XV. *On the Brain of a Bushwoman; and on the Brains of two Idiots of European Descent.* *By* JOHN MARSHALL, *F.R.S., Surgeon to University College Hospital.*

Received June 18,—Read June 18, 1863.

THE chief purpose of the present paper is to describe the *convolutions* of a Bushwoman's brain, and also those of the two smallest human idiot brains yet on record, belonging respectively to a microcephalic woman and boy of English parentage. But other points of interest, such as the weight, size, general form, and internal structure of these brains and their several parts, are likewise noticed; and, in the case of the idiots, such information is prefixed as could be collected concerning their feeble mental and bodily powers.

The attention which has recently been directed to the study of the cerebral anatomy of man, as compared with that of the quadrumanous animals, and the acknowledged scantiness of our information concerning the brain in the various races of mankind, induced me to request several medical friends residing in our colonies, to endeavour to procure certain specimens for me.

From my former pupil, Mr. JOHN EDWARD DYER, now practising in Cape Town, I received in April last, in part fulfilment of a promise made to me in the previous August, the entire head of a Bushwoman duly prepared according to my instructions. I most cordially acknowledge my obligations to him.

As a guarantee of the authenticity of the specimen, the entire head was to be sent with the brain in it. For this purpose, the neck was divided below the larynx; some strong spirit was injected into the carotid and vertebral arteries; the skull was trephined over each parietal bone, and the dura mater carefully slit open, so as to allow the spirit to percolate into the cranial cavity. The head was then put into a tin case, which was filled with spirit, hermetically closed by soldering, and despatched to England without delay. On opening the case on its arrival, no decomposition was apparent in any part of the preserved head; but the cerebellum was afterwards found to be somewhat softer than the cerebrum, owing probably to an accidental want of success in injecting the vertebral arteries, so that less spirit had been directly conveyed to the posterior parts of the encephalon.

Having secured, for further identification, a plaster cast of the entire head, and four photographic views of it, half the size of nature, viz. a front, back, and two profile views, I proceeded, by means of a longitudinal and other sections of the skull, to remove a sufficient portion of the left half of the cranium and dura mater to expose the corresponding side of the brain, still covered by the cerebral arachnoid and pia mater and

shrunken within the cranium, but having undergone no observable flattening or distortion.

The membranes being dissected off, a photograph was taken of this side of the head, with the brain and spinal cord *in situ*, so as to put on record the *bonâ fide* relationship between them. The brain being now removed with the medulla, and both cleared of their remaining membranes, nine photographs, the size of nature, were taken of it. These views included the base and vertex, the frontal and occipital aspects, both sides, a section showing the inner surface of the left half of the encephalon, the under surface of the left cerebral hemisphere, and, lastly, the left lateral ventricle and its contents. The right half of the encephalon was left undissected, to serve as a museum specimen, or for further investigation. The weight of this right half of the preserved brain being ascertained, the separated pieces of the left half, all of which had been preserved, were weighed in three portions, so as to give the respective weights of the left cerebral hemisphere, and of the left half of the pons, cerebellum and medulla oblongata. By adding all these weights together, the total weight of the preserved brain was found; and by allowing proportionate values for the several parts of its undivided right half, a sufficiently near approximation was obtained to the respective weights, in the preserved condition, of the entire cerebrum, cerebellum, and pons with the medulla oblongata. In proof of the satisfactory character of these weighings, it may be stated that the right and left halves of the brain differed in weight only 20 grains, the advantage being on the right side, in which, however, a part of the choroid plexus was necessarily included. The left half was probably, as has been observed in European brains by Dr. Boyd*, somewhat the heavier.

To determine from the preceding data the probable weight of the recent brain and its parts, two modes were had recourse to—the first depending on the ascertained loss of weight in brains preserved in spirit, the second having reference to the cubical capacity of the cranium measured by means of water. It cannot be assumed that such calculations are quite correct; but I have given the subject careful consideration, and have recorded the actual weights, taken from the preserved brain, with all other data which have been employed.

A plaster cast of the interior of the cranium, taken after putting its several pieces together, before the membranes were removed from the right half, assisted in determining the general form, dimensions, and relative position of the parts of the recent encephalon.

The fissures, lobes, and convolutions were studied on the preserved brain, and are illustrated in the several photographic views. They are compared, in the paper, with the same parts in the European brain, with the brain of the so-called Hottentot Venus†, who, there seems reason to believe, was of the Bosjes race, and with the brains of the higher Apes. The commissures, ventricles, and ganglionic masses were also examined and measured on the preserved brain, and are nearly all shown in the photographs.

* Philosophical Transactions, 1861, vol. cli. p. 261.

† Gratiolet, 'Mém. sur les Plis Cérébraux de l'Homme,' &c. Paris. No date (1854?).

Various measurements of the Bushwoman's brain are tabulated at the end of this paper, with similar measurements taken from an average female English brain, the intracranial cast corresponding with which is in my possession. Furthermore it has been thought that additional interest would be given to the subject by introducing into the same Table the comparative measurements of a young Chimpanzee's brain, described by me elsewhere*, and also those of the two idiots' brains hereinafter investigated.

With regard to these idiots' brains, the larger one, that of the woman, has been temporarily placed at my disposal, for special description of the convolutions, by my friend Mr. R. T. GORE of Bath, who has given a general account of this brain to the Anthropological Society of London†. I have also had access to a cast of the interior of the cranium taken by Mr. GORE, from whom I have likewise received additional information relating to the woman herself.

The smaller of the two idiots' brains, and indeed the smallest yet described, that of the idiot boy, has been lent to me from the Anatomical Museum of University College, London, by the recommendation of Professor SHARPEY. It had been presented to that Museum by Professor JENNER, who supplied to the Catalogue a very full and circumstantial account of the appearances observed at the post-mortem examination‡. When living, this idiot was under the observation of Dr. BEGLEY, of the Lunatic Asylum, Hanwell, who has kindly given me information concerning the mental manifestations of the boy during life. It is to be regretted that, of the skull of this idiot, nothing but the calvarium is preserved, so that I could only obtain a cast of the upper half of the interior of the skull. Unfortunately, though this includes the part which lodged the posterior lobes of the cerebrum, it scarcely extends to the posterior border of the cerebellum.

So far as was practicable, the same method of examination was followed with the two idiots' brains as with the Bushwoman's brain. Nine photographs of the Bushwoman's brain, nine of the idiot woman's brain, and eight of the idiot boy's were taken by Mr. HERBERT WATKINS. Lithographs from these accompany and illustrate this paper.

I. THE BRAIN OF THE BUSHWOMAN.

a. *General Account. The Face and Head.*

Mr. DYER states that the height of the Bushwoman was 5 feet, and her age doubtful; but she was certainly aged. It is fair to assume that she presented no remarkable departure in either direction from the ordinary intellectual and moral condition of her race. Her height being somewhat unusual (that of the Hottentot Venus was 4 feet 9 inches§), the question arose whether she was a Hottentot, not a Bushwoman proper.

* Nat. Hist. Review, July 1861. † Anthropological Review, vol. i. 1863.

‡ I recently submitted these facts to the Anthropological Society of London, as will appear in the Anthropological Review for August 1863.

§ See WAILLY's figures, one-fourth the height of nature, in G. CUVIER's account of the Hottentot Venus, 'Hist. Nat. des Mammifères,' &c., par I. ST. HILAIRE et F. CUVIER. Paris, 1826.

But a friend, long resident at the Cape, who also knows Mr. DYER, tells me that no mistake between these two people is likely to be committed by a Colonist, their habits, mode of life, and language being quite distinct; and moreover, from a mere glance at the cast and photographic portraits, he unhesitatingly pronounced the head to be that of a genuine Bushwoman.

The colour of the skin is brownish black, with pale freckles on both cheeks; the hair, scattered in little tufts over the scalp, is mixed grey and black. There is no trace of moustaches or beard, and the hairs of the eyebrows and the eyelashes are very scanty. The skin of the face is much wrinkled, partly from the effect of the spirit, but also from old age. The eyebrows are not heavy. The distance between the inner angles of the eyelids is great, being equal to the width of the eyelids themselves. The conjunctivæ are slightly stained with pigment. The root of the nose is broad and remarkably flat; the nose itself is short, small, and also flattened, the nostrils being visible from the front. The cheeks are prominent and wide; there is great breadth opposite the angles of the lower jaws. The chin is square and somewhat prominent. The lower part of the face is only slightly prognathous; the mouth is large and projecting; the lips are thick, but rather straight in outline, the peculiar curves of the upper lip, as seen in the European, not being well pronounced. The ears are long, but tolerably flat to the head; the right one is equal in length to the vertical distance between the eyebrows and the mouth; the left one is shorter; their cartilaginous forms are well developed; the lobe is short and wide, and its posterior border glides without distinction into that of the rest of the ear; the external auditory meatus is smaller than in the European, and somewhat compressed from before backwards. The incisor and canine teeth are small; the upper ones are inserted somewhat obliquely, the lower ones nearly vertically. All the molars are wanting in both jaws, as is also the upper left premolar. The existing teeth are much worn, so as to appear short, the canines being quite level with the incisors, a proof of advanced age. The tongue is small, and the frænum scarcely distinguishable.

Considered as a whole, the face is characterized by the width and flatness of the cheeks, the extreme flatness and small size of the nose, the full mouth, and the moderate amount of prognathism. The general shape of the cranium, seen from above, is a long flattened ovoid—the greatest transverse diameter being placed a good way behind the ears, from which line the cranium is suddenly rounded backwards, but gradually narrowed off towards the forehead, the left half of which projects a little in advance of the right. The front, although narrow, is well elevated, so that the line of the vertex is evenly curved from before backwards—there being a total absence of the depressed forehead often observed in Negro heads.

Subjoined are a few measurements of the head, by which it will be seen that it is by no means small, as regarded from without:—

	inches.
Total height of the head and face	7·15
Extreme length of the head and face	7·25

	inches.
Extreme width at the parietal eminences	5·5
Extreme depth of the cranium, from beneath the occiput to the vertex	5·5
From one external auditory meatus to the other . . .	12·5
From the root of the nose to the occipital protuberance	12
Circumference close above the ears	21

The proportions between the length and breadth of the cranium, which are as 100 to 76, show that it is not nearly so dolichocephalic as the Negro skull. In its thickness, however, it resembles the latter. The thinnest part on the median section is over the vertex, and measures 3 of an inch; passing backwards, the thickness of the parietal bone increases to ·35 of an inch, whilst the occipital protuberance exceeds ·5 of an inch; passing forwards, the average thickness of the frontal bone is about ·35 of an inch, increasing at the forehead itself to ·5 of an inch. The diploë is scarcely distinguishable, owing to the closeness of the bony texture. There is no appearance of frontal sinuses. The foramen magnum measures 1·4 inch in its antero-posterior diameter and 1·3 inch transversely; its anterior border corresponds with a line passing across ·375 of an inch behind the internal auditory meatuses. All the sutures at the top of the skull are closed; the line of the fronto-parietal is quite obliterated, that of the sagittal suture nearly so, whilst the lambdoidal suture can still be traced. The squamous part of the left temporal bone is also absolutely joined to the frontal and parietal. The petrosal and other ridges in the base of the cranium are prominently marked; the crista galli is large, and the sella turcica deep. The internal surface of the cranium is more strongly marked than usual by the convolutions, especially in the orbital, frontal, temporal, and occipital regions, but much less distinctly so along the vertex. The auditory meatuses and optic foramina are small; the cribriform lamellæ are of moderate extent; the other foramina are of average size. On the outer surface of the cranium the zygomatic arches, though of well-marked curvature, are slender; the mastoid processes are very small, and the styloid processes also slender.

The right half of the cranium, as defined by the falx, which, together with the tentorium, was left undisturbed, holds nearly exactly 17·5 oz. avoirdupois of water; so that the total capacity of the entire cranial cavity is about 35 oz. of water, which are equal to 60·64 cubic inches. Thus the actual capacity of the cranial cavity proved to be less than its external dimensions would have led one to anticipate. The capacity of the largest skull measured by MORTON* was 114 cubic inches. The largest examined by WAGNER† was 115 cubic inches; the smallest, that of an adult female, 55·3 inches. As measured in ounces of water, the capacity of the male Hottentot's skull has been given as high as 75 cubic inches; whilst that of the Negro's ranges from 69·3 to 60·5 cubic inches, that of the Malay's skull from 62·2 to 57·1 cubic inches, and that of the Hindoo's

* Crania Americana. Philadelphia, 1839.

† Vorstudien zu einer Morph. und Phys. des menschlichen Gehirns. Leipzig, 1860.

as low as 46·7 cubic inches *. Between all these examples, however, the stature having been neglected, comparisons, to say the least, must be inexact; and the height of the Bushwoman, a fair average one even for a European female, must not be forgotten in any estimate of the dimensions of her cranial cavity.

In the Bushwoman's head no evidence of arrested development exists, either in the character of the bones, or in the sutures, or in the features of the face, though a supposition of that kind has been entertained, yet not generally assented to, in regard to the so-called Hottentot Venus. Certain infantile characters are undoubtedly present in the cranium of the Bushwoman—such as the slight elevation of the nasal bones, the absence of the frontal sinuses, the small size of the mastoid processes, the slenderness of the styloid processes, and the markings on the inner surface of the cranium; but these characters should probably be regarded rather as belonging to sex or race than as indicative of any arrest of development in the individual, especially as the general proportions between the face and the cranium, the dolichocephalic form of the latter, the prominent cheek-bones, the square jaw, and the well-marked chin would lead to the opposite inference of a perfected individual development.

b. *Weights of the Encephalon and its parts.*

The entire encephalon of the Bushwoman, hardened in spirit and deprived of its membranes, weighed 21·77 oz. The loss of weight in specimens of brain preserved in a similar way I find to be from one-third to one-fourth, *i. e.*, as a mean, $\frac{7}{24}$ths of their original weight, on which calculation the recent Bushwoman's brain, deprived of its membranes, would weigh exactly 30·75 oz. With the membranes, the weight would be about 31·5 oz.

The capacity of the skull, as already stated, was equal to 35 oz. avoirdupois of water, or 60·64 cubic inches. If the brain, in its natural state, filled the cranial cavity as completely as water will afterwards, it would be easy, by taking the specific gravity of nervous substance as compared with water, to estimate the quantity of brain which once occupied any given skull; but the fact that this is not the case, especially in regard to the base of the brain, and the difficulty of determining the weight of the membranes, the amount of blood which the vessels may contain, and the quantity of cerebro-spinal fluid which fills the ventricles and all otherwise unoccupied spaces, render it impossible thus to arrive at so definite an estimate as in the other way.

Now the smallest healthy European female brain recorded by WAGNER weighed about 31·7 oz.†; and the smallest observed by Dr. REID, in the case of an aged woman, 32 oz.‡ These numbers, however, are unsatisfactory, as neither the heights nor the weights of the individuals are on record. But Dr. BOYD'S valuable Tables § supply this omission, and thus enable us to appreciate the comparative size of the Bushwoman's brain. Among 149 females between the ages of 60 and 70 years, the minimum weight of the

* TIEDEMANN and HUSCHKE, quoted by SCHAAFHAUSEN, MÜLLER'S 'Archiv,' 1858.

† *Loc. cit.* ‡ London and Edinburgh Monthly Journal, &c., April 1843.

§ Philosophical Transactions, vol. cli. p. 251.

entire encephalon, as found by Dr. BOYD, was 32·5 oz.; but then the minimum stature in 148 women at the same period of life was only 4 feet 6 inches; whilst the average weight of the encephalon, in the same groups of individuals, was 42·96 oz., and the average height 5 feet 1½ inch. Deducting the odd 2·96 oz. for the 1½ inch over 5 feet, which is more than enough, the European female brain at that stature, and between 60 and 70 years of age, would weigh 40 oz.; or, again, by adding 7·5 oz. to the minimum weight for the difference between the minimum height and that of the Bushwoman, which would be about a proper allowance, we should again obtain a European average of 40 oz. for the brain of a female measuring 5 feet at the above-named age; whilst the weight of the Bushwoman's brain, including the membranes, was probably, as shown, not more than 31·5 oz.

Considering, therefore, on the one hand, the stature of the Bushwoman, and allowing, on the other, for her advanced age (the former justifying the expectation of a large brain, the latter of some comparative waste in that organ), the safe general conclusion is that her entire encephalon was, for her height, decidedly small.

In the absence of positive information, it is impossible to do more than speculate on the ratio between the weight of the entire brain and the body in the Bushwoman; but, considering her height, 90 lbs. would not be an exaggerated estimate for the latter quantity in health. The ratio in that case would be 1 to 45; whereas the mean proportions usually given for the European, dying from a sudden cause, are as 1 to 37.

The weight of the preserved encephalon being, as already stated, 21·77 oz., the left half of the preserved cerebellum weighed 1·22 oz., and the left half of the pons and medulla oblongata ·25 oz. Doubling these halves, we have 2·44 oz. for the total weight of the preserved cerebellum, and ·5 for the total weight of the preserved pons and medulla oblongata. Their joint weights, 2·94 oz., being deducted from the weight of the preserved encephalon above mentioned, gives 18·83 oz. for the total weight of the cerebrum. On these data, the weight of the cerebrum to the cerebellum is as 7·7 to 1. In the adult female European, according to Dr. REID, the average ratio is 8·25 to 1; but by Dr. BOYD'S Tables it is, between 60 and 70 years of age, also 7·7 to 1.

The actual weights above given, being increased in the proportion of 17 to 24, to allow for the loss by maceration in spirit, we arrive at a total weight of 3·44 oz. for the recent cerebellum, and of ·7 oz. for the recent pons and medulla oblongata; and lastly, by deducting their joint weight, viz. 4·14 oz. from 30·75 oz., the estimated weight of the entire fresh encephalon, we have 26·61 oz. as the weight of the recent cerebrum. Distributing the estimated weight of the membranes in relative quantities, we obtain 27·25 for the recent cerebrum, 3·45 for the cerebellum, and ·8 for the pons and medulla oblongata, enveloped in their respective shares of membranes, making, as above shown, 31·5 oz. for the entire encephalon. The average weights of the same parts in 134 European females, between the ages of 60 and 70, and measuring 5 feet 1½ inch high, according to Dr. BOYD, are 37·13 oz. for the cerebrum, 4·68 for the cerebellum, and ·83 for the pons and medulla oblongata, making 42·64 oz. for the entire encephalon.

The ratio of the cerebrum to the body in the Bushwoman, assumed with a height of 5 feet to weigh 90 lbs., would therefore be as 1 to 52, whilst that of the cerebellum to the body would be as 1 to 418; whereas, allowing 6 lbs. additional weight (96 lbs.) to the average European females of 5 feet $1\frac{1}{2}$ inch high, the corresponding ratios would be 1 to 41, and 1 to 328.

Without claiming for these numbers a perfect accuracy, and even subjecting them to certain small corrections, they support the statement that, in reference to the body, the cerebrum and cerebellum are both inferior in the Bushwoman as contrasted with the European aged female; and it will be seen that both organs are about equally defective, *i. e.* in a proportion of about ·78 to 1.

Judging from the restored figure of the Hottentot Venus's brain, the Bushwoman's brain was in its recent state only a very little smaller than it (see Plate XX. and its explanation).

c. *The general Form, Dimensions, and relative Position of the Parts of the Encephalon.*

The Bushwoman's brain, injected with spirit, and hardened within the cranium, had, as already stated, undergone very little change of form, although it had shrunk from the cranial walls, chiefly over the vertex, and slightly at either end. This subsidence of the brain was less marked before the veins passing from its upper surface into the longitudinal sinus were divided. Even when removed from the cranium and denuded of its membranes, the brain maintained its shape, and the relations of its several parts; but in describing these reference is made to the intracranial cast, and the dimensions of the organ are also given from that source.

