me seems to confirm this interpretation, and I am compelled to regard the very interesting condition shown by Cunningham (1892, Fig. 51) as simply anomalous. Much. however, remains to be done in this region.

§ 310. *Fig. 776 illustrates:* A. The degree of fissuration at this period.

B. The early condition of the paroccipital fissure as a upsiloid (U-shaped), depressed line with lateral branches, rami.

C. The independence of the paroccipital fissures at this period.

D. The absence of any fissure closely resembling the "transverse occipital."

E. The distinctness of the inflected fissures at this period.

F. The difficulties of identifying fetal fissures in the condition of those upon the frontal and parietal regions of this specimen.

§ 311. *Fig. 777 illustrates:* A. An almost schematic condition of the paroccipital fissure, simple in form and

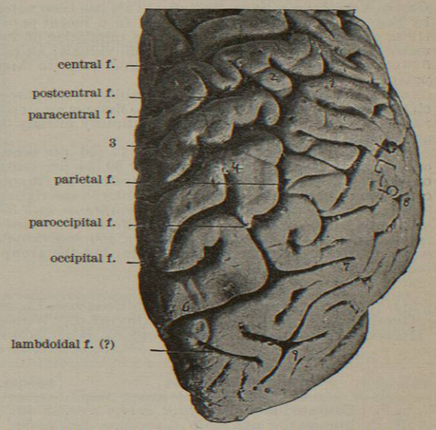

FIG. 777.—Dorso-Caudal Aspect of the Occipital Region of the Right Hemicerebrum of an Irishwoman, Thirty-Five Years Old, Exhibiting an Unusually Simple Condition of the Paroccipital Fissure; 385. × .8. Other aspects of this brain are shown in Figs 720 and 721. 1, Subcentral fissure, continuous with the parietal, but separated from the postcentral by a considerable isthmus; 2, the branch of the postcentral just below (caudad of) the isthmus does not really enter the parietal, although the shadow upon the slightly depressed narrow portion of the isthmus gives that appearance; 3, an independent fissure parallel with the postcentral; 4, cephalic ramus of the paroccipital; 5, cephalic stipe of the same; 6, 7, caudal stipe and ramus; 8, supertemporal; 9, the triradiate termination of a fissure superficially continuous with the supertemporal. The name *lambdoidal* is applied with considerable hesitation.

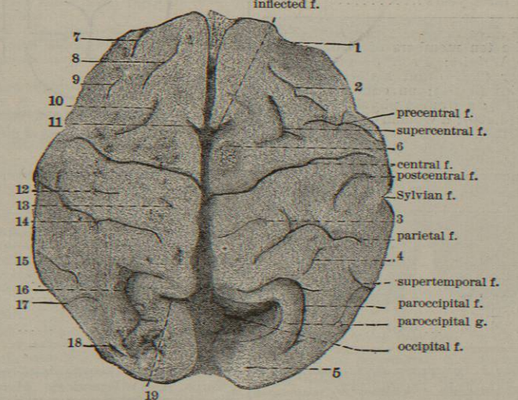

FIG. 776.—Dorso-Caudal Aspect of the Brain of a Fetus Measuring 41 cm. from Heel to Bregma, and Estimated at Eight Months; 734. × 1. 11, Left inflected fissure; 12, 13, separate portions of the left postcentral; 14, left parietal (?); 16, left paroccipital; 17, left supertemporal; 19, left occipital fissure. The remaining numbers indicate fissures of doubtful identity.

Preparation.—The arteries were injected with starch mixture; extravasation took place at several points, especially the two following: (1) into the dorsal part of the right occipital fissure, converting it into a kind of fossa, at the bottom of which is seen the unaffected part of the fissure; (2) into the left paroccipital fissure, separating its walls to some extent. The essential relations of parts are not affected.

wholly independent of the parietal, although the isthmus (opposite the end of the line from paroccipital) is slightly depressed.

B. An unusual divergence of the caudal stipe (6) and ramus (7) of the paroccipital; the former again bifurcates just over the margin on the mesal aspect.