When viewed from above, the Bushwoman's cerebrum (Plate XVII. fig. 1), like her cranium, presents a long and narrow ovoid form. The line of greatest width corresponds with the parietal eminences, and is placed rather far back, viz. at two-thirds the total length of the cerebrum from its anterior border, so that one-third only is behind those eminences. From this prominent parietal region the cerebrum slopes or falls away in all directions—very suddenly backwards, and rather so forwards, as far as the entrance of the Sylvian fissure, where, like the fœtal brain, it appears remarkably constricted, and then widens again a little (Plate XVII. fig. 2) at the outer angles of the frontal region, which is nevertheless decidedly narrow. The left hemisphere, as seen from above, is ·2 of an inch longer than the right, the increase being almost entirely behind. This relative greater length of one hemisphere backwards (usually the left, so far as I have observed) is very common in European brains.

Viewed laterally (Plate XVIII. fig. 3), the parietal region is salient; the vertex is low and flattened, its highest point being placed far back; the frontal region is shallow, but ends in a nearly upright anterior border, whilst the beak-like projection of its median portion next to the longitudinal fissure is very marked, and its outer corner projects over the entrance to the Sylvian fissure. The temporal lobe is narrow, the line from its point to the tip of the posterior lobe being very long; the curve formed by the under

border of the cerebrum, above the cerebellum, is slighter, and its direction more oblique upwards and backwards than in the European brain, owing apparently to a want of downward development of the occipital region, which is very shallow.

Viewed in front, the narrowness and want of depth of the frontal region, accompanied, however, by the singular projection of its outer angles and the depth of its beak-like projections, again strike the eye. Besides this, the orbital borders are strongly curved, the orbital surfaces deeply excavated, and the median beak-like portions very narrow and wedge-shaped; the angle formed by the meeting of the two orbital surfaces is smaller than in the European; and the tips of the temporal lobes are pointed and much incurved towards the middle line. Altogether this is an unfavourable, and indeed ape-like aspect of the Bushwoman's brain, the promise given by the better elevation of the frontal region of the skull being disappointed in consequence of the thickness of its walls.

Seen from behind, the comparative prominence of the parietal regions gives an angular outline to the cerebrum, in comparison with its usual fuller form. The deficiency of height at the vertex is very striking, as well as the upward inclination of the posterior border of the cerebrum, owing to the tapering of the posterior lobes.

On the base view (Plate XVII. fig. 2) the general form is again that of a long narrow cerebrum, the details concerning each region being such as have been already pointed out in speaking of the lateral, front, and hind views. The orbital surfaces are especially contracted, but have a square or human, and not a pointed or ape-like shape.

The median section of the cerebrum (Plate XVIII. fig. 4) again shows its low, flattened, elongated form. The portions of hemisphere in front, above, and behind the corpus callosum measure respectively 1·3, 1·25, and 1·9 inch; whereas in the European they measure 1·4, 1·6, and 2·2 inches.

Imaginary lines drawn from the centre of the medulla oblongata, where it intersects the pons, to the extreme occipital, frontal, parietal, and vertical points of the cerebrum, lines which I have elsewhere designated *cerebral radii**, measure, in the Bushwoman, respectively 34, 40, 35, and 41 tenths of an inch; whilst in a European female they measure 33, 43, 39, and 46 tenths. Accordingly the occipital radius, owing evidently to the length of the temporal lobe backwards, is slightly in excess, the frontal radius is a little defective, the parietal a little more so, whilst the *vertical radius is the most so*, as compared with the European brain.

The final result of these measurements, as well as of others given in Table I. at the end of this paper, and of the facts elicited by the examination of the several aspects of the brain, is to show that in this Bushwoman the cerebrum is small but long, defective in width, and especially so in *height*; that its outlines and surfaces are angular and flat, instead of rounded and full as in the European; that, of its several regions, the frontal, though long, is very narrow and *shallow*, much excavated below, and compressed laterally in a remarkable manner behind its angles, in front of the Sylvian

* Nat. Hist. Review, 1861, p. 304.

fissure; that the parietal region is *low*, though, relatively to the surrounding parts, prominent; that the occipital region is long, but narrow, and also remarkably defective in *height*; and, lastly, that the temporal region is long, though somewhat narrow.

As to the relations between the posterior lobes of the cerebrum and the cerebellum, the latter is entirely concealed by the former in the upper view of the brain (Plate XVII. fig. 1). In the base and lateral views (Plates XVII. & XVIII. figs. 2 & 3), the backward projection of the cerebrum beyond the cerebellum is equal to ·5 of an inch on the left side, and a little more than ·3 on the right, where the cerebral hemisphere is shorter. The actual amount of overlapping is therefore as great as in the European; but the relative overlap, as compared with the length of the cerebrum, of which it equals one-thirteenth part, is rather less, owing to the disproportionate length of the cerebrum in the Bushwoman. On the base view, less of the posterior part of the cerebrum is seen on each side of the cerebellum than usual. The cerebellum itself, judging from the intracranial casts, is more prominent at the sides, and proportionally wider and longer than in the European; but its outline is not so full and rounded, so that its actual bulk is smaller. It is, however, quite human and not ape-like in shape.

d. *The Fissures, Lobes, and Convolutions of the Cerebrum.*

The Fissures.—The *fissure of* Sylvius (Plate XVIII. fig. 3, *e–e*) in the Bushwoman's brain extends well backwards, but inclines more upwards than in the European brain, and its course is marked, soon after its commencement, by a peculiar horizontal step. It measures 3 inches in length on both sides; in the European brain it is 3·5 inches. On the left side, it sends off a branch near its summit, which nearly reaches the vertex. Its depth opposite the island of Reil is ·75 of an inch, instead of 1 inch (the usual depth). Its margins are not very closely adapted together, especially opposite the hinder border of the frontal lobe, which is here very defective. The fissure, indeed, is so patent that, without any separation of its margins, a portion of the island of Reil, or central lobe (C), though small, is distinctly visible. This condition recalls to mind the fœtal state of the human cerebrum*, but, so far as I am aware, is not present in any adult quadrumanous brain. The defect in the frontal lobe explains the remarkable constricted form of the Bushwoman's brain, already mentioned as existing at that point, a form which we may perhaps assume is a characteristic of the Bosjes brain, as it is equally present in the brain of the so-called Hottentot Venus, where it has also been noticed by Gratiolet as a fœtal character†. Coupled with the infantile features noticeable in the Bushwoman's skull, this peculiarity becomes very interesting.

The *fissure of* Rolando (Plates XVII. & XVIII. figs. 1 & 3, *d–d*) commences 1·25 inch behind the tip of the temporal lobe, instead of 1·375 as in the European, just above the horizontal step of the Sylvian fissure, from which it is separated as usual. It terminates

* Compare Tiedemann's figures, Anatomie, &c. des Gehirns, &c. Nürnberg, 1816, taf. v.; and Leuret's plates 29 and 30, Anatomie Comparée du Système Nerveux, &c. Paris, 1837.

† *Op. cit.* plates 1 and 2, and p. 66.

considerably beyond the middle of the long axis of the cerebrum, nearly as far back as the line of greatest width of that organ; so that it passes proportionally further back than in the Hottentot Venus, or indeed than in the European, as illustrated in the outlines of the three brains given in Plate XX. figs. 7, 8, & 9. The left fissure reaches a little further back than the right.

The *external perpendicular fissures* (Plates XVII. & XX. figs. 1 & 9, *h*, *h*) can be traced as easily as in the Hottentot Venus (Plate XX. fig. 8), but are soon interrupted by the external connecting convolutions (α, β). Towards the sides, these fissures are certainly more easily followed than in the European—a circumstance which imparts a lower character to this part of the Bosjes brain; at the same time they are far more interrupted than in the Chimpanzee or Orang-outang (Plate XXIII. fig. 20). These short external perpendicular fissures join, as usual, the summits of the internal perpendicular fissures (Plate XVIII. fig. 4, *k*), and, together with the fissures of ROLANDO, divide the upper surface of the cerebrum into three regions. Supposing the total length of the hemispheres, as seen vertically, to be represented by 100, the region in front of the point of the V formed by the two fissures of ROLANDO is equal to 65; thence to the perpendicular fissures equals 17·5; and thence to the tips of the posterior lobes, also 17·5. The proportions in the European are 57, 23, and 20; in the Chimpanzee, 49, 28, and 23. Measured longitudinally over the vertex, the relative spaces occupied by these regions are, in the Bushwoman, as 60, 15, and 25; in the European, as 54, 23, and 23; in the Chimpanzee, as 46, 28, and 26. So that the fronto-parietal region in the Bushwoman appears lengthened backwards, with a proportionate want of development in the purely parietal and occipital regions.

The remarkable irregular and very deep fissure (Plate XVIII. fig. 3, *c*–*c*) always seen on the outer side of the frontal lobe (*antero-parietal*, HUXLEY) is very strongly marked. It commences about one inch behind the entrance of the fissure of SYLVIUS, with which it is more nearly continuous than in the European brain, except in the fœtal condition; passes more obliquely backwards than usual; and corresponds with the place of deficient width in this region already twice alluded to.

The *parallel fissure* (*f*–*f*) on the side of the temporal lobe is more tortuous on the left side than in the Hottentot Venus, though less so than in ordinary European brains. The *inferior temporal fissure* (*g*–*g*) is comparatively short and simple.

On the internal surface of the hemisphere, the *great fissure of the fronto-parietal lobe* (Plate XVIII. fig. 4, *i*–*i*), or *calloso-marginal fissure*, is twice interrupted by convolutional bridges, once (as usual) in front of the corpus callosum, and once (unusually) above the middle of that body. As in ordinary European brains, it reaches the surface of the hemisphere, well behind the hinder border of the corpus callosum.

The *internal perpendicular fissure* (Plates XVIII. & XIX. figs. 4 & 5, *k*–*k*) is more vertical than in the European, but much less so than in the Chimpanzee—the angle formed by this fissure and a base-line drawn through the corpus callosum being in the European 123°, in the Bushwoman 115°, and in the Chimpanzee 93°. As in the Euro-

pean brain, however, this fissure joins the fissure of the hippocampi below (Plate XIX. fig. 5), whilst in the Quadrumana it usually stops short of that fissure, owing to the development of a *superficial* connecting convolution in that situation.

The *fissure of the hippocampi* (Plates XVIII. & XIX. figs. 4 & 5, *l–l*, *m*) is nearly horizontal. Its outer or *calcarine portion* (*l–l*) ends in two shallow sulci, or notches, on the tip of the posterior lobe; it extends a little further forwards than is customary beneath the corpus callosum, but is separated, as usual, from the inner or *dentate portion* (*m*) of the fissure by a ridge of cerebral substance (*), which connects the convolution of the corpus callosum (18) with the uncinate convolution (19). The dentate fissure (*m*) is shallow. The *inferior middle temporal*, *parallel* or *collateral fissure* (Plate XIX. fig. 5, *n–n*) is very long and simple, and may be traced further upwards on to the hinder surface of the occipital lobe than usual.

On the whole, the fissures of the left hemisphere are rather more complex than those of the right, which would seem to be not only smaller but inferior in organization. This want of symmetry is itself, however, a mark of comparative elevation.

With a few exceptions, these primary fissures are somewhat more complex than those represented in GRATIOLET'S figures of the brain of the Hottentot Venus; but nevertheless they are far more simple and more easily distinguished amongst the numerous secondary sulci than in the ordinary European brain. In this greater simplicity and definition of the fissures generally, in the slightly more vertical direction and step-like course of the Sylvian fissure, and in the decidedly more upright position of the internal perpendicular fissure, the Bushwoman's brain approaches somewhat the quadrumanous characters; but it deviates more widely from them by the special interruption of the external perpendicular fissure, by the greater length and inclination backwards of the fissure of ROLANDO, by the more marked want of symmetry on the two sides of the brain, and by the greater number and complexity of the secondary sulci.

The lobes.—Regarding the more important fissures as the true lines of subdivision between the cerebral lobes, we find that the frontal lobes (F), though contracted in width and depth, are proportionally long, that the parietal lobes (P), though high, are relatively contracted from before backwards, especially behind, that the occipital lobes (O) are very shallow from above downwards, and very pointed, that the temporal lobes (T) are long and narrow, and that the island of REIL, or central lobe (C), is small and partly visible at the entrance of the Sylvian fissure.

The convolutions and secondary sulci.—The *orbital* sulci and *convolutions* of the frontal lobe (Plate XVII. fig. 2) are certainly remarkably simple. The olfactory sulcus, which lodges the so-called olfactory nerve (*o*), has its ordinary length; but, owing to the shortness of the frontal lobe, it reaches to within half an inch of the tip of that lobe, whilst in the European it does not reach within one inch of that point. On the inner side of this sulcus is seen, as usual, the edge of the great marginal convolution (17) of the inner surface. To its outer side, the deep triradiate sulcus, which cuts up the rest of the orbital surface into a posterior convolution (1″) limiting the Sylvian fissure, an

internal convolution ($1'''$) bounding the olfactory sulcus, and an external curved convolution ($1''''$) forming the outer border of the frontal lobe, consists of three short simple curved branches, very like those found in the Ape, instead of the tortuous sulci seen in the European brain. The forms of the surrounding orbital convolutions themselves, including the proper supraorbital ($1'$), are so broad and simple, that their subordinate divisions, which are so complex in the European brain, can hardly be said to exist.

The *frontal convolutions* (Plates XVII. & XVIII. figs. 1 & 3) are, as usual, arranged in three stages or rows, separated from each other by two deep secondary sulci. The *lower row* (1–1) (le premier étage, GRATIOLET; infero-frontal, HUXLEY) is well defined, and intermediate in complexity between its condition in the Hottentot Venus and an average European brain. The *middle row* (2–$2'$) (le second étage, GR.; medio-frontal, H.) resembles, in its simplicity of form and detail, that of the Hottentot Venus much more than that of the European brain, especially as seen from above. Posteriorly ($2'$) it joins the upper end of the first ascending parietal convolution (4), as in the Hottentot Venus, whilst in the European the continuity is usually interrupted by a secondary sulcus; but instead of being continuous, as in the former, in front of the Sylvian fissure, with the lower frontal, it is there separated from it, as in the latter. The *upper row* (3–$3'$) of frontal convolutions (le troisième étage, GR.; supero-frontal, H.), in its proportion to the other two rows and its subordinate divisions, approaches nearer to the European type; but it is simpler, and in the upper view (Plate XVII. fig. 1) much narrower, narrower even than those figured in the Hottentot Venus. As usual, it joins ($3'$) the first ascending parietal convolution ($4'$), behind and above, in front of the fissure of ROLANDO. Along the border of the longitudinal fissure, where it is blended with the great marginal convolution, it is less frequently notched than in the European brain; so that one particular notch (in front of $3'$) becomes very evident. In this respect the resemblance is very close to the Hottentot-Venus brain; but the left notch is further back than the right, instead of the reverse. In the European brain these notches are symmetrically placed on the two sides (see Plate XX.).

The *first*, or *anterior ascending parietal convolution* (Plates XVII. & XVIII. figs. 1 & 3, 4–$4'$) (premier pli ascendant, GR.; antero-parietal, H.) is larger and more pronounced in its form than in the Hottentot Venus; in its general mass it approaches the European character; but it has fewer secondary sulci, and, as already stated, joins anomalously the middle frontal row. It is broader on the right side than on the left. As usual, it forms the anterior border of the fissure of ROLANDO, joins at its lower end the supramarginal convolution ($4''$–$5''$) which limits that fissure below, and at its upper end runs forwards into the upper row of frontal convolutions, and backwards around the upper end of the fissure of ROLANDO into the second or posterior ascending parietal convolution (5). In the brain of the Hottentot Venus (see Plate XX.), this last-named connexion is almost concealed within the longitudinal fissure; whereas in the European brain it is superficial, owing to the greater upward development of this part of the brain. In the former case the hinder end of the fissure of ROLANDO loses itself in the longitudinal

fissure, whilst in the latter it stops short of that fissure. On the left side the Bushwoman's brain presents the European character, whilst on the right side it has the Hottentot-Venus character. As in the case of the deep notch in the upper frontal convolutions, the fissure of ROLANDO extends further back on the left hemisphere than on the right. In the Hottentot-Venus brain the reverse is the case. From all this it may be deduced that in the Bushwoman's brain the left frontal region is developed further backwards than the right, whilst in the Hottentot Venus the condition is reversed.

The *posterior ascending parietal convolution* (Plates XVII. & XVIII. figs. 1 & 3, 5–5) (deuxième pli ascendant, GR.; postero-parietal, H.) holds, as regards size and complexity of modelling, a position between the Hottentot and the European brain, but on the whole is nearer to the former than the latter (Plate XX.). But, as seen in the lateral view (Plate XVIII. fig. 3), its lower and posterior border is joined, as in the European brain, by a superficial connecting convolution (*) with the lobule (A–A) of the supramarginal convolution above and near the upper end of the Sylvian fissure, whilst in the Hottentot-Venus brain this is not the case. On the left hemisphere this posterior ascending convolution is broader and more complex in form than in the Hottentot Venus, or indeed than in many European brains; but on the right side it is quite simple and unusually narrow. It ends posteriorly, as is the rule, in its so-called "*lobule*" (5′–5′) (lobule du deuxième pli ascendant, GR.; postero-parietal lobule, H.), a triangular mass of secondary convolutions more or less variable in different brains, and even on the two sides of the same brain. In the Bushwoman's brain these lobules are, in point of size and complexity, intermediate between those of the Hottentot Venus and the ordinary European, but are nearer to the latter than the former. On the left side, however, the hinder border of the lobule is absolutely defined on the surface, owing to the deep position there within the external perpendicular fissure of the upper external connecting convolution (α), or first external "pli de passage" of GRATIOLET. In this point the Bushwoman's brain is more ape-like than even that of the Hottentot Venus (see Plate XX.).

The *supramarginal convolution* (Plate XVIII. fig. 3, 4″–5″) connects, as usual, the two ascending parietal convolutions below the lower end of the fissure of ROLANDO, and there forms the step-like border of the Sylvian fissure already alluded to, which is now seen to depend on the great downward development of the two ascending parietal convolutions. The anterior part of the supramarginal convolution, which overhangs the island of REIL, and is continued into the inferior frontal and adjacent orbital convolutions, is scantily developed, in correspondence with the open state of the Sylvian fissure, and the constricted form of the brain at this point.

The *central lobe, or island of* REIL (C), is small on both sides of the brain, but is somewhat larger on the right side than on the left; its total length is 1·75 inch on the left side and 1·5 inch on the right, whilst its average length, in an ordinary European brain, is from 1·75 inch to 2 inches. On the left side it is subdivided into three chief radiating convolutions, the middle one of which is partially subdivided by a slight sulcus; on the right side this middle portion is more deeply subdivided; so that there are four

radiating convolutions on both sides, but on the right side these appear larger than on the left. In the European brain these radiating convolutions again subdivide along their upper and outer borders, so as to appear still more numerous.

The hinder end of the *supramarginal* convolution expands, as usual, into its so-called "*lobule*" (Plates XVII. & XVIII. figs. 1 & 3, A–A), which is described by GRATIOLET as a part peculiar to Man—a statement undoubtedly true if the lobule be regarded merely as an expanded or highly developed portion of the supramarginal convolution itself, but not to be accepted as implying that the lobule is an entirely new part of the cerebrum, wholly unrepresented in the quadrumanous brain. Even as regarded in the former light, the condition of this lobule of the supramarginal convolution in the Bushwoman's brain is of special interest. It protrudes in her brain in the form of a large nearly quadrangular mass, situated exactly beneath the parietal eminence of the skull, and corresponding therefore with the line of greatest width of the cerebrum; it overhangs the upper part of the Sylvian fissure; it is connected in front, by a partially concealed convolution (*) already mentioned, with the posterior ascending convolution, above with the lobule of that convolution, and behind with the bent convolution (6); and it is marked by several secondary sulci. In all these particulars it resembles the part in the European brain, but it is somewhat smaller. On the other hand, it is decidedly superior to that of the Hottentot-Venus brain, being larger and more complex, projecting more over the Sylvian fissure, and having a more superficial connexion with the posterior ascending convolution. Relatively it is one of the most developed parts of the Bushwoman's brain.

The *bent convolution* (6–6) (pli courbe, GR.), which limits the summit of the Sylvian fissure, is connected in front with the lobule of the supramarginal convolution, and, turning downwards, sinks in between the upper external temporal (Plate XVIII. fig. 3_7) and middle temporal (8) convolutions, on the left side, as is usual; whilst on the right it continues superficial, but does not join the superior temporal convolution as in the Hottentot-Venus brain; in the latter brain it is a simple though somewhat tortuous convolution, whilst in the European brain it is represented by two or more convolutional folds. It is decidedly defectively developed in the Bushwoman's brain.

The three rows of *external temporal convolutions* (Plates XVII. XVIII. & XIX. figs. 2, 3, & 5) are intermediate in character between the European and Hottentot condition. On the left side they are more complex than on the right, where they resemble more nearly those of the Hottentot Venus. The *upper temporal*, or *inframarginal convolution* (7–7) (pli temporal supérieur, GR.; antero-temporal, H.) is bent, and somewhat constricted, opposite the ends of the ascending parietal convolutions, at the peculiar horizontal step of the Sylvian fissure. It is separated from the bent convolution, as usual, by a secondary sulcus. As in the Hottentot Venus, it is proportionally wider than in the European brain. The *middle temporal convolution* (8–8) (pli temporal moyen, GR., medio-temporal, H.) is narrower, more tortuous, and slightly more complex than in the Hottentot brain, but not nearly so wide or so much intersected with secondary sulci as in the

European. The *lower temporal convolution* (9–9) (pli temporal inférieur, Gr.; postero-temporal, H.), which is not well defined along its upper border, also approaches the European rather than the Hottentot type, but is much less complicated than the former.

The three rows of *occipital convolutions* (Plates XVII. & XVIII. figs. 1 & 3, 10, 11, 12) (plis occipitaux, supérieur, moyen, et inférieur, Gr.; super-, medio-, and infero-occipital, H.), which in quadrumanous brains of moderate complexity (as in Cercopithecus) are simple and easily distinguishable, but which in the anthropoid Apes assume a puzzling complexity, become, as is well known, in the human brain so highly complicated and involved with the external connecting convolutions, that a detailed description of them is almost impossible. Considered generally, they are remarkably defective in total depth and in individual complexity, in the Bushwoman's brain. The vertical depth of the three rows, and of their connecting convolutions, in the European brain is 2·75 inches; in the Hottentot-Venus brain 2·25 inches; in the Bushwoman's brain only 2 inches. This deficiency affects all three rows of occipital convolutions, but is especially noticeable in the inferior row, along the lower border and extreme point of the occipital lobe. This is perhaps the most defective region of the Bushwoman's cerebrum.

Of the *external connecting convolutions* already mentioned, four in number, which in Man interrupt the external perpendicular fissure, the *upper one* (α) (premier pli de passage externe, Gr.; first external annectent, H.) is on the left side superficial behind, but sinks beneath the bent convolution in front. On the right side it is superficial throughout, so as speedily to obliterate the external perpendicular fissure, and is very tortuous. The three remaining connecting convolutions, viz. the *second* (β), *third* (γ), and *lowest* (δ) are remarkably simple and small, occupying so little space as, together with the deficiency in the bent and occipital convolutions, to account for the slight depth of the cerebrum in this region. They are all continuous posteriorly with the several rows of occipital convolutions, but are less directly connected anteriorly with the middle and inferior temporal convolutions than in the European, or even in the Hottentot-Venus brain, on the left side, whilst on the right side they are easily traceable into those convolutions.

On the inner surface of the hemisphere (Plate XVIII. fig. 4), the *great marginal convolution* (17–17) (pli de la zone externe, Gr.) is proportionally narrow. As usual, it is thicker opposite the beak-like prominence of the frontal lobe, where it is subdivided into two parallel convolutions by an unusually simple longitudinal secondary sulcus. It is intersected above the corpus callosum by transverse radiating sulci, which divide it into short secondary convolutions, arranged like the stones of an arch. In both hemispheres it is twice connected (*, *), in front of and above the middle of the corpus callosum, across the great fronto-parietal fissure (*i*–*i*), with the convolution of the corpus callosum.

The *convolution of the corpus callosum* (18–18) (pli du corps calleux, Gr.; circonvolution de l'ourlet, Foville; callosal, H.) presents its usual characters, turning round the posterior end of the corpus callosum (*c*), and becoming continuous beneath the cerebral

peduncle (Plate XIX. fig. 5), by a narrow ridge (*), with the middle internal or uncinate convolution (19) of the temporal lobe. The callosal convolution is large, and its crested upper border is well marked posteriorly. The marginal convolution is relatively rather narrow, and its secondary convolutions are simple. Altogether these internal convolutions are less complex than in the European.

The *quadrilateral lobule* (Plates XVIII. & XIX. figs. 4 & 5, 18*l*) (lobule quadrilatère, Foville; quadrate lobe, H.), the extension backwards and upwards of the callosal convolution, is very well marked; but it is short, and, in accordance with the more upright direction of the internal perpendicular fissure (already described), is not quite so much inclined backwards as in the European. It is smoother and narrower above than below, instead of being wider than, or of equal width as, in the European—a condition which coincides with the backward extension of the ascending parietal convolutions and the fissure of Rolando.

Of the three *internal temporal convolutions* (Plate XIX. fig. 5), the *upper* one, concealed in the dentate fissure, *m*, and corresponding with the corps godronné of authors (the dentate convolution, H.), is present, but very small, the fascia dentata being only just recognizable. The *middle internal temporal convolution* (19–19) (pli temporal moyen intérieur, Gr.; uncinate, H.), continuous upwards by the narrow ridge (*) with the convolution of the corpus callosum, and ending forwards in the *unciform lobule* (19*l*) (lobule de l'hippocampe, Gr.; and *crochet* of Vicq d'Azyr), is relatively narrow and less prominent in the Bushwoman's brain, the crochet being particularly small. The *lower temporal convolution* (9–9), which in fact is the same as the lower external temporal, and is marked off from the middle one by the parallel fissure of Gratiolet (*n*–*n*) (collateral fissure, H.), is very broad, though smooth. The secondary sulci of these convolutions are chiefly longitudinal, and more simple than in the European brain. The middle convolution (19), that above the collateral fissure, is traceable round the very tip of the occipital lobe, and, curving upwards on its hinder aspect, joins the middle and lower occipital convolution; the lower one (9) unites more directly with the lower occipital row.

The bottom of the calcarine portion (*l*–*l*) of the fissure of the hippocampi corresponds with the hippocampus minor in the posterior horn of the lateral ventricle. Deeply seated between its two short branches behind is a ridge of cerebral substance, representative of the *calcarine lobule* of Flower.

The triangular *occipital lobule* (Plates XVIII. & XIX. figs. 4 & 5, 25–25) (lobule occipital, Gr.) is of small size, and has its anterior and inferior margins more even, and its surface less complex than in the European brain. Owing to the less inclined position of the internal perpendicular fissure, this lobule approaches somewhat nearer to the vertex than is customary.

Lastly, the *lower internal connecting convolution* (Plate XIX. fig. 5) (pli de passage inférieur interne, Gr.) which joins the lower and anterior angle of the occipital lobule with the adjacent part of the quadrate lobule, is represented, as usual, by a ridge *con-*

cealed (near ε) within the perpendicular fissure, which accordingly joins superficially the fissure of the hippocampi. The *upper internal connecting convolution*, which in the Apes commonly crosses higher up between the occipital and quadrate lobules (opposite ζ), is, as customary in Man, completely absent; so that the development of these internal connecting convolutions, like that of the external ones, is perfectly normal.

From a general consideration of the above detailed convolutional characters of the Bushwoman's brain, the following conclusions may be announced.

1. All the primary convolutions which exist in the human brain, viz. the orbital convolutions, the three frontal rows, the two ascending parietal and the parietal lobule, the supramarginal with its lobule and the bent convolution, the three external temporal, the three occipital rows, those of the island of Reil, the marginal and callosal convolutions, the quadrate and occipital lobules, and the three internal temporal convolutions, are present in the Bushwoman's brain; but, as compared with the same parts in the ordinary European brain, they are smaller, and in all cases so much less complicated as to be far more easily recognized and distinguished amongst each other. This comparative simplicity of the Bushwoman's brain is of course an indication of structural inferiority, and indeed renders it a useful aid in the study of the more complex European form. On contrasting the several regions of the cerebrum, the primary convolutions of the upper frontal and outer parietal regions are, on the whole, the best developed; those of the middle and lower frontal regions, the temporal region, the central lobes, and the inner surface the next; whilst those of the orbital surface and occipital lobe are the least developed.

2. Of the connecting convolutions, those highly important and significant folds, the external connecting convolutions are, in comparison with those of the European brain, still more remarkably defective than the primary convolutions. All four of these convolutions are present; but all are characteristically short, narrow, and simple, instead of being complex, and occupying a large space; hence, though the external perpendicular fissure is soon filled up, the parietal and occipital lobes are more easily distinguishable from one another than in the European brain. The upper external connecting convolution on the left side does not superficially join the parietal lobule, but sinks beneath it and the bent convolution. Of the internal connecting convolutions the arrangement is normal.

The numerous secondary sulci and convolutions, which so complicate the larger ones in the European brains, are everywhere decidedly less developed in the Bushwoman—but especially so in the occipital and orbital regions, on the bent convolution, and on the external connecting convolutions. This is a further sign of structural inferiority.

3. Compared with the brain of the Hottentot Venus, as that is represented by Gratiolet, the Bushwoman's brain is, in nearly all cases where comparison is possible, a little, though a very little, more advanced and complex in its convolutional development—the one exception being in regard to the size of the occipital and external connecting

convolutions, which are smaller in the Bushwoman. It is possible, however, that some of the apparent simplicity of the Hottentot-Venus brain may be due to the unavoidable loss of form and detail incidental to its long period of preservation, as compared with the more recent and comparatively uninjured Bushwoman's brain. This may account, for example, for the comparative breadth and smoothness of the upper frontal and of the middle and lower temporal convolutions in the figures of M. GRATIOLET. Allowance being made for this, the resemblance between the convolutions of the two brains is very close, and serves to confirm the demonstration by that author of the relative simplicity of the Hottentot-Venus brain—a simplicity which he has only seen partially paralleled in normal European brains, but which, in my own more limited experience, I have never even seen approached in healthy brains.

4. Whilst, then, the difference between the Bushwoman's brain and the European brain, not merely as to size, but as to convolutional development, is very marked, that between the Bushwoman and the Hottentot Venus is very small; and indeed if we regard the relative general development of the convolutions as a gauge of proximity or separation, it is turned into a near resemblance; and since no suspicion either of idiocy or other defect exists as concerns the Bushwoman, this would go far towards proving that the inferiority in the cerebrum of the Hottentot Venus is not due, as has been suggested, to an arrest of development of a personal or individual kind, but that, whilst undoubtedly both brains show an infantile or fœtal leaning, this is to be attributed partly perhaps to sex, but in the main to the characterization of the race itself.

5. As regards the question of the symmetry of the convolutions, it may be said that, although it is certainly easier to compare those of the two hemispheres in the simpler brains of the Bushwoman and Hottentot Venus than in the more highly developed European brain, still a very cursory examination shows that in numerous particular points, already mentioned in our description, there is just as frequent an occurrence of asymmetry in the two former as in the latter, by which circumstance therefore they manifest a truly human character.

6. Although not only in size, but in every one of the signs of comparative inferiority manifested in the lower convolutional development of the Bushwoman's cerebrum, it leans as it were to the higher quadrumanous forms, yet, as regards the sum of its convolutional characters, judged of by the presence or absence, the individual and relative size and position, the comparative complexity or simplicity, and the symmetry or asymmetry of particular fissures and convolutions, there is a greater difference between it and the highest Ape's brain yet described, viz. the adult Orang's brain, than between it and the European brain (compare Plates XX. & XXIII. figs. 7, 9, & 20). This difference is, as one evidently would expect, especially marked in the regions peculiarly developed in Man, viz. in the anterior outer and upper parts of the frontal lobe, in the prominent part of the parietal lobe (that is, in the characteristically human supramarginal lobule), and in the regions of the external connecting convolutions, especially of the two upper external ones. It is almost needless to add that there is far less difference,

in convolutional development, between the Bushwoman's brain and the European brain, than between the lowest and highest quadrumanous brains. If, indeed, we disregard the general differences of size and complexity, and look only to those which have been considered as special peculiarities, such as the existence of the supramarginal lobule, and the joint relative development of the two upper connecting convolutions, there is less difference between the Bushwoman and the European than between the Chimpanzee and the Orang. But perhaps it is premature yet to decide this latter point. It is certain, however, that there is less difference in convolutional development between the Bushwoman and the highest Ape, than between the latter and the lowest quadrumanous animal.

7. Finally, the establishment of the conformable development of the brains of the Bushwoman and Hottentot Venus (herself believed by G. CUVIER to have been a Bushwoman of small stature) is a step gained in cerebral anatomy; and their common inferiority to the European brain may justify the expectation that future inquiries will show characteristic peculiarities *in degree* of convolutional development in the different leading races of mankind.

e. *Internal Structure of the Cerebrum and Cerebellum. The Commissures, Cavities, Ganglionic masses, and Laminæ, studied on the Preserved Brain.*

The cerebrum.—The general depth of the sulci in the Bushwoman's brain is rather more than half an inch; they are deepest on the parietal region, shallower in the frontal, and, with the exception of the posterior part of the fissure of the hippocampi, are shallowest on the occipital lobe. They are deeper on the outer than on the inner surface of the cerebrum; they are very shallow on the under surface near the tip of the temporal lobe, and also on the orbital surface of the frontal lobe. In these respects the Bushwoman's brain conforms to the usual conditions.

The average thickness of the grey matter is nearly $\frac{4}{30}$ths of an inch, the extremes being $\frac{2}{30}$ths and nearly $\frac{5}{30}$ths of an inch. The thickest grey matter is in the frontal and parietal regions, the thinnest at the tip of the occipital lobe, as usually found in both human and quadrumanous brains. The proportion of white matter in the centre of the hemisphere (see Plate XIX. fig. 6), which forms, on a horizontal section, the centrum ovale, appears smaller than in the European—a condition which coincides with the comparative narrowness of the brain. Both the grey and the white substance are darker than in the European, having a peculiar yellow tint. There was much pigment here and there in the membranes.

The corpus callosum (Plate XVIII. fig. 4, *c*) is long, but is wanting in general depth and in thickness at each end. As measured in the hardened brain, in thirtieths of an inch, its length, its greatest thickness, its least thickness, and its average thickness are represented by the numbers 78, 13, 5, and 6; whilst in the European the corresponding dimensions are 93, 16, 6, and 13; in the Chimpanzee I found them to be 51, 6, 2, and 4·5. The sectional area of the longitudinally divided corpus callosum is therefore in the

Bushwoman $\frac{468}{900}$ of a square inch, whilst in the European it amounts to $\frac{1209}{900}$, and in the Chimpanzee to $\frac{230}{900}$ of a square inch. Compared with the area of the internal surface of one hemisphere, the sectional area of the corpus callosum is in the Bushwoman's brain as 1 to 25, in the European as 1 to 12·5, and in the Chimpanzee as 1 to 28·5; so that the corpus callosum, thus estimated in proportion to the cerebrum, is in the Bushwoman only *half as large* as in the European, and not much larger proportionally than in the Chimpanzee. The anterior commissure (*a*) is also singularly small; the posterior commissure is very slender; whilst (probably an individual peculiarity only) there is no trace of the so-called soft commissure. On the whole, therefore, the system of transverse commissural fibres is defective; and as the size of the medulla oblongata, in proportion to the unusually narrow cerebrum, is larger even than in the European (so that the radiating system is probably not so much diminished), it would seem as if the relative deficiency of white substance within the hemispheres was owing in a great degree to the fewness of the transverse, as well, perhaps, as of other commissural systems of fibres. I have elsewhere pointed out the same condition in the Chimpanzee's brain; and it doubtless is associated, in the Bushwoman's brain, with its inferior bulk and less convoluted surface. The proportional size of the corpus callosum, thus considered, offers, I believe, a not inconvenient test of the relative perfection of any given normal brain of certain plan. Comparative anatomy supports this view. Of the longitudinal system of commissures, the fornix is thin, the tænia semicircularis slender, and the striæ longitudinales plainly visible.

The septum lucidum, with its intervening ventricle, is large, both in depth and extent from before backwards. The lateral ventricle in the left hemisphere (Plate XIX. fig. 6) proved to be a very large cavity; the body (*a*) measured 1·5 inch in length, the anterior cornu (*b*) between ·6 and ·7, the posterior cornu (*c*) 1·8, the descending cornu (*d*) 1·5; the corresponding numbers in an ordinary example of a European brain were 2·1, 1·4, 1·2, and 2·6. Comparing these dimensions with the total lengths of the two cerebra respectively, viz. 5·8 inches for the Bushwoman, and 6·5 for the European, we get the following proportions: ·25, ·11, ·31, and ·43 to 1 in the Bushwoman, and in the European ·32, ·21, ·184, and ·4 to 1. In the former, therefore, the body is short, the anterior cornu very short, the descending cornu long, and the posterior cornu very long, the proportion being as 5 to 3. The width and depth of the posterior cornu are as remarkable as its length; the width varies from ·3 of an inch, opposite the projection of the hippocampus minor, to upwards of ·4 in the wide recess behind that eminence; the depth of the cornu, at its deepest part, is ·4 of an inch. From the end of the posterior cornu to the extremity of the occipital lobe is ·5 of an inch, that is, a little more than $\frac{1}{11}$th of the total length of the brain, showing an unusual proximity of the posterior cornu to the apex of the posterior lobe. The hippocampus major (*e*) is narrow, it expands at its lower end, on the anterior border of which is a single prominence, but otherwise there is no trace of indentation. The hippocampus minor (*f*) is of large dimensions, projecting boldly into the middle of the posterior cornu, and subsiding

gradually backwards, being 1·1 inch in length, and ·4 inch in greatest breadth. The eminentia collateralis (*g*) is represented by a broad triangular and elevated surface between the two hippocampi.

On the method employed by Mr. FLOWER to determine the ratio between the antero-median and posterior portions of the cerebrum, measured forwards and backwards from the point of junction of the hippocampi, I find that the antero-median portion measures 3·75 inches, and the posterior 2·05 inches, showing a ratio of 100 to 54·6; whilst the ordinary ratio in the European is said by Mr. FLOWER to be 100 to 53; in the Chimpanzee it is as 100 to 52; so that in the Bushwoman the posterior region (thus measured on its under surface) is proportionally longer, or the antero-median region proportionally shorter than in the European or Chimpanzee's brain; but in other Quadrumana the posterior region is stated to be longer still (in Hapale 100 to 62).

As seen in the body of the ventricle, the corpus striatum (*h*) and optic thalamus (*a*) occupy about the same relative spaces from before backwards as in the European; but both, especially the optic thalamus, appear narrower from side to side. In an ordinary European brain, the exposed part of the corpus striatum measured ·9 inch long and ·5 inch wide; the optic thalamus 1·3 inch long and ·5 inch wide. In the Bushwoman the corpus striatum is ·9 inch long and ·3 inch wide, and the optic thalamus 1·2 inch by ·45 inch.

The corpora quadrigemina (Plate XVIII. fig. 4, *q*) are rather small, even in proportion to the brain; the anterior one, as usual, is the more prominent, and the posterior one the wider of the two. The corpora geniculata are both well marked, though of moderate size. The pineal body is small; its habenulæ are well developed. The corpora albicantia are prominently developed. The pituitary body is of moderate size.

The pons Varolii seems proportionally large: from its upper to its lower border it measures ·9 inch, whilst in the European brain it is about 1 inch; the mean thickness of its section is, in the Bushwoman's brain, ·8 inch; in the European, ·9 inch.

The medulla oblongata is relatively wide, and so are the cerebral peduncles. The medulla oblongata is ·85 inch wide at its widest part, offering the ratio of 1 to 6, instead of the ordinary ratio of 1 to 7, to the width of the cerebrum. Upon the medulla oblongata the anterior pyramids are well pronounced, and the corpora olivaria are narrow but prominent: the corpus dentatum within the latter is neatly defined and waved.

The cranial nerves generally appear small; the olfactory nerves, however, are well developed. The optic nerves, commissure, and tracks are small and flattened, even the nerves having an unusually thin oval section. The small size of the optic tracks and corpora quadrigemina is interesting in connexion with the defective development of the occipital lobes of the cerebrum, a part to which many of their fibres have been traced by GRATIOLET.

The cerebellum.—Every part of the cerebellum (Plates XVII. & XVIII. figs. 2, 3, 4, *Ce*) is present. The lateral portions or hemispheres are especially wide. On the upper surface the square lobes are not so square as usual, but are elongated laterally, and narrow

externally; the upper posterior lobes are also narrower and less curved than in the ordinary European brain; the superior vermiform process is long, but relatively narrow. On the under surface, the amygdalæ are not more than half the usual size, and are narrow and oblong, not broad and pyramidal in shape; the biventral lobes are, on the contrary, large, and, owing to the small size of the amygdalæ, are placed nearer to the middle line and have their laminæ more vertical; the slender lobes are also large and broad; lastly, the lower posterior lobes, separated from the upper posterior by the usual deep horizontal fissure, are likewise very broad. In the vallecula, the pyramid, uvule, and nodule are clearly defined, but somewhat narrow; the posterior velum is very well developed. The floccules, or subpeduncular lobes, are small, being both short and compressed. On the whole, therefore, the median parts of the cerebellum are relatively small, whilst its hemispheres are relatively large.

The transverse commissural, or middle peduncular fibres appear, even to the eye, proportionally more abundant than in the European, and likewise more so than in the Chimpanzee. A comparison of the sectional area occupied by these fibres in the pons, with the weight of the cerebellum, confirms this observation. The oval surface (Plate XXIII. fig. 23, *p*), which includes the ends of these transverse fibres, as divided in the median plane of the pons, is in the European ·95 inch long by ·65 inch wide, giving a sectional area of ·6175 square inch, which, as the total weight of the cerebellum is 4·68 oz., gives about ·13 square inch of surface to each ounce of cerebellum. In the Bushwoman, the corresponding oval surface (fig. 24, *p*) measures 1 inch by ·6 inch; its area equals therefore ·6 square inch, which, divided by the weight of the cerebellum, 3·45 oz., gives ·173 square inch of surface to each ounce of cerebellum. In the Chimpanzee the equivalent measurements are ·55 by ·4 inch; the area is ·22 square inch; the weight of the cerebellum is 2·02 oz., and the ratio of cut surface to each ounce of cerebellum is nearly ·11 square inch. This is an important point in which the brain of the Bushwoman does not stand intermediately between the European and the Ape, but surpasses even the European brain. The inferior peduncles, and also the superior peduncles of the cerebellum, appear relatively small; but no precise method of measurement could be adopted in regard to them.

It is difficult also to devise any satisfactory mode of determining the number of laminæ in any given cerebellum. If the superficial laminæ be counted, they are found to vary so in length, that, whilst some pass round the whole surface or border of the cerebellum, others disappear between adjoining laminæ at various points, so that no single line can be drawn over the surface which will cross the edges of all the superficial laminæ. On the other hand, if the deep as well as the superficial laminæ be counted, then it is difficult to determine how small or short a fold shall be considered a distinct lamina, some of them being very short. Furthermore, the larger ones are often slightly grooved along their edge, and might be reckoned or not as consisting of two. Malacarne*, who gives the number of laminæ in the healthy cerebellum at as

* Neuro-encefalotomia. Pavia, 1791, p. 7.

high numbers as 600 and 780, evidently counted all the laminæ he could find. I have adopted the plan of counting the superficial laminæ only in the principal lobes and superior vermiform process; whereas in the smaller parts of the organ, and in the inferior vermiform process, all the laminæ have been counted. The following Tables show the results in the European, the Bushwoman, and the Chimpanzee, for the *left* half of the cerebellum.

Superficial laminæ only counted.

	Median portion.	Lateral parts.						Total laminæ in lateral parts.
	Superior vermiform process.	Square lobe.	Posterior superior lobe.	Amygdala.	Biventral lobe.	Slender lobe.	Posterior inferior lobe.	
European	18	21	13	9	6	5	16	70
Bushwoman	23	21	14	8	9	5	14	71
Chimpanzee	20	25	10	8	4	11	5	63

Superficial and deep laminæ counted.

	Median portion.						Lateral parts.	
	Inferior vermiform process.	}	viz. Pyramid and uvula.		Nodule.		Amygdala.	Floccule.
European	37	=	28	+	9		21	18
Bushwoman	33	=	24	+	9		20	17
Chimpanzee	34	=	29	+	5		22	17

As thus counted, the number of laminæ in the Bushwoman's cerebellum agrees very closely with that in the European, the differences being probably only such as might be met with between individuals of either race. The total number in the lateral parts or hemispheres is nearly identical. The differences between the upper and lower posterior lobes nearly compensate each other, as do those between the amygdalæ and biventral lobes; the square and slender lobes exactly agree. In the median portion the chief point of difference is found, viz. in the larger number of laminæ in the upper vermiform process of the Bushwoman; but then there is a smaller number in the pyramid and uvula of the lower vermiform process: the nodules coincide. It is worthy of note that, in the Bushwoman, the amygdala and floccule show but a slight defect in the number of their laminæ, although both those parts are so remarkably small. Indeed the total deficiency in weight, which has previously been shown to exist in the Bushwoman's cerebellum, depends essentially, not on the absence of any parts or laminæ, but on the narrowness of these latter; for they are obviously much finer than in the European brain.

In the Chimpanzee the square lobe occupies more of the upper surface of the hemisphere than in the European cerebellum, whilst the Bushwoman's cerebellum presents an intermediate condition. The upper posterior lobe is consequently straighter in the

Ape, and forms less of the outer border of the hemisphere; in this respect the Bushwoman also occupies an intermediate position. On the other hand, the amygdalæ, which are very small in the Bushwoman, are very large in the Ape; whilst the biventral lobes are large in the former and small in the latter. The slender lobes are very broad in both; the lower posterior lobes, broad in the Bushwoman, are very narrow in the Ape. The superior and inferior vermiform processes, especially the latter, are proportionally more marked in the Ape than in the Bushwoman, in whom they are smaller than in the European. The floccules, small in the Bushwoman, are well developed in the Ape. In none of these particulars, then, is the Bushwoman's cerebellum intermediate between that of the European and the Chimpanzee; nor is this the case in regard to the number of the laminæ, for there are fewer on the whole in that animal even than in the European, the particular excesses and deficiencies not appearing to be reducible to any rule. In accordance with the smaller bulk of this organ in the Ape, the laminæ themselves are very much finer even than in the Bushwoman.

In the Bushwoman the corpus dentatum is represented by a comparatively small oblong mass of grey matter, almost destitute of foldings, and having its internal white substance ill defined. Is this connected with the small size of the quadrigeminal bodies? In the Chimpanzee this body is long and narrow, but its foldings are distinct.

On the whole it may be said, judging from its transverse commissural fibres and its laminæ, that, with the exception of the amygdala and floccule, and the grey matter of the corpus dentatum, the cerebellum in the Bushwoman is very well developed, and that, as an organ, it is far more completely evolved than the cerebrum.

II. THE IDIOTS' BRAINS.

a. *General Account of the Idiots.*

The female idiot came of a healthy family, and died at the age of 42, of phthisis. Her height was about (probably below) 5 feet; her weight is unknown, but she was well proportioned, with shapely limbs, and small well-made hands and feet; she was never fat, and did not become emaciated until phthisis occurred. The general appearance of her microcephalic head, the form, size, and condition of the cranium, with other particulars, are described in Mr. GORE's paper*. From that source, and from information since supplied by him, it appears that her senses were perfect, including the appreciation of heat and cold. She had memory both of persons and things; she could say "child," "mamma," "morning," and "good" with tolerable distinctness; in the report of Mr. GORE's paper it is added, "but without connexion or clear meaning." In explaining this he writes, "I think she had *some*, though probably a very imperfect *knowledge* or *conception* of the meaning of the words she used; she certainly knew what was the meaning of 'good,' in relation to her own acts and conduct; she was, however, quite incapable of anything like conversation." It is stated that she could not count, and did

* Anthropological Review, vol. i. 1863.

not know the value of money. She was obedient to those around her, affectionate, and fond of carrying and nursing a doll. She never manifested any sexual propensity, though she menstruated regularly. She was not passionate, nor violent, but was susceptible of joy and fear. She could not feed herself with any degree of method or precision, nor could she dress herself; in walking her gait was unsteady and tottering, the heels not bearing with any firmness on the ground. As already stated, her articulation was imperfect. There is no reason to suppose that she had any sense of religion, or idea of futurity.

The idiot boy was born of healthy parents. They, however, were first cousins, and met with great vicissitudes of fortune, accompanied, as regards the mother, with other causes of grief. No ancestral relative, on either side, was known to have exhibited any mental defect; but a second child, also a boy, one year younger, was likewise idiotic, though able to walk and to talk pretty distinctly. Both children were born at their full time; the mother was not frightened when pregnant with either of them. The brother is also dead now*.

The boy whose brain we are about to describe did not notice persons or things till he was 6 months old, and then very little. He lived in London till he was 4 years of age, and was then sent into the country, but he could not be taught anything; he could not articulate, nor walk, nor feed himself, and was regarded as unimprovable.

When about 10 years of age he is described as having a remarkably small head, and a large face; he had a fine set of teeth, large eyes, prominent nose, receding forehead, and features resembling those of the male Aztec. His hands and arms were perfectly formed. He often put his hands into his mouth, like an infant; he was invariably fed, cleaned, and dressed by others. He smiled and cried; he could not talk, but uttered inarticulate sounds. Even at this age he was unable to walk, or even stand; and though he grew taller and stouter, he never gained strength to move about, but sat all day in a chair with a rail in front, to prevent him from sliding out. At the age of $10\frac{1}{2}$ years he weighed, with his clothes, 37 lbs., the weight of the clothes being 3 lbs. $8\frac{1}{4}$ oz. At the age of 11 he is said to have known persons, plucking at their garments, looking up in their face, laughing, and clapping his hands. By wriggling his chair about he contrived to move it a little way from its place; still he required to be dressed and fed, and could not handle anything. Subsequently he became irritable, fretful, and noisy, crying much, and striking the sides of his chair or bedstead. He never manifested any further signs of intelligence, emotion, or will, or any power of articulate speech. It is said that the head did not grow larger during the last two years of his life. He died at the age of 12 from spinal abscess, followed by abscess in the lung. At his death the body measured, from vertex to sole, $39\frac{1}{2}$ inches. Various measurements of the body and cranium, with other particulars, will be found in a paper in the 'Anthropological Review'†. His incapability of walking was a true accom-

* Dr. Down, of Earlswood Asylum, intends to publish an account of this boy's brain.

† For August 1863.

paniment of the idiotic condition, for it existed years antecedently to any spinal affection.

In neither the female nor the male idiot was there found any diseased state of the *substance* of the brain.

b. *Weights of the Idiots' Encephala and their parts.*

The recent brain of the female idiot, after removal of the membranes, weighed 10 oz. 5 grs. In the idiot boy the brain, with the membranes, weighed $8\frac{1}{2}$ oz. The normal weight of the female brain at 42 years of age would be about 42 oz., and that of a boy 12 years of age about 44 oz. Idiots' brains have already been noticed weighing 20·25 oz. (TODD *), 19·88 oz. (TIEDEMANN †), 13·125 oz. (OWEN ‡); and the lightest brain, not altered by disease, previously recorded (THEILE'S case), weighed 10·6 oz.§

The weight of the body of the female idiot, seeing that she was of good proportions, about 5 feet high, but deficient in about 2 lbs. of brain, may be assumed to have been about 88 lbs. The idiot boy, at $10\frac{1}{2}$ years old, weighed $33\frac{1}{2}$ lbs. At his death, 19 months afterwards, his stature having increased though his growth was slow, for his ultimate height was only $39\frac{1}{2}$ inches, his weight, independent of the effects of disease, may be taken at 36 lbs.

In the idiot woman the weight of the brain, after preservation in spirit for many years, was found by Mr. GORE to be $7\frac{1}{2}$ oz., but, as subsequently weighed by myself, it proved to be 7 oz. 102 grs., or 7·23 oz. This weight was made up as follows:—cerebrum, 5·52 oz.; cerebellum, 1·41 oz.; pons and medulla oblongata, ·3 oz. Maintaining similar proportions for the several parts of the recent brain, which weighed 10 oz. 5 grs., the recent cerebrum would weigh 7·63 oz.; the cerebellum, 1·95 oz.; and the pons and medulla oblongata ·42 oz.

In the idiot boy the preserved brain weighed 5·1 oz., which total weight was thus composed:—cerebrum, 3·51 oz.; cerebellum, 1·35 oz.; pons and medulla oblongata, ·24 oz. Taking 8·5 as the ascertained weight of the recent brain, the recent cerebrum would weigh 5·85 oz.; the cerebellum, 2·25 oz.; and the pons and medulla oblongata ·4 oz.

The average weight of the cerebrum, cerebellum, and pons with the medulla oblongata, observed by Dr. BOYD in 94 females between the ages of 40 and 50, was 37·12 oz., 4·69 oz., and ·89 oz.; whereas the average weight of the same parts in 22 males between the ages of 7 and 14 was 40·36 oz., 4·84 oz., and ·76 oz.

Assuming 90 lbs. to be the weight of a healthy female 5 feet high, between 40 and 50 years of age, and 88 lbs. to have been the weight of the idiot woman; and again, taking 42 lbs. to be the weight of a healthy boy between 7 and 14 years of age, and 36 lbs. as the weight of the idiot boy, we have the following results:—

* Cyclop. Anat. and Phys. vol. iii. p. 719.

† Philosophical Transactions, vol. cxxvi. 1836, p. 502.

‡ Trans. Zool. Soc. vol. i. p. 343.

§ WAGNER'S Vorstudien, *ut supra*, Th. 2.

	Female (Boyd) 40 to 50 years.	Idiot woman.	Boy (Boyd) 7 to 14 years.	Idiot boy.
Encephalon to body	1 to 33	1 to 140	1 to 14	1 to 67
Cerebrum to body	1 to 38	1 to 184	1 to 16	1 to 98
Cerebellum to body	1 to 307	1 to 722	1 to 140	1 to 256
Cerebrum to cerebellum ...	7·9 to 1	3·9 to 1	8·3 to 1	2·6 to 1

The relative amount of brain to body in both idiots, 1 to 140 in the woman, instead of 1 to 33, as in the healthy female at the same age, and 1 to 67 in the boy, instead of 1 to 14, is very small. Absolutely, as we have seen, the idiot boy had a brain smaller than the idiot woman's, in the ratio of 8·5 to 10; but his brain was more than twice as large, in proportion to his body, as that of the idiot woman was to hers. It must be observed, however, as is well shown in the Table, that the ratio of brain to body is far greater in the growing individual than in the adult; and, allowing for that, the proportion of brain to body in both idiots was somewhat less than one-fourth of what it would have been at corresponding ages in health. In neither case is the ratio between the idiotic and the healthy condition exactly as 1 to 4, being in the idiot woman 1 to 4·24, and in the idiot boy 1 to 4·78; so that, thus tested, instead of the boy's brain being twice as much developed as the woman's, the woman's was comparatively a little larger than the boy's.

Again, the idiot boy's cerebrum, absolutely smaller than the woman's in the ratio of 5·85 to 7·63, was, as compared with the idiot woman's, about twice the proportionate weight in reference to the body, the one being equal to $\frac{1}{98}$th part by weight of the body, the other being only $\frac{1}{184}$th. But if the two idiots be compared with the healthy condition in persons of corresponding age, then they are nearly equal in this respect; for, thus studied, the idiot woman's cerebrum is about 1 to 5 as compared with the ordinary proportion to the body, and the idiot boy's about 1 to 6, the actual ratios being, in the idiot woman's case as 1 to 4·84, in the boy's as 1 to 6·12. Hence a greater superiority is manifested, as regards the cerebrum, in the woman, than existed in reference to the entire encephalon. In her the cerebellum, as we shall next show, was below its due size.

Thus, the idiot boy's cerebellum, absolutely larger than the woman's in the ratio of 2·25 to 1·95, is, in proportion to his body, three times as large as the idiot woman's to her body—the boy's being $\frac{1}{256}$th part of his body, and the woman's only $\frac{1}{722}$nd part of hers; but, again allowing for the normal differences in the proportions between the cerebellum and the body at different ages and in the two sexes, this extreme inferiority of the idiot woman is somewhat, though not entirely redressed. For in the idiot woman the ratio of the cerebellum to the body, as compared with the healthy ratio, is nearly as 1 to 2 (actually 1 to 2·35), whilst in the idiot boy it is rather less than 1 to 2 (actually 1 to 1·8). In other words, the woman's cerebellum reached $\frac{1}{23}$rds of the natural standard, and the boy's $\frac{10}{18}$ths. Thus the idiot boy had not merely a cerebellum larger,

in proportion to his body, than the idiot woman, *i. e.* in the ratio of 3 to 1, but also larger in proportion to the healthy standard at the same age—the ratio in his favour then being, however, only as 4 to 3.

Lastly, as shown in the Table, in the idiot woman the ratio between the cerebrum and cerebellum is 3·9 to 1, in the idiot boy 2·6 to 1. Hence the idiot woman's cerebrum, in proportion to the cerebellum, is superior to the idiot boy's in the ratio of 3 to 2. But comparing these abnormal proportions with those observable in healthy persons of corresponding sex and age, the proportion of cerebrum to cerebellum in the idiot woman is to the natural proportion as 1 to 2, and in the idiot boy as about 1 to 3. In other words, the cerebrum in the woman, when compared with the cerebellum, has half the normal proportion, whilst in the boy it has only one-third. These figures show, not merely the exceedingly small relative size of the cerebrum in both idiots, but a marked superiority on the side of the woman; for whether we compare the actual ratios between the cerebrum and cerebellum in the woman and in the boy, or whether we contrast their respective ratios with the healthy standards, the superiority of the female's cerebrum, as compared with her cerebellum, is to the boy's, in either case, as 3 to 2.

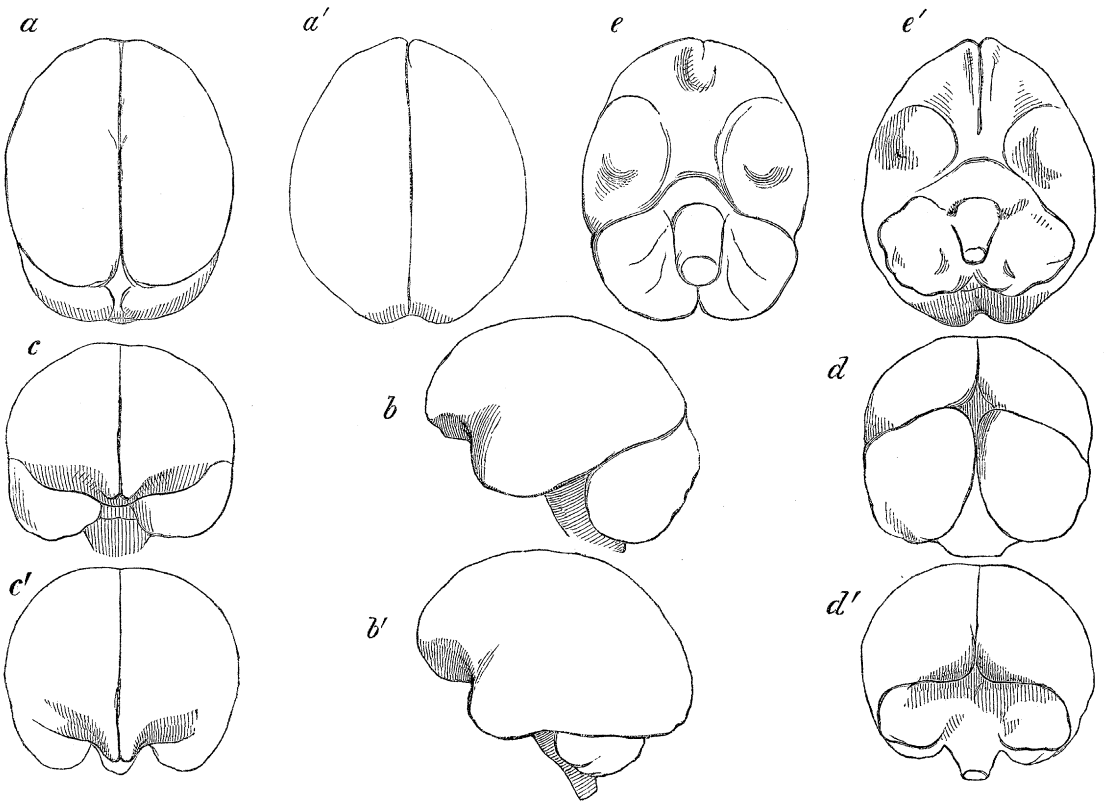
The general conclusions may thus be stated. These idiots fell remarkably short in both cerebral and cerebellar mass: in each the deficiency in cerebral mass was greater than in cerebellar: the idiot boy had more cerebellum than the idiot woman: the idiot woman had more cerebrum than the idiot boy.

c. *The general Form, Dimensions, and relative Positions of the Parts of the Idiots' Encephala.*

Judging from the intracranial cast, the general form of the cerebrum in the idiot woman, as compared with the normal human cerebrum, is, when seen from above, a short oval rather than a long ovoid,—the greatest transverse diameter being about the middle of the mass, and having a ratio to the length of 1 to 1·14 instead of 1 to 1·3. Far from being concealed, the cerebellum projects largely behind the cerebrum, and thus gives a long figure to the whole encephalon. Seen laterally, the entire brain has a low, contracted, globular outline, except of course below. The cerebellum appears to form about a fourth part of the mass, and projects beyond the cerebrum ·35 of an inch. In the base view, the relative preponderance of the cerebellum is again the most striking feature. The temporal portions of the cerebrum appear full and prominent; no part of the parietal region is seen on either side of them, and no part of the occipital either behind or at the sides of the cerebellum. The frontal region is singularly short, narrow, and pointed, instead of square, in front. The orbital surfaces are much excavated, the beak-like prominence of their median portions is well marked, and a slightly obtuse angle is formed by the meeting of their planes in the middle line.

In size and general form, the encephalon of the idiot woman, as represented by the intracranial cast, resembles at first sight that of the young Chimpanzee; but a nearer

examination reveals great differences in every aspect, as is illustrated in the subjoined outline figures.



a. Upper view of the intracranial cast of the cranium of the Idiot Woman.
a′. Ditto of a young Chimpanzee. *b*, *b′*. Left sides of the same two casts.
c, *c′*. Front views of the same. *d*, *d′*. Back views of the same. *e*, *e′*. Base views of the same.

N.B. All these figures are reduced to one-third of the proper linear dimensions.

Viewed from above (*a*), the general mass is more nearly oval, its greatest transverse diameter being opposite its centre, whilst in the Chimpanzee (*a′*) it is further back. The frontal region is not so pointed. The cerebrum does not project beyond the cerebellum, as in the Ape. Seen laterally (*b*, *b′*), when the idiot's brain is placed in its natural position, the base line of the encephalon slants obliquely upwards and forwards, whilst the Ape's is nearly horizontal. The vertex in the idiot is turned backwards and upwards, instead of directly upwards; the frontal lobe has a smaller beak-like projection, and in its general mass is deeper from its orbital margin upwards. The temporal lobe is much larger in all directions than in the Ape; the parietal lobe is less prominent; the occipital lobe is shorter. The cerebellum, in this view, appears very much larger than in the Ape, seeming to occupy an area more than twice as great. In front (*c*, *c′*), the general resemblance between the two casts is the most striking,—the differences

being, on the part of the idiot's brain, a slightly more elevated and broader frontal region; a shorter beak-like process; less excavated orbital surfaces, so that the angle formed by their meeting-point in the middle line is more obtuse; and larger, less incurved, and more widely separated temporal lobes. On the posterior aspect (*d*, *d'*) the casts, on the other hand, are very different,—the cerebrum of the idiot being of less width in the parietal region; attenuated in length, width, and depth in the occipital region; and having the cerebellum projecting at each side, and so large as to appear to tilt the cerebrum upwards, and to occupy in this aspect an area equal to one-third of the whole encephalon; whilst in the Ape the cerebellum is overhung by the cerebrum, and forms a mass not more than one-fourth of the visible part of the encephalon. Seen on the base (*e*, *e'*), the oval shape of the entire mass, the greater width and flatness of the frontal lobes, the size of and width between the temporal lobes, and the complete concealment of the posterior lobes of the brain by the voluminous cerebellum, distinguish the idiot's from the Ape's brain.

The preceding description, and the tabulated measurements of the brains, given at the end of this paper, show that in the idiot woman the temporal regions manifest the greatest relative size, whilst the parietal, occipital, and frontal are very small; whereas in the Chimpanzee's cerebrum the occipital lobes have a larger relative development; the frontal lobes stand next, whilst the temporo-parietal are defective.

The cerebrum of the idiot boy, as seen from above, the only view of which we have an intracranial cast, differs from that of the idiot woman in being at once narrower and somewhat angular in its outlines. The frontal region is more pointed (indeed, singularly so), the occipital region flatter, and the parietal regions longer and more compressed. The widest part corresponds with the centres of the parietal regions, and is somewhat behind the middle of the mass. The ratio between the width and length of the cerebrum is 1 to 1·23; so that the idiot boy's cerebrum is longer, in proportion to its width, than the idiot woman's—not from any actual superiority as to length, but rather owing to a deficiency in width of the whole cerebrum. As in the idiot woman, the cerebellum is not covered by the cerebrum behind; but probably it was not so much exposed. In shape the idiot boy's brain is so long and narrow as not to be comparable with the Ape's.

In the idiot woman the forms of the convolutions are scarcely traceable at any part of the intracranial cast, excepting some slight undulations about the frontal region. In the idiot boy they are remarkably distinct on the parietal regions, whilst the frontal and occipital regions are perfectly smooth. GRATIOLET regards this marking of the cranium by the convolutions as a sign of inferiority or degradation. This would appear to be, to a certain extent, an individual character, as it is not noticeable in the idiot woman.

d. *The Fissures, Lobes, and Convolutions of the Idiots' Cerebra.*

The Fissures.—The fissure of SYLVIUS (Plates XXI. & XXII. figs. 12 & 16, *e–e*) is not only absolutely, but relatively short, measuring 1·3 of an inch in the idiot woman, and 1·1 in the idiot boy. In both brains it is comparatively shallow. In the idiot woman its direction is nearly vertical; in the idiot boy it is more oblique, being pressed back by the large parietal lobe. Its posterior margin is well defined; but the anterior margin in the idiot boy, on the left side, is interrupted, and gives off a long branch towards the vertex. At the entrance of the fissure in the idiot woman is seen a slight elongated ridge, which runs transversely inwards and joins the feebly developed eminence (C) which represents the island of REIL; in the idiot boy this ridge is very narrow, and there is scarcely any insular eminence. In the idiot woman its upper end is simple on the left side, slightly bifurcated on the right; in the idiot boy it is more deeply bifurcated on the two sides.

The fissure of ROLANDO (Plates XXI. & XXII. figs. 10, 12, 14, & 16, *d–d*), in both these brains, is better marked on the right hemisphere. In the female idiot, on that side, it forms a simple sulcus, commencing, by a slight curve, in front of the Sylvian fissure, and then running, less obliquely than usual, backwards towards the longitudinal fissure. On the left side, the symmetry of this fissure is interfered with, in a remarkable manner, in both brains, by the upward intrusion of a triangular convolution, which appears to be the rudiment of the intended perfect anterior border of the fissure. In the idiot boy, on the right side, the anterior margin of this fissure is also irregular.

It may be noticed, then, thus early, in our examination of the cerebral surface of the idiots' brains, that they are at once distinguishable from the quadrumanous brains, and assert, even in their imperfect condition, their human character by an absence of symmetry in primary fissures and convolutions, so nearly symmetrical in the highest Apes.

The external perpendicular fissure (Plates XXI. & XXII. figs. 10 & 14, *h*) can be traced, in the case of the idiot woman, on each side for ·75 of an inch on to the surface of the hemisphere, defining accurately the parietal from the occipital lobe. It then divides into two deep sulci, the hinder one being the continuation of the fissure, which is not prolonged over the side of the hemisphere. In the idiot boy the external perpendicular fissure cannot be traced so far outwards from the longitudinal fissure, being sooner interrupted by the connecting convolutions.

The great parallel fissure (Plates XXI. & XXII. figs. 12 & 16, *f–f*) of the temporal lobe is well marked in the idiot woman's brain, running at first nearly vertically, and then backwards on the occipital lobe. It is of unequal extent on the two sides of the brain, reaching, on the right side, completely to the posterior border of the occipital lobe. It presents a curious wavy course. In the idiot boy this fissure is not quite so extensive, and ends, on both sides, further forward on the occipital lobe; on the left side it presents a simpler outline than on the right.

On the internal surface of the hemispheres, *the calloso-marginal or fronto-parietal*

fissure (Plates XXI. & XXII. figs. 13 & 17, *i–i*), in the idiot woman, curves as usual around the corpus callosum, but sooner reaches the upper border of the hemisphere, a little short of the hinder margin of that commissure. It is interrupted, as usual, by a convolution (*) just above the front of the corpus callosum. In the idiot boy's brain this fissure has a similar course, and is also interrupted (*) immediately in front of the corpus callosum; but it reaches the upper border of the hemisphere opposite the hinder end of the corpus callosum. This fissure is nearly symmetrical, in both idiots, on the two sides.

The internal perpendicular fissure (*k*) in the idiot woman is short and simple, and inclines backwards from a point about half an inch behind the corpus callosum; it joins the fissure of the hippocampi below, but a rudimentary connecting convolution exists in this situation. In the idiot boy this fissure has precisely the same arrangement.

The fissure of the hippocampi (Plates XXI. & XXII. figs. 13 & 17, *l–l*, *m*), in both brains, is less horizontal than usual. In the idiot woman its calcarine portion (fig. 13, *l*) terminates on the very point of the occipital lobe, in an open notch. On the right hemisphere, its anterior portion passes, as usual, a short distance beneath the cerebral peduncle; but on the left side it curves outwards on the under surface of the temporal lobe, and joins a deep sulcus which represents an irregular collateral fissure. In the idiot boy, on the left side, the fissure of the hippocampi is simple in outline and oblique in direction, reaches the tip of the occipital lobe, and extends forwards to the side of the cerebral peduncle. On the right side this fissure is represented by two deep parallel sulci (fig. 17, *l–l*), separated by a thin ridge (26) of convolutional substance. A further development of the convolutions above and below would have concealed this ridge, and left a single fissure.

The *collateral fissure* (Plate XXII. fig. 17, *n–n*) is normal but simple in both idiots, except, as above alluded to, on the left hemisphere in the idiot woman.

On comparing the fissures of the idiots' brains with those of the healthy human brain on the one hand, and those of the Chimpanzee on the other, the following points deserve notice. The Sylvian fissure is both shorter and much more vertical in the idiots' than in either the human or quadrumanous brain, owing evidently to the defective development of the fronto-parietal region of the cerebrum in its ordinary backward direction, and to the disproportionate size of the temporal region. In respect to the former region, the idiots' brains manifest a marked inferiority even to the Ape; for, whilst the masses of brain seen on the lateral aspect in the Chimpanzee, in front of and behind the Sylvian fissure, appear nearly equal, or even show a preponderance in front, in the idiots' brains the quantity in front is only about half the quantity behind. In the healthy human brain, the preponderance is decidedly in the fronto-parietal region. The fissure of ROLANDO, so complex and zigzag in the healthy human brain, is in the idiots' brains, even on the side where it is most clearly traceable, a simple oblique sulcus, a little curved at its outer end, where, like the Sylvian fissure, and for the same reason, it is

more vertical than in the healthy cerebrum. The angle formed by the two fissures of ROLANDO posteriorly is a little more acute than in the perfect brain, owing to the narrownes of the brain in front of them. These fissures are far more simple in the idiots than in the highest Apes.

The external perpendicular fissure is traceable further on the upper surface of the cerebrum than in the perfect state, but cannot be followed at all on the lateral aspects of the hemispheres as in the quadrumanous brain.

Assuming the total length of each cerebrum to be 100, the relative lengths of the three regions, in front of the fissure of ROLANDO, between it and the external perpendicular fissure, and behind that fissure, when seen from above are in the preserved brain of the idiot woman about 46, 30, and 24; in the idiot boy 38, 34, and 28. In the healthy brain, the proportionate dimensions of these regions are 54, 23, 23. Measured longitudinally over the vertex in the cranial casts, the same regions occupy the following relative spaces: in the idiot woman, 46, 29, 24; in the idiot boy, 42, 32, 26; in the healthy brain, 54, 23, 23. In both idiots the frontal region is therefore strikingly defective, the parietal region is proportionally increased, whilst the occipital region exceeds somewhat the healthy ratio. The frontal region is larger in the idiot woman, the parietal and occipital regions are larger in the boy. The preponderance of the parietal region in the boy is very remarkable. In the Chimpanzee, the corresponding spaces are 46, 28, and 26; so that the idiot woman presents nearly similar proportions; whilst in the idiot boy the frontal region still exhibits a marked deficiency; whilst the parietal region is in exactly corresponding excess, and the occipital region equal.

The parallel fissure is at first more vertical, and extends further back than in the perfect brain. The internal perpendicular fissure, short and simple in its course, still approaches the human type in its inclination backwards, contrasting very remarkably with its vertical direction in the Ape. The fissure of the hippocampi is less horizontal than in the perfect brain, slanting upwards behind, in accordance with the want of depth in the occipital lobe—in this respect approaching the quadrumanous character. In the idiot woman, on the left side, this fissure is anomalous in its junction with the collateral fissure, which is elsewhere regular.

The Lobes.—Considered as defined by the several fissures, and compared with the perfect brain, the frontal lobes (Plates XXI. & XXII. F), in both idiots, are remarkably contracted both in length, in width, and in vertical height, being very short, pointed, and shallow, especially in the idiot boy. The parietal lobe (P) is defective in the antero-posterior direction in the idiot woman, and in the transverse direction in the idiot boy; whilst it is comparatively long in the boy, and wide in the woman. The occipital lobe (O) is much and equally contracted in the two, especially in its vertical measurement. The temporal lobes (T) are larger proportionally than any other part of the cerebrum, and are fuller and rounder in the idiot woman than in the idiot boy. The central lobe, or island of REIL (C), lies on the surface, but is slightly developed in the idiot woman, and scarcely recognizable as an eminence in the idiot boy. As regards

mass, the temporo-parietal region predominates in both brains, whilst the occipital and, especially, the frontal are defective.

Contrasting the idiots' brains with the Orang-outang's or the Chimpanzee's brain, the frontal lobe is still small, especially in the idiot boy; the parietal lobe occupies, on the whole, proportionally a larger space, whilst the occipital lobe occupies less. The temporal lobes are relatively much larger and fuller, but shorter than in the Chimpanzee's brain. The central lobe is much less developed; for in the Chimpanzee this part, completely concealed as in Man, has five radiating convolutions; whilst in the idiot woman's brain it consists only of a slight smooth eminence; and in the idiot boy no very distinct elevation of the surface can be detected.

The Convolutions.—The *orbital convolutions* (Plates XXI. & XXII. figs. 11 & 15, $1'$–$1'''$) are remarkably simple, being only slightly marked off from one another, and very smooth. In the idiot woman's brain (Plate XXI. fig. 11), the sulci which lodged the olfactory nerves are very short and shallow, especially that (*o*) on the left hemisphere; they are represented in the idiot boy's brain (Plate XXII. fig. 15) by a slight linear depression only on the right hemisphere, and a still smaller depression on the left. The deep triradiate sulci which cut up the orbital surfaces in the perfect cerebrum in so complex a manner, are much simplified in both the idiots' brains; they are more developed in the woman's than in the boy's brain, and in both cases are more developed on the right than on the left hemisphere. On the right hemisphere of the female idiot brain alone is this sulcus distinctly triradiate; on the left hemisphere it is more irregular. In the idiot boy it is represented on the right by a shallow longitudinal sulcus, on the left by a slightly curved one. Accordingly the orbital surfaces are much less complex and smoother even than in the Ape; at the same time, with all their simplicity, the want of symmetry of the two sides is remarkable.

The three rows of *frontal convolutions* (Plates XXI. & XXII. figs. 10, 12, 14 & 16) can be distinguished on each side, above the orbital border, in both the idiots' brains. In the idiot woman (figs. 10 & 12), the *inferior row* (1) is represented by a short, simple, horizontal convolution, which speedily joins the anterior ascending convolution behind and the middle frontal row in front. This *middle row* (2) consists likewise of a single convolution bent once outwards. The *upper row* (3), as usual, larger and more complex than the others, occupies half the frontal lobe, but is still remarkably simple in form. The upper frontal row, as ordinarily, blends with the upper end of the anterior ascending parietal convolution; the middle row is joined to that convolution near its lower end, by the same connecting ridge as the third row. In the idiot boy (figs. 14 & 16) the *three rows* can be distinguished, but are still more simple in their form and direction. The three rows are more equally developed, the inferior row being relatively well pronounced, giving a proportional breadth and squareness to that part only of the frontal lobe, not noticeable in the female brain. Easily discriminated in the idiots' brains, both as to their position and connexions, chiefly owing to their great simplicity, these frontal convolutions are singularly short and defective as compared with their wonder-

fully tortuous and complex character in the perfect brain. In comparison even with the Orang's (Plate XXIII. fig. 20) or Chimpanzee's brain, they are far more simple. They are rather better developed in the idiot woman than in the boy.

The *two ascending parietal convolutions* (Plates XXI. & XXII. figs. 10, 12, 14 & 16, 4–4′ & 5–5) commence, in both idiots, very far forward on the cerebrum, just above the entrance to the Sylvian fissure, instead of, as in the perfect human brain and in the higher Apes, a little in front of the middle of that fissure; they thus resemble the condition found in Cercopithecus and other similar Quadrumana. In the perfect human brain these ascending convolutions, as pointed out by GRATIOLET, are interposed between an anterior and a posterior set of longitudinal ones, which occupy the rest of the cerebrum—the portions in front and behind the slanting line of the ascending convolutions being nearly equal, the occipital region preponderating slightly. On the other hand, in the idiots' brains the portion in front of these ascending convolutions, as seen either laterally or from above, is by far the smaller; indeed it is not a *fourth* as large as that behind. In the Orang and Chimpanzee it is about one-third. (Compare Plates XX. & XXIII. figs. 7, 18, 19 & 20.)

As usual, these ascending parietal convolutions arise from the supramarginal convolution, which unites them below the outer end of the fissure of ROLANDO. In the idiot woman, on the right side, where the fissure of ROLANDO is a simple sulcus, the two ascending parietal convolutions are also simple, forming two oblique ridges instead of the zigzag bands seen in the perfect human brain. On the left side, the anterior convolution is represented partly by the intrusive triangular mass (4′) before spoken of, as if by an arrest of development. In the idiot boy it is curious that the same condition exists on the same side of the cerebrum, whilst on the right side the anterior ascending convolution is developing itself, as it were, into its more perfect but still simple form of an even oblique ridge. The symmetry between the two sides is thus again effectually destroyed in both brains. In both the idiots' brains, as usual, the *anterior ascending parietal convolution* (4–4′) joins, or would have joined, at its upper end, the upper frontal row, whilst the *posterior convolution* (5–5) expands into its so-called *lobule* (5′–5′), which is proportionally large, has its customary lozenge-shape, and extends backwards to the external perpendicular fissure (*h*). In the idiot woman (Plate XXI. fig. 10), on the left side, this lobule is notched by a single deep sulcus running from the longitudinal fissure; on the right side it has this sulcus placed further forwards, and another slight triradiate one besides, but its surface is remarkably smooth in comparison with its complex form in the perfect brain, or even in the Orang (Plate XXIII. fig. 20) or Chimpanzee. In the idiot boy's brain (Plate XXII. fig. 14) the lobule of the posterior ascending parietal convolution is on both sides proportionally larger, and slightly more complex in form, in accordance with the greater development of the parietal region in the idiot boy. In both the idiots' brains the outer border and angles of the lobule are distinctly defined on the left hemisphere, whilst on the right hemisphere it blends at the outer border with the neighbouring convolutions—that is to say, with the lobule of the supramarginal convo-

lution (A), the bent convolution (6), and the second connecting convolution (β). This better definition of the lobule of the left side, it is worthy of remark, is not uncommon in perfect European brains. In the Bushwoman's brain, too (Plate XVII. fig. 1), described in the first part of this paper, the lobule in question is better defined on the left than on the right hemisphere. In the brains of the higher Apes (Plate XXIII. fig. 20) the parts are more nearly symmetrical; so that in this region again the idiots' brains manifest the human want of symmetry.

In both the idiots' brains the Sylvian fissure is so short that the *supramarginal convolution* (4″–5″), its so-called *lobule* (A), and the *bent convolution* (6) are all three necessarily very small, and, indeed, are represented only by a simple convolutional band, turning round the front and upper end of the nearly vertical or slightly oblique Sylvian fissure. Nothing can show more clearly the fundamental unity of these parts, especially of the supramarginal convolution and its so-called lobule; whilst the bent convolution is a sort of connecting convolution between the supramarginal and one of the temporal convolutions. Thus understood, the very short supramarginal convolution ultimately joins, in both idiots, the lower frontal row anteriorly. In the idiot woman it sends downwards and inwards a short process to the transverse smooth eminence, lying partly exposed at the entrance of the Sylvian fissure, which expands into the *rudimentary central lobe, or island of* REIL (C). In the idiot boy this process is a mere ridge, and the eminence itself is not distinctly recognizable. The so-called *convolutions* of the island of REIL, or central lobe, are absent, even in the idiot woman, whilst in the idiot boy a plain indistinctly elevated surface occupies its usual situation.

The supramarginal lobule (A), if defined to be a largely developed part of the convolution so named, overhanging the Sylvian fissure and helping to depress its hinder end, is certainly absent in both the idiots' brains; but it is doubtless really represented by the part of the supramarginal convolution just in front of the hindmost bifurcation of the upper end of the Sylvian fissure. The structure of this part of the idiots' brains is exceedingly simple, as simple indeed as in the Cercopithecus, far simpler than in the higher Apes (Plate XXIII. fig. 20). It is smaller and more simple in the idiot woman than in the idiot boy, is larger in both on the right than on the left side, and is largest on the right side in the idiot boy. In the idiot woman the supramarginal lobule is connected, on the right side, with the lobule of the posterior ascending parietal convolution, and also with the second external connecting convolution; on the left side only with the latter. In the idiot boy it is, on both sides, connected only with the latter, but by a larger and more tortuous band.

The bent convolution (Plates XXI. & XXII. figs. 10, 12, 14 & 16, 6), turning, as usual, behind the summit of the Sylvian fissure, is connected posteriorly, in both the idiots' brains, with the second connecting convolution, and joins below the upper external temporal or inframarginal convolution (Plates XXI. & XXII. figs. 12 & 14, 7), instead of being separated from that by a secondary sulcus and running between it and the middle external temporal (8); this peculiarity is found only in the simplest quadrumanous brains, and

indicates a very great degree of simplicity in the idiots' brains. The bent convolution itself, also, is very simple and symmetrical. The two correspond, in both brains, to the most prominent parts of the parietal regions, and therefore to the widest part of the cerebrum, lying beneath the parietal eminences of the skull; whereas in the perfect human brain it is the large and peculiar supramarginal lobule which occupies this post.

The temporal convolutions (Plates XXI. & XXII. figs. 12 & 16) in both the idiots' brains are simple in form, but large, and, indeed, in the female enormously developed. On both sides in the latter (Plate XXI. fig. 12) the *middle temporal* (8–8) is the largest, the *upper temporal* or *inframarginal* (7–7) is the next in size, whilst the *lower temporal* (9–9) is rather more moderate in size. In the idiot boy (Plate XXII. fig. 16), on both sides, the middle temporal is still the largest, but the difference is not so marked. In both brains there is a want of symmetry in the convolutions of the two sides, those of the right side being bounded by more tortuous furrows, and having a few secondary sulci; whilst on the left side they are nearly smooth. They are all continued backwards into the diminutive occipital lobe by simple, but, in the woman, serpentine connecting convolutions.

The occipital lobe is so small in both idiots, and so slightly marked by rudimentary sulci, that its three ordinary stages or rows (Plates XXI. & XXII. figs. 12, 14 & 16, 10, 11, 12) can scarcely be separately recognized; but it may be described as consisting of a shallow, smooth edge of cerebral substance, so blended on the outer side with the second, third, and lowest external connecting convolutions, and on its under side with the internal temporal, as almost to lose its identity in those aspects, and to appear like a mere narrow continuation backwards of the temporal lobe itself. It is defined only on its inner border, and for a short distance on its upper surface.

The upper external connecting convolution in the idiot woman (Plate XXI. fig. 10, α) does not completely bridge over the external perpendicular fissure on either side, but is more nearly superficial throughout on the right hemisphere; in the idiot boy (Plate XXII. fig. 14, α) this convolution dips downwards into the internal perpendicular fissure, becoming partly concealed on both sides. In the perfect brain (Plate XX. fig. 7) it is quite superficial throughout. In the female idiot, on the left side, *the second connecting convolution* (Plate XXI. fig. 10, β–β) is massive and double, one part ending in the bent convolution, and the other in the upper temporal; the *third* (γ) ends in the middle temporal, and the *lowest* one (δ) both in that and the lower temporal; on the right side the second, also double and very tortuous, runs by its upper part into the parietal lobule and the supramarginal lobule, and by its lower part into the upper temporal, whilst the third and fourth are blended, and end in the middle and lower temporal. In the idiot boy (Plate XXII. fig. 14), on the left side, the second connecting convolution (β–β), very broad and tortuous, runs into the bent convolution, the upper temporal, and the middle temporal; the third (γ) and fourth (δ) connecting convolutions join the middle and lower temporal; on the right side they are more tortuous, and serve to connect the same parts, the second one also joining the parietal lobule. In both idiots the second (β), third,

and lowest external connecting convolutions, though broad and superficial (the second being especially massive), are so simple, in comparison with their singular complexity and extraordinary tortuosity in the perfect brain, as to form mere bands between the temporal and occipital lobes. Nevertheless this part of the brain, more deeply furrowed in the woman than in the boy, but larger from before backwards in the boy than in the woman, is relatively well developed, and has perfectly human characters; for all four connecting convolutions exist, instead of there being defects in one or other of the two upper ones, as is found in the higher Apes. They are also, as seen above, singularly asymmetrical.

On the inner surface of the hemisphere *the marginal convolution* (Plates XXI. & XXII. figs. 13 & 17, 17–17) pursues its usual course, and terminates just behind the upper ends of the two ascending parietal convolutions. Like these convolutions, and owing also to a defective development backwards of the frontal lobe, it does not extend so far back as in the perfect brain, but, becoming very narrow, stops, in the idiot woman, on the left side (Plate XXI. fig. 13) at a point opposite the hinder border of the corpus callosum (*c*), on the right side somewhat short of that point. In the idiot boy (Plate XXII. fig. 17) it is on both sides arrested at a point a little in front of the hinder border of the corpus callosum. In the idiot woman, instead of the numerous radiating secondary sulci which in the perfect state cut up this convolution into little quadrangular lobes, only two or three such sulci exist, passing horizontally forwards in front of the corpus callosum; below the anterior border of the corpus callosum is another rudimentary longitudinal sulcus, and a little depression indicative of a second; above the corpus callosum this marginal convolution is joined, as usual (*), to the convolution of the corpus callosum (18–18), and then becomes very wide, and faintly marked with a slight depression. In the idiot boy's brain the same description would suffice. In both brains its forms and subdivisions, simple as they are, imitate closely its general features in the perfect state, but are wanting in complexity. As compared with its condition in the Apes, it is less uniform in width, and far less frequently subdivided by secondary sulci.

The convolution of the corpus callosum (Plates XXI. & XXII. figs. 13 & 17, 18–18) occupies its customary position around that commissure, but differs from its condition in the perfect brain by the absolute smoothness of its surface and the absence of the peculiar crest-like upper margin posteriorly. It is equally smooth in both the idiots' brains. Its surface is more complex in the higher Apes. In the idiots' brains the marginal convolution (17) greatly exceeds in width the subjacent convolution of the corpus callosum (18), especially in the region in front of and below the corpus callosum—a character well marked also in the perfect European brain—whereas in the Ape the proportionate space occupied by the two convolutions is nearly equal. The connecting bridge of convolutional substance (*) passing from one to the other in both the idiots' brains, on both hemispheres, is usually present also in the human brain, but not in the brains of the higher Apes.

The quadrilateral lobule in both the idiots' brains (Plates XXI. & XXII. figs. 13

& 17, $18l$–$18l$), the prolongation upwards and backwards of the callosal convolution, is, owing to the deficient development of itself and of the portions of the cerebrum in front and behind it, less compressed than in the perfect state, so that it has a roundish and not angular outline, and forms a perfectly smooth, bent or knee-like, and not quadrate lobule, ascending in front of the internal perpendicular fissure (*k*). Though thus rudimentary and smooth, it has the oblique direction backwards characteristic of this part in the human brain, and not the nearly vertical position which it exhibits in the Apes. Indeed the angle which its posterior border, bounding the internal perpendicular fissure, forms in both idiots with a base line passing through the corpus callosum is nearly 145°, *i. e.* greater than in the perfect brain, owing probably to the very scanty development of the occipital lobule behind it.

The triangular occipital lobule (Plates XXI. & XXII. figs. 13 & 17, 25), like the quadrilateral lobule, is so feebly developed in both the idiots' brains, that it does not appear to fit closely in between the parts in front and behind it, but forms a mere ridge of cerebral substance, widening as it passes from below upwards and backwards to the tip of the occipital lobe, interposed between the internal perpendicular fissure (*k*) and the posterior part (*l*) of the fissure of the hippocampi. This simple, smooth, but slightly flexuous ridge takes the place then of the triangular and complexly convoluted lobule seen in the perfect brain. This condition coincides with the simplicity of the upper external connecting convolution, with the region of which this occipital lobule corresponds. It is far less developed than in the Apes.

On the under surface of the idiots' brains, the convolution of the corpus callosum (Plate XXII. fig. 17, 18) is, as usual, continued beneath the cerebral peduncle by a ridge of cerebral matter (*) into the middle internal temporal convolution, or uncinate convolution (19). This connecting ridge is proportionally wider than in the perfect cerebrum; it is said by GRATIOLET to be peculiar to the human brain; it certainly does not exist in every Chimpanzee's brain, though it is met with again in lower Quadrumana.

Of the *internal temporal convolutions*, the *upper*, or *dentate convolution*, is very narrow, and on neither idiot's brain can the fascia dentata be traced. In the idiot woman, however, the parts are much damaged here, and in the idiot boy somewhat injured also. The *middle internal temporal convolution* (Plate XXII. fig. 17, 19), ending anteriorly in the *unciform lobule* ($19l$), is proportionally well developed. On the right hemisphere of the idiot woman's brain, the unciform termination, or crochet, is well marked; on the left hemisphere this convolution is much narrower, and the crochet scarcely recognizable. In the boy this convolution is very broad on both sides, and the crochet neatly defined, though small. The *lower internal temporal convolution* (9–9), which is the same as the lower external one, is also well marked. On both sides these two last-named convolutions are proportionally more simple than in the perfect human brain, or even than in the higher Apes. They are continued, as usual, backwards into the occipital lobe, and, owing to the imperfect development of that lobe, seem to extend almost to its tip. They are broader in the idiot boy.

It has already been stated that within the double fissure of the hippocampi, in the right hemisphere, in the idiot boy's brain (Plate XXII. fig. 17, *l–l*), there is present a projecting ridge of cerebral substance (26), which appears to be the analogue of the *calcarine lobule*, described by Mr. FLOWER in the brains of Cercopithecus, Macacus, and Cebus, but which is absent in the highest and lowest Quadrumana. It is not present on the left side of the idiot boy's brain, nor on either side in the idiot woman's brain. In the perfect human brain, I have sometimes found it as a superficial ridge extending along the posterior two-thirds of the fissure, sometimes as a well-marked concealed ridge; sometimes it is altogether absent. It is continuous backwards with the lowest occipital convolutions.

The *lower internal connecting* convolution (Plate XII. fig. 17, ε) is feebly represented in both idiots, being, as usual, concealed in the idiot woman, but superficial in the idiot boy; the upper one is absent, as usual, in both idiots.

In the preceding account of the cerebral convolutions in the idiots' brains, constant comparisons have been made between them and the perfect brain, between the brains of the one and the other idiot, and between both and the brains of the higher Apes. Notwithstanding, it is necessary to state some further general conclusions from the facts above recorded.

1. In the first place it is obvious that the idiots' cerebra are not merely diminutive brains possessing every convolution, both primary and secondary, proper to the perfect human cerebrum, each having its natural shape, proportion and position, though on a diminished scale; but, on the contrary, that they are profoundly modified in their convolutional forms, which are not merely smaller in bulk, but are fewer in number, of simpler shape, and different in proportion and position, as compared with those of the perfect cerebrum.

2. Nevertheless all the primary and connecting convolutions belonging to the perfect cerebrum are represented by definite corresponding parts in these brains, mostly by actual convolutional foldings of the cerebral substance of a comparatively more simple kind, but sometimes by scarcely convoluted, or even by entirely smooth though slightly elevated portions of the cerebral substance.

3. The parts which can be easily detected as actual convolutions in the idiots' brains are the three frontal rows, the two ascending parietal convolutions, with the lobule of the posterior one, the supramarginal and bent convolutions, the external and internal temporal convolutions, the marginal and callosal convolutions on the inner surface, with the quadrilateral and occipital lobules, and all the connecting convolutions proper to the human cerebrum. The parts which are less easily distinguished are the orbital convolutions and, especially, the three rows of occipital convolutions. The central lobe, or island of REIL, is distinguishable, as a distinct smooth eminence, in the idiot woman, but only as a smooth indistinctly elevated surface in the idiot boy. In neither does there exist such an expansion of the supramarginal convolution as would form a prominent supramarginal lobule, a part so characteristically human.

On the whole, the temporal convolutions, in both brains, are the boldest and best marked; then the convolutions of the parietal lobes, especially in the idiot boy; next stand the connecting convolutions and frontal rows, and those of the inner surface; afterwards the orbital and occipital convolutions; and lastly the island of REIL.

4. On contrasting the idiots' brains with one another, the convolutions generally are seen to be decidedly more developed in the idiot woman than in the idiot boy—the marked exception being in the parietal region of the latter, where the lobule of the posterior ascending parietal convolution, the supramarginal convolution on the left side, the bent convolution, and the adjacent second external connecting convolution are more fully developed.

5. Agreeably to the opinions already expressed by other anatomists in regard to similar examples, the condition of the cerebra in these two idiots is neither the result of atrophy, nor of a mere arrest of *growth*, but consists essentially in an imperfect evolution of the cerebral hemispheres or their parts, dependent on an arrest of *development* (*agénésie, asthénie-génie*) occurring at some stage or other of their metamorphosis from a simpler to a higher form.

6. On comparing the condition of the cerebral convolutions of these brains with the representations of the brains of two fœtuses at about $6\frac{1}{2}$ and 7 months, published by LEURET and GRATIOLET*, it would appear that in both idiots the convolutions are more complex than in the former, but less so than in the latter fœtus. From this, one might hastily suppose that in both idiots the development of the convolutions, and indeed of the entire cerebra, had been arrested in the latter part of the seventh month of intra-uterine life; those of the idiot boy a little earlier than those of the idiot woman.

But on further reflection such a supposition does not appear to be tenable, and it is not supported by facts. It necessarily assumes that, up to a certain period of development, the evolution of all the parts of the cerebrum had been normal in rate and in character; whereas, in the first place, there is nothing at present to show why that rate may not, in such cases as these, be more or less retarded, so that any given stage is attained at a much later period than usual, and the ultimate condition of development be reached perhaps some time after birth; and, in the second place, there is evidence in the brains themselves, of such a disproportionate development of parts as to prove that the normal character of the evolutional changes has been profoundly disturbed at some period or other, by at least one *local* departure from, or interference with the regular mode and order of development.

A comparison of the size of the cerebellum and cerebrum in the idiots' brains, and in the brain of a fœtus at the seventh month, shows most strikingly that the development of the former organ had continued to progress long after the latter had experienced its final arrest; but, what is more essential to the present inquiry, even within the idiots' cerebra themselves there is proof that all the parts are not equally and normally developed.

* *Op. cit.* pl. 30. figs. 1, 2, 3; pl. 31. figs. 1, 2.

In the two fœtal brains represented by LEURET and GRATIOLET, already alluded to, the parts in front of the fissure of ROLANDO, comprising the frontal lobe and the so-called anterior ascending parietal convolution (which latter should, I think, be associated with the frontal region itself), form a far larger proportion of the entire cerebrum than they do in the idiots' brains. In the brain of the human fœtus between the fourth and fifth months (Plate XXIII. figs. 21 & 22), in which the fissure of ROLANDO (*d*–*d*), the great parallel temporal fissure (*f*), and the perpendicular fissure (*h*) are clearly traceable, the same fact is well illustrated. In fœtal brains at still earlier periods* the same thing is observable, whilst at later periods than the seventh month the parts in front of the fissure of ROLANDO become still longer in proportion to those behind it. Indeed, in the normal course of development, there is no period at which the frontal part seems, as it were, to stand still, or retrograde relatively to the rest of the cerebrum; but after once the fissure of ROLANDO is formed, there is a variable but progressive relative increase of the parts in front of that fissure. It is certain, therefore, that the frontal lobes of the idiots' cerebra are not proportionally developed in comparison with the temporo-parietal regions. The same appears to me to be true likewise of the occipital lobe; but we may confine the argument here to the defective state of the frontal lobes.

Fully to appreciate the importance of the diminutive size of these last-named lobes, we must take into account certain facts to be hereafter stated in detail, regarding the internal structure of the cerebral hemispheres. The corpora striata in the idiots' brains are very small; not merely absolutely, but also relatively to the size of the optic thalami, the ordinary proportions between these two ganglia being actually reversed, the former being usually much larger than the latter, whilst in the idiots' brains they are much smaller. Since in a series of normally developed fœtuses the corpora striata, at all periods, form larger masses than the optic thalami, we have further evidence, within the idiots' brains themselves, of the fact already announced of an irregular and disproportionate development of their parts. There is, indeed, an obvious correspondence between the diminutive size of the corpora striata and that of the frontal lobes; whilst the relatively larger optic thalami are associated with a larger growth of the hinder portion, especially of the temporo-parietal regions.

The conclusions which we would draw from the preceding facts are these:—First. Instead of the idiots' cerebra having been uniformly and normally developed up to a certain date (say the latter part of the seventh month), and having then been subjected to a general cessation of development, they have experienced an inequality or irregularity of evolution in certain of their parts. Secondly. Whilst all parts have been more or less arrested, the frontal and occipital lobes have suffered more than the temporal and parietal. Thirdly. Whilst both the large ganglia at the base of the cerebrum (those cores or nuclei of the cerebral hemispheres, the corpora striata and optic thalami) have participated in this disturbance of the ordinary course and degree of evolution,

* See LEURET, *loc. cit.* pl. 29, from fig. 10; and also TIEDEMANN, Anat. Bildungsgeschichte des Gehirns. Nürnberg, 1816.

the corpora striata have been more especially involved. Fourthly. The original vice of formation, in all probability, affected these two pairs of ganglia primarily; and this entailed, as a necessary consequence, an interrupted, irregular, defective, and perhaps retarded evolution of the convolutions of the hemispheres themselves. Fifthly. The primitive starting-point of the future idiotic condition dates from a period far earlier than that at which all further evolution ceases; and in fact, as regards the optic thalami and, especially, the corpora striata, probably from a very early period of development indeed. This conclusion is obviously more acceptable to the physiologist (because more consistent with the radical deficiency in cerebral power manifested by idiots) than the supposition that the idiotic state should be due to a sudden arrest of a previously normal development at some later period of fœtal life. Sixthly. The anatomical connexion which, by the comparison of these idiots' brains with healthy fœtal brains, has been shown to exist (in human brains, at least) between the development of the corpora striata and the frontal lobes, and the optic thalami and the temporal and parietal lobes, has a considerable general interest, and probably has a physiological significance which may hereafter throw light on the functions of the convolutions of those several parts. Lastly. The deficiency in the corpora striata and the associated frontal lobes becomes particularly interesting when we reflect on the special connexion of those ganglia with the anterior or motor columns of the cord, and on their probable intimate concern in the execution of voluntary movements, *i. e.* in the mechanical expression by the body of those numerous acts which are the outward exponents of that important psychical faculty commonly designated "the will." Now, it is the inadequate performance or entire abrogation of those acts, whether locomotive, manipulative, or articulate, which constitutes one of the most striking characteristics of the idiotic state.

7. It is impossible, in the present state of our knowledge, to determine the interesting question whether some parts of the idiots' cerebra had undergone, after the general arrest of ordinary morphological changes, further local development, as the result of use or ordinary training.

8. There are, however, certain evident grounds for inferring that, after the cessation in these cerebra of all further evolutional changes, they experienced an increase of size, or a mere growth of their several parts. Thus the idiots' cerebra are considerably larger than fœtal cerebra in which the convolutional development is at a similar stage; whilst the individual convolutions themselves, the same in number, are necessarily broader and deeper. Again, from Dr. Boyd's observations, it appears that in a certain number of fœtuses prematurely born, with an average height of 14 inches for males and 13·5 for females, whose brains would about correspond with the idiots' degree of convolutional development, the average weight of the cerebrum in the former was 5·33 oz., and in the latter 4·42 oz.; whereas, as we have seen, the idiot boy's cerebrum weighed 5·85 oz., and the idiot woman's 7·63 oz. The greatest difference is in the case of the woman, who lived to the adult age; whilst the boy, it must be remembered, died at the age of 12.

9. It has been shown that the temporal region preponderates in the idiot woman,

and the parietal in the idiot boy; the frontal lobe is also relatively a little larger in the woman. There can be no doubt also that the emotions, intelligence, and voluntary power of the woman were in advance of those of the boy; but at present it would be premature to attribute too much importance to these probably individual anatomical differences, or to endeavour to associate them with peculiarities of psychological endowment.

10. On contrasting the cerebral convolutions of the two idiots' brains with those of a female and male idiot, each four years of age, represented by LEURET*, there appears a very close and remarkable resemblance between them. There is the same paucity, simplicity, and breadth of the convolutions, the same deficiency in the frontal lobes, though in one of them (the second referred to in the foot-note) to a less degree. The details of the convolutions are also nearly similar; but in some slight particulars they are superior to those of the idiot woman, and especially so to those of the boy. For example, in both, the anterior ascending parietal convolution has passed beyond the stage of an intrusive convolution to that of an oblique smooth ridge of cerebral substance. There are also more numerous secondary sulci in most regions of the cerebrum, and the convolutions themselves are somewhat more tortuous.

11. Lastly, on comparing the convolutions of the idiots' cerebra with those of the Orang and Chimpanzee, they appear, in the human idiots, to be fewer in number than in the Apes, because, although the primary foldings correspond in each, they are individually less complex, broader, and smoother in the former than in the latter. In this respect the idiots' brains are even more simple than the brain of the Gibbon, and approach that of the Baboon (Cynocephalus) and Sapajou (Ateles)†.

As special and interesting results of this general simplicity of the primary convolutions, are the absence, as in the quadrumanous brains, of such a development of the supramarginal convolution as to constitute its so-called lobule, and the partial concealment of the upper external connecting convolution, as well as the imperfect development of the anterior ascending parietal convolution, and the extreme simplicity of the bent convolution. Of these, the non-development of a distinct supramarginal lobule is the most interesting defect, since it indicates the late appearance in the brain of a part whose presence is regarded by GRATIOLET as peculiarly characteristic of Man.

On the other hand, the points of special difference between the idiots' and the quadrumanous brains, both general and particular, are even more numerous. First, as a general difference, there is a remarkable want of symmetry even in these imperfectly developed cerebra, as if already preparations were being made to establish that higher and almost exclusively human character; this point has been so frequently exemplified in the previous descriptions that we may refer to them for abundant illustration of it. Secondly, the special differences, which likewise exhibit the decidedly human character, are the superficial position of all four of the external connecting convolutions; the consequent speedy interruption of the external perpendicular fissure, and complete obliteration of its posterior border or operculum; the concealed position of the lower internal

* *Op. cit.* pl. 24. fig. 4; pl. 32. figs. 1 to 5.

† GRATIOLET, pl. 4. figs. 1 & 2; pl. 9. figs. 1 & 4; pl. 10. figs. 1 & 2.

connecting convolution, and the absence of the upper one; and lastly, the great breadth of the connecting ridge which joins the callosal and uncinate convolutions.

Although, therefore, so defective in developmental detail, these microcephalic cerebra are still human, and differ as much from the Ape's cerebrum, or constitute as little an intermediate step towards it, as any other bodily defect in man is found to differ from a truly quadrumanous form, or manifest a serial approximation to it. Just as in a case of webbed human fingers the digits are still human and not gorilla-like, and just as in the deformity named talipes valgus, though the foot is inverted and the weight of the body is supported on its outer border, still the member is human and not ape-like, so these brains, though simplified by defect, possess characteristics which distinguish them as imperfectly human yet not quadrumanous. The community of plan observable in the brains of all the Primates, including Man himself, necessitates a general conformity to that plan, even in these defective human brains; but the special marks of human divergence from that plan have already been set upon them at some very early, probably at the earliest moment of their development.

e. *Internal Structure of the Idiots' Cerebra and Cerebella. The Commissures, Cavities, Ganglionic Masses, and Laminæ.*

Excluding the great fissures, the depth of the sulci (or, in other words, the prominence of the convolutions) in the idiots' brains is greatest in the lateral temporal region, next in the frontal and parietal regions, and least in the occipital region, where many of the sulci are mere marks or notches. The average depth of the sulci is, in the idiot woman's brain, ·5 inch, in the idiot boy's ·4 inch. In the idiot boy the thickness of the grey matter in the recent brain varied between $\frac{6}{30}$ths and $\frac{3}{30}$ths of an inch; in the preserved brain it varies from $\frac{5}{30}$ths to $\frac{2}{30}$ths of an inch, averaging $\frac{3}{30}$ths. In the idiot woman it ranges between $\frac{6}{30}$ths and $\frac{2}{30}$ths, averaging about $\frac{3}{30}$ths; in both brains it is, as usual, thickest in the frontal and parietal regions, and thinnest in the occipital. Unlike what is found in the Chimpanzee's brain, the quantity of white matter in proportion to the grey is very large, in accordance, as we shall find, with the relatively full development of the transverse commissural system of fibres.

The corpus callosum, in both the idiots' brains, is proportionally shorter though thicker than in the perfect human brain, but it is relatively longer than in the Chimpanzee. In the recent brain of the idiot boy it measures ·75 inch long. Its length, greatest thickness, least thickness, and average thickness in the preserved brain of the idiot woman are 46, 13, 6, and 7 thirtieths of an inch; in the idiot boy 41, 7, 4, and 5 thirtieths of an inch. The sectional area of this part in the idiot woman is about $\frac{322}{900}$ths of an inch, in the idiot boy only $\frac{205}{900}$ths of an inch. Comparing these numbers with the area of the internal surface of one cerebral hemisphere, we find that in the idiot woman the ratio is as 1 to 13·3, in the idiot boy as 1 to 14·5, whereas in the perfect human brain the ratio is 1 to 12·5, and in the Ape as 1 to 28·5; so that in respect of the transverse commissural fibres of the corpus callosum, the idiots' brains, diminutive as they are, are truly human in their structure. The anterior and posterior commissures likewise are

well developed in both brains; the soft commissure is very large in both. Of the longitudinal commissures the fornix is proportionally large; the tænia semicircularis and striæ longitudinales, very distinct in the boy, are also easily traceable in the woman. The septum lucidum and middle ventricle are small in both the idiots' brains, the interval between the fornix and the corpus callosum being narrow. The lateral ventricles in both brains, in accordance with the restricted development of the frontal and occipital regions, are comparatively short and wide cavities. The general direction of the body of the ventricle is not parallel with the median line, but divergent outwards and backwards—a condition owing evidently to the optic thalamus being proportionally large, or at any rate well developed, whereas the corpus striatum is relatively very small, the eminence formed by it within the ventricle being short and narrow, whilst the comparatively large optic thalamus carries the back part of the body of the ventricle outwards. This part of the ventricle in the idiot woman's brain measures 8·5 thirtieths of an inch; the anterior cornu 4, the posterior cornu 8, and the descending cornu 9 thirtieths. In the idiot boy the same parts measure respectively 6, 2·5, 7·5, and 8 thirtieths of an inch; the body of the ventricle is therefore in both cases shorter than in the perfect brain, being shorter in the idiot woman than in the idiot boy, the length of whose parietal region has already been noticed; the anterior cornu is also proportionally short, particularly so in the idiot boy; the posterior cornu is likewise short but wide, directed almost immediately backwards in the idiot boy, but divergent outwards in a remarkable manner in the idiot woman. The thickness of cerebral substance, between the end of the posterior cornu and the hinder edge of the cerebrum, is disproportionally great, being ·4 inch in the idiot woman and ·7 in the idiot boy. In the idiot woman the divergent direction of the point of the cornu makes it impossible to compare its relative proximity to the apex of the posterior lobe with that observed in ordinary brains; in the idiot boy the distance from the point of the cornu to the end of the posterior lobe, viz. ·7 inch, is more than one-fifth of the total length of the brain, whereas the ordinary proportion is about one-eighth. The descending cornu, in correspondence with the size of the temporal lobe, is well and equally developed in both the idiots' brains. The hippocampus major is large and wide in form, and terminates in front in an expanded and slightly sulcated extremity. The hippocampus minor is very wide, though short, in both brains; in the idiot boy it is directed backwards, in accordance with the direction of the posterior horn; whilst in the idiot woman it branches off outwards, in harmony with the divergent course of that cavity. The length of the hippocampus minor in the idiot woman is ·8 inch, its greatest breadth ·35; in the idiot boy the length is ·5 inch, and the greatest breadth ·3. The eminentia collateralis is distinctly visible in both brains.

Measuring off the antero-median from the posterior portion of the cerebrum on Mr. Flower's method, the ratio between the former and the latter is, in the idiot woman, 100 to 62·2, in the idiot boy 100 to 61·9; so that the occipital region, as thus estimated, *i. e.* in its inferior layers, is proportionally longer in the idiots' brains than in the perfect brain, or even than in the Chimpanzee's brain, in which the proportions are

100 to 53 and 100 to 52 respectively. This apparent relative increase in the posterior portion of the brain should rather be interpreted as due to a comparatively undeveloped condition of the antero-median region.

It has already been mentioned that the corpora striata are in both idiots' brains very small, whilst the optic thalami are relatively large. The part of the corpus striatum seen in the left lateral ventricle is, in the idiot woman, ·35 inch long and ·15 inch wide; in the idiot boy ·25 inch long and ·15 inch wide. The visible portion of the optic thalamus in the woman is ·8 inch long by ·3 inch wide, in the idiot boy ·65 inch long by ·4 inch wide. It has been previously noted that the large size of the optic thalamus corresponds with the great development of the temporo-parietal region in both the idiots' brains, and the diminutive corpus striatum with the wasted form of the frontal region; but besides the mere relative size of the two ganglionic masses, another condition doubtless concurs to produce this correspondence, viz. the relative number of the radiating fibres which spring from them to branch out into the corresponding parts of the hemisphere. The corpora quadrigemina are quite of proportional size to the rest of the brain in both idiots, the superior one being larger as usual. The corpora geniculata are likewise well developed in both. In the idiot woman the corpora albicantia are separate but not prominent; in the idiot boy the corpora albicantia are broad and somewhat fused together. The pineal gland is proportionally large in the idiot woman; in the idiot boy it was not found, having probably been destroyed. The habenulæ could not be traced in either brain. The pituitary body in the idiot woman is very large; in the idiot boy it has not been preserved, but the infundibulum is present and large. The cerebral peduncles in the idiot woman appear long and narrow, and the interval between them is deep; in the idiot boy, on the other hand, they are broad and flat, and the interval between them is shallow. This may be due to elongation of the woman's brain occurring as the effect of long suspension in spirit after complete removal of the membranes.

In the preserved brains the pons Varolii is broader from before backwards in the idiot woman than in the idiot boy, measuring in the former nearly ·6 inch deep, but only ·5 inch thick, in the latter only ·4 inch deep and ·5 inch thick: this appears remarkable, as the cerebellum of the boy is larger than the cerebellum of the woman.

The medulla oblongata is large in both idiots: in the woman its greatest width is ·7 inch, in the boy ·6 inch; its proportions to the entire width of the brain are as 1 to 5·14 in the former and 1 to 5·3 in the latter, instead of 1 to 7, the normal ratio. The olivary bodies are large, but especially so in the idiot boy; the grey matter in their interior is folded, as usual. In other respects the medulla is normal.

The cranial nerves, so far as can be judged from those which remain in the preparations, are of full size, and, indeed, large in proportion to the size of the cerebral mass.

The Cerebellum (Plates XXI. & XXII. figs. 10–16, *Ce*).—As already shown, this organ in both idiots, though more highly developed than the cerebrum, is still small, especially in the idiot woman. All its parts, however, are present, though more or less reduced in size and in complexity of structure.

In the idiot woman the hemispheres are proportionally large and well shaped, whilst the median portion is not quite so well developed. In the idiot boy the hemispheres are relatively larger, projecting laterally, and preponderating still more over the median portion.

In the idiot woman the square lobe is normal in shape and proportions, the posterior superior lobe is narrow and shallow, the amygdala and biventral lobe are strikingly large; the slender lobe is very small, the posterior superior lobe is, on the contrary, well developed; the pyramid and uvula are prominent, but narrow; the nodule is small; the posterior velum is exceedingly thick; the floccule is very small. In the idiot boy the square lobe is of ordinary shape and proportions, the posterior superior lobe is wide and deep; the amygdala, contrary to its condition in the idiot woman, is small, and partly concealed beneath the biventral lobe, which is large; the slender lobe is of moderate size, and the posterior inferior lobe again large; the pyramid, uvula, and nodule are small; the posterior velum, as in the idiot woman, is exceedingly thick, suggesting the idea that it usually becomes attenuated as development advances; the floccules are small, but not so small as in the female idiot.

The middle peduncular (or transverse commissural) fibres are defective, not merely in comparison with the perfect organ, but also in relation to the size of the idiots' cerebella, especially considering the great development of their hemispheres. The oval surface occupied by the divided ends of these fibres, as seen on a median section through the pons, is shorter and much smaller than usual. In the idiot woman (Plate XXIII. fig. 25, *p*) it measures ·6 of an inch long by ·325 inch wide, its sectional area being therefore ·195 square inch, whilst in the idiot boy (fig. 26, *p*) the dimensions of the same part are ·45 inch by ·28 inch, and the sectional area ·126 square inch. The idiot woman's recent cerebellum having weighed 1·95 oz., and the idiot boy's 2·25 oz., there would be to each ounce weight of that organ ·1 square inch of commissure in the woman, and only ·05 square inch in the idiot boy. The healthy proportion, as shown at a previous page, is ·13 square inch. In this point of view, then, the cerebellum is very defective in both idiots, but especially in the idiot boy; which is remarkable anatomically, since in him this organ is so much larger than in the woman. The imperfect gait and feeble power of control over the muscles generally, always associated with true idiocy, were noticeable in the case of both idiots; and this might appear to be in part explicable, on the ordinary hypothesis that the cerebellum is concerned in coordinating the voluntary muscular movements, by the obvious deficiency in the bulk of that organ in both these cases; but, on the other hand, the fact that the cerebellum is larger in the idiot boy, though his powers of locomotion were altogether absent, and though he could not handle anything, nor articulate any words, seems contradictory and inexplicable. Under these circumstances it is at least interesting to find that one of the cerebellar commissural systems of fibres is so much more deficient in him than in the idiot woman; and whether we adopt the view that the office of the cerebellum is directly to coordinate the muscular movements, or that it indirectly aids in this coordination, by registering the various muscular sensa-

tions indicative of the manifold conditions of the muscles, such a deficiency of these commissural fibres may be equally supposed to interfere with the functions of the organ. In both idiots the inferior and superior peduncles likewise appear small; but no exact computations could well be made concerning these parts.

On counting the total number of laminæ in the cerebellum of an idiot, MALACARNE found that they numbered only 324*, whilst in a healthy cerebellum there were from 700 to 780. In another case he found 362 laminæ, 240 on the upper surface, and 122 on the under surface†. It appears that he afterwards met with a third example, in which a similar deficiency in the number of the laminæ was likewise noted‡.

For reasons already stated in describing the cerebellum of the Bushwoman, I have limited myself to counting the superficial laminæ only of certain parts, and the deep and superficial ones of others. The following are the results.

Superficial laminæ only counted.

	Median portion.	Lateral parts.						Total laminæ in lateral parts.
	Superior vermiform process.	Square lobe.	Posterior superior lobe.	Amygdala.	Biventral lobe.	Slender lobe.	Posterior inferior lobe.	
Healthy brain.....	18	21	13	9	6	5	16	70
Idiot woman	15	14	9	7	7	4	12	53
Idiot boy	19	14	11	5	7	4	12	53

Superficial and deep laminæ counted.

	Median portion.						Lateral parts.	
	Inferior vermiform process.		viz. Pyramid and uvula.		Nodule.		Amygdala.	Floccule.
Healthy brain.....	37	=	28	+	9		21	18
Idiot woman	25	=	17	+	8		18	8
Idiot boy	20	=	15	+	5		11	11

The preceding numbers confirm the interesting observations made by MALACARNE eighty years ago; and it is to be noted that when both the superficial and deep laminæ are counted, the difference between the healthy and idiots' cerebellum is greater, and approaches more nearly the proportions shown by MALACARNE'S numbers. The total number of superficial laminæ counted is the same in both idiots, and their distribution in the several lobes is equal, with the exception of the posterior superior lobe, which has two more laminæ in the idiot boy, and of the amygdala, which has two less. As compared with the healthy cerebellum, the greatest deficiency is in the square lobe; the

* *Op. cit.* p. 7. † P. 226.

‡ C. BONNET, Palingénésie Philosophique, part 2, chap. iv. vol. vii. of his collected works in 4to.

next in the two posterior lobes, and the least in the amygdala. A loss in the slender lobe is balanced by a gain in the biventral. In the median parts the whole of the laminæ are counted, and there is a more marked deficiency, as compared with the healthy condition, especially in the idiot boy. The floccule, however, presents an exception to this, being more complicated in him than in the woman. The laminæ of the cerebellum in both idiots are not only fewer in number, but are shorter and narrower than in the healthy cerebellum.

The corpus dentatum is represented merely by an elongated streak, differing in colour and consistence from the surrounding medullary substance, but presenting no indented outline, and no white mass in its interior.

In a fœtal brain the convolutions of whose *cerebrum* correspond with the idiot condition, the *cerebellum* is strikingly small, and would measure transversely not more than 1·5 inch, whereas in the idiot woman its transverse diameter is 3·15 inches, and in the idiot boy 3 inches. At the same period of development the laminæ visible on its under surface are only twenty in number, whilst in the same parts in the idiot woman there are thirty, and in the idiot boy twenty-eight. It is obvious, therefore, that in these idiots the cerebellum was not arrested in its development cotemporaneously with the cerebrum, but continued to increase greatly in size, and to undergo further changes of an evolutional character long after the cerebrum had ceased to be affected in the latter way. At the same time, from the small relative size of the cerebellum to the body in both idiots as compared with the healthy standard at corresponding ages, from the undoubted paucity, shortness, and narrowness of its laminæ, from the deficiency in its transverse commissural fibres, and from the ill-defined condition of its corpus dentatum, it had at length, as well as the cerebrum, succumbed from want of developmental energy. In other words, though more evolved than the idiots' cerebra, the cerebella are still imperfectly developed. The date of their final arrest of development is uncertain; it was probably retarded to a period several years after birth; it may be assumed to have corresponded with the condition attained by the healthy cerebellum at about the end of the second year of life.

Postscript. (August 6, 1863.)

Since the preceding paper was written I have had opportunities of inspecting the exterior of two idiots' brains in the Museum of St. Bartholomew's Hospital, and of examining, besides a wax model and two drawings of an idiot's brain, a most interesting series of models in wax of human fœtal brains, from the second month to the full term, in the Anatomical Museum at Guy's Hospital.

a. Of the two idiots' brains preserved at St. Bartholomew's, the smaller one (Catalogue, Series A. 123) is that mentioned by Professor Owen as weighing 13 oz. 2 dr. avoirdupois*. It was the brain of a male idiot, aged 22. The larger brain (Series A. 121) was that of a female idiot, also aged 22.

* See p. 527.

In both cerebra the fissures and convolutions are readily comparable with those of the idiots' brains of which an account is given in this paper, and so resemble them as to suggest a similarity in their mode of evolution. Like them, too, they present individual peculiarities, and a disproportional development of their component parts. In a few points they are more advanced than even the idiot woman's brain described above. An examination of them serves to confirm in every particular the explanations ventured upon in the preceding pages. The fissures present nothing remarkable; but the convolutions require some notice.

In the smaller or male brain (A. 123) the orbital convolutions are extremely simple, the triradiate sulcus being only a linear mark; the frontal are very simple also; both ascending parietals are preesnt on the right side, whilst on the left only the posterior one exists, but the intrusive convolution is seen largely developed, forming nearly a complete anterior ascending convolution; the parietal lobules are plain, short, and wide; the supramarginal and bent convolutions are simple, and there is no developed supramarginal lobule; the temporal are short and thick; the occipital are simple; the external connecting are very short.

In the larger or female brain (A. 121) the orbital convolutions are not quite so rudimentary; the frontal are large and few; the two ascending parietals are present on both sides, but are plain narrow bands; the parietal lobules are large, the left one being more defined than the right; the supramarginal and bent convolutions are large, and so well formed as to remind one of the condition of the parts seen in the Orang's brain, but there is no overhanging supramarginal lobule; the temporal are very large, and especially long; the occipital are broad, shallow, and coalesced; the external connecting are short and simple.

The ridge leading to the island of Reil is prominent and exposed in the female brain, but not so much so in the other. Both brains exhibit in special details a decided want of symmetry.

It is interesting to find that the variable conditions of the anterior ascending parietal convolution establish the correctness of the explanation given above of the ultimate conversion of the intrusive convolution into that gyrus. It must not escape notice that, in the smaller or male brain, this intrusive convolution is again present on the left side, as in our idiot woman and idiot boy. The two brains, moreover, differ, not only in the parietal convolutions, but also in the orbital region, in the shape of the temporal lobes, and in other respects to be presently mentioned. There is evidence of a defective and therefore disproportional size of the frontal lobe in both brains, in the fact that, taking the total length of the cerebrum as 100, the part in front of the fissures of Rolando, the part between them and the perpendicular fissures, and the part behind the latter, as seen from above, measure in the smaller or male brain 29, 42, and 29, and in the larger or female brain 40, 35, and 25. The frontal region, in front of the fissure of Rolando, as compared with the parts lying behind that fissure, is therefore in the former as 29 to 71, and in the latter as 40 to 60. In both idiots the frontal region

is therefore defective, but unequally so in the two. It is scarcely possible to doubt that dissection would establish the fact of a coincident want of development in the corpora striata of these brains.

In both these idiots also the cerebellum is, comparatively to the cerebrum, enormously developed. In the smaller brain, only one-third of it is covered by the cerebrum; in the larger brain, the two parts reach back to exactly the same level; in both, the laminæ appear to be few, only twenty being distinguishable on the under surface of one hemisphere in each.

The skull of the male idiot is thin, and appears to be much marked on its internal surface with the convolutions; that of the female idiot is thicker, and not so much marked in that way.

b. Assuming the accuracy of the dates assigned to the several models of fœtal brains in the Museum at Guy's, the effect would be to place the period at which the idiots' cerebra reached their ultimate stage of evolution, at from one month to even six weeks later than that given in the preceding paper. But it is notoriously difficult to determine the age of any given fœtus. An examination of the entire series shows that, if the dates be correct, the cerebrum does not, either in size, or in the condition of development of its convolutions, always attain exactly the same point at exactly the same period of intra-uterine life.

The condition of the convolutions in these models confirms the history above given of the conversion of the intrusive convolution into the anterior ascending parietal; for the change is traceable through a certain number of the fœtal brains. It also supports the views expressed as to the early arrest of the evolution of the corpora striata, and of the special effect of this on the development of the frontal lobes; for, with certain fluctuations, the corpora striata, where shown in the models, are always larger than the optic thalami; and the proportions of the frontal to the hinder regions of the cerebrum, as marked off by the fissures of ROLANDO, vary, from the first appearance of this fissure to the full term of development, between the ratios of 37 to 63 and 58 to 42. Lastly, these models show that idiot brains must grow a little after they have ceased to be further evolved; for the convolutions, and indeed the cerebral hemispheres themselves, are broader and larger in the idiot brains than in the models of brains of equally forward convolutional development. It is certainly true that, taking the four idiots' brains, viz. the two hereinbefore described and the two in the Museum at St. Bartholomew's, their respective sizes and their degrees of evolution correspond; but this does not disprove the occurrence of a growth in them after the cessation of development, an event shown to occur on other grounds.

The model and drawings of the idiot's brain at Guy's also confirm all our previous notions; and indeed it may be concluded that the idiotic condition is produced in all cases by conformable influences, affecting the cerebrum in slightly different degrees in different examples.

TABLE I.—Measurements of the parts of the Encephalon in the European, in the Bushwoman, in two idiots of European descent, and in the Chimpanzee, given in tenths of an English inch, with the ratios of those measurements to the European measurements regarded as units. The measurements of the Cerebrum and Cerebellum are taken by aid of the intracranial casts. In the case of the idiot boy, the cast of the skull being defective, only a few such measurements could be obtained; but in a second column are given the corresponding measurements taken from the preserved brain. The measurements of the Medulla oblongata, Corpus callosum, Corpus striatum, Optic thalamus, and Pons Varolii are taken from the preserved brains.

						Ratios of the several measurements.				
	European.	Bush-woman.	Idiot woman.	Idiot boy.	Chim-panzee.	European.	Bush-woman.	Idiot woman.	Idiot boy.	Chim-panzee.
Cerebrum.										
a. Extreme breadth	50	51	36	32 31	37	1	1·02	·72	·64	·74
b. Extreme length	65	66	41	39·5 34	44	1	1·01	·63	·61	·68
c. Extreme height	45	41	31	14*	29	1	·91	·68	.....	·65
d. Length of orbital surface	23	23	15	9	15	1	1	·65	.....	·65
e. Extreme depth of the frontal lobe	35	31·5	20·75	11*	20	1	·9	·59	.....	·57
e'. Extreme width of the frontal lobe	42	38	29	23 18	31	1	·9	·69	·54	·73
f. From the point of the middle lobe to the hinder end of the brain	48	49	35	28	34	1	1·02	·72	.....	·7
g. Cerebral radius, occipital	33	34	25	.....	23	1	1·03	·75	.....	·7
h. „ frontal	43	40	27	.....	29	1	·93	·62	.....	·67
i. „ parietal	39	35	25	.....	26	1	·9	·64	.....	·66
j. „ vertical	46	41	29	.....	29	1	·89	·63	.....	·63
k. Projection of the cerebrum beyond the cerebellum	6	5	−3·5	−3·5	5	1	·83	„	.....	·83
Cerebellum.										
l. Extreme breadth	36	41	31·5	30	30	1	1·1	·87	.....	·73
m. Extreme length	24	25	21	14	16	1	1·04	·87	.....	·66
n. Extreme depth	14	14	20·5	12	8	1	1	1·46	.....	·57
Medulla oblongata.										
o. Extreme breadth	7·1	8·5	7	6	.....	1	1·26	·98	·7	
Corpus callosum.										
p. Length	31	26	15·3	13·6	17	1	·84	·5	·44	·55
q. Average thickness	4·3	2	2·3	1·6	1·5	1	·46	·53	·37	·35
Corpus striatum.										
r. Length of visible part	9	9	3·5	2·5	8	1	1	·39	·28	·9
s. Width of visible part	5	3	1·5	1·5	3	1	·6	·3	·3	·6
Optic thalamus.										
t. Length of visible part	13	12	8	6·5	10	1	·92	·61	·5	·76
u. Width of visible part	5	4·5	3	4	4·5	1	·9	·6	·8	·9
Pons Varolii.										
v. From upper to lower border	10	9	6	4	6	1	·9	·6	·4	·6
w. Thickness	9	8	5	5	6·5	1	·9	·5	·5	·72

* These measurements are especially diminished by the extreme flattening of the preserved brain.

TABLE II.—Ratios between the Dimensions of different parts of the Encephalon, in the European, in the Bushwoman, in the two Idiots, and in the Chimpanzee.

	European.	Bushwoman.	Idiot woman.	Idiot boy.	Chimpanzee.
Cerebrum — *a* to *b*	1 to 1·3	1 to 1·29	1 to 1·14	1 to 1·23*	1 to 1·19
Cerebrum — *a* to *c*	1 to ·9	1 to ·82	1 to ·86	1 to ·45	1 to ·78
Cerebrum — *c* to *b*	1 to 1·44	1 to 1·61	1 to 1·32	1 to 2·43	1 to 1·52
Cerebrum — *d* to *f*	1 to 2·09	1 to 2·13	1 to 2·3	1 to 3·1	1 to 2·26
Cerebellum — *m* to *l*	1 to 1·5	1 to 1·64	1 to 1·5	1 to 2·14	1 to 1·87
Cerebellum — *m* to *n*	1 to ·58	1 to ·56	1 to ·97	1 to ·86	1 to ·5
Cerebellum — *n* to *l*	1 to 2·57	1 to 2·91	1 to 1·53	1 to 2·5	1 to 3·75
Cerebrum and Cerebellum — *m* to *b*	1 to 2·7	1 to 2·64	1 to 1·95	1 to 2·43	1 to 2·75
Cerebrum and Cerebellum — *n* to *c*	1 to 3·21	1 to 2·91	1 to 1·51	1 to 1·16	1 to 3·62
Cerebrum and Cerebellum — *l* to *a*	1 to 1·39	1 to 1·42	1 to 1·14	1 to 1·03	1 to 1·23
Medulla oblongata and Cerebrum — *o* to *a*	1 to 7	1 to 6	1 to 5·14	1 to 5·3*	1 to 5·7

EXPLANATION OF THE PLATES.

With the exception of figures 7, 8, and 20, which are taken from GRATIOLET, and of figure 23, which is merely a tracing from nature, the illustrations to this paper have been lithographed from Mr. HERBERT WATKINS'S photographs, aided by reference to the objects themselves. All the figures agree in size with the preserved brains, excepting figure 9, which, as well as figures 7 and 8, taken from GRATIOLET, is reduced to three-fourths of the proper linear dimensions. The references to the cerebral convolutions are alike in all the Plates; and a common explanation of these is appended to the general description. References to a few other details are given under each Plate.

PLATE XVII.

Fig. 1. Upper surface of the preserved brain of the Bushwoman.

Fig. 2. Base of the same brain: *o*, olfactory nerve; *a*, corpora albicantia.

PLATE XVIII.

Fig. 3. Left side of the same brain.

Fig. 4. Vertical median section of the same brain, showing the inner surface of the left hemisphere of the cerebrum, with the cut surfaces of the cerebral peduncle, the corpus callosum, the cerebellum, pons Varolii (*p*), medulla oblongata, and other parts: *a*, anterior commissure; *q*, corpora quadrigemina.

* These ratios are calculated from measurements taken on the intracranial cast; the rest of the ratios, in the case of the idiot boy, are taken from measurements of the preserved brain.

PLATE XIX.

Fig. 5. The left hemisphere of the same brain, detached from its peduncle, showing the under surface with the inner surface foreshortened.

Fig. 6. Horizontal dissection of the same hemisphere, showing the left lateral ventricle laid open: *a*, body of the ventricle and optic thalamus; *b*, anterior cornu; *c*, posterior cornu; *d*, commencement of middle cornu; *e*, hippocampus major; *f*, hippocampus minor; *g*, eminentia collateralis; *h*, corpus striatum.

PLATE XX.

Fig. 7. Convolutions of the upper surface of a European brain, shown in outline (from GRATIOLET).

Fig. 8. Corresponding view of the brain of the Hottentot Venus (from GRATIOLET).

Fig. 9. Corresponding view of the brain of the Bushwoman. To suit the size of the page, these comparative views of the upper cerebral convolutions in the European, the Hottentot Venus, and the Bushwoman, are reduced to three-fourths of their proper linear dimensions. But it must be observed that the originals of figures 7 and 8 are of the full size of the recent or restored brains; whilst the original figure of the Bushwoman's brain (figure 1 of this memoir) is of the size of that organ after it had become shrunk from maceration in spirit. Judging from the measurements of the interior of the Bushwoman's skull, this reduced figure of her brain should be about $\frac{1}{10}$th of an inch shorter than that of the brain of the Hottentot Venus.

PLATE XXI.

Fig. 10. Upper surface of the preserved brain of a female idiot, aged 42 years.

Fig. 11. Under surface, or base, of the same brain: *o*, olfactory sulcus.

Fig. 12. Left side of the same brain.

Fig. 13. Vertical median section of the same brain, showing the inner surface of the left hemisphere of the cerebrum, with the cut surfaces of the corpus callosum (*c*), cerebral peduncle, cerebellum, pons Varolii (*p*), medulla oblongata, and other parts.

PLATE XXII.

Fig. 14. Upper surface of the preserved brain of a male idiot, aged 12 years.

Fig. 15. Under surface, or base, of the same brain: *o*, olfactory sulcus.

Fig. 16. Left side of the same brain.

Fig. 17. Right hemisphere of the same brain, detached from its peduncle, showing the internal and under surfaces. The frontal region is turned to the left hand of the observer. The section of the corpus callosum (*c*) is also shown.

PLATE XXIII.

Fig. 18. Convolutions of the upper surface of the brain of the female idiot.

Fig. 19. Convolutions of the upper surface of the brain of the male idiot.

N.B. In both of these figures a few additional markings, not represented in figures 10 and 14, have been put in from careful examinations of the brains themselves.

Fig. 20. Convolutions of the upper surface of the brain of an Orang-outang (after GRATIOLET'S restored figure).

Fig. 21. Outer surface of the left hemisphere of the cerebrum of a human fœtus, at probably between the fourth and the fifth month.

Fig. 22. Median vertical section of the same fœtal cerebrum, showing the inner surface of the same hemisphere.

Fig. 23. Vertical median section of the medulla oblongata and pons Varolii of a preserved European brain, to show the area (*p*) occupied by the divided transverse fibres of the pons.

Fig. 24. The same parts from the brain of the Bushwoman.

Fig. 25. The same parts from the brain of the female idiot.

Fig. 26. The same parts from the brain of the male idiot.

References to the Lobes, Fissures, and Convolutions.

The names here given to the fissures and convolutions are, for the most part, founded on M. GRATIOLET'S nomenclature.

Ce. The cerebellum.

Lobes.

C. Median lobe, or Island of REIL.
F. Frontal.
P. Parietal.
O. Occipital.
T. Temporal.

Fissures.

c–c. Antero-parietal (HUXLEY).
d–d. ROLANDO'S.
e–e. Sylvian.
f–f. Parallel.
g–g. Inferior temporal.
h, h. External perpendicular.
i–i. Fronto-parietal (*calloso-marginal*, HUXLEY).
k–k. Internal perpendicular.

l–l, *m*. Hippocampal.
l–l. Outer or calcarine portion (HUXLEY).
m. Inner or dentate portion (HUXLEY).
n–n. Inferior middle temporal or great collateral.

Convolutions.

1′. Supraorbital.
1″. Posterior orbital.
1″′. Internal orbital.
1⁗. External orbital.
1–1. Lower frontal.
2–2′. Middle frontal.
3–3′. Upper frontal.
4–4′. Anterior ascending parietal.
5–5. Posterior ascending parietal.
5′–5′. Lobule of the posterior ascending parietal.
4″–5″. Supramarginal.
A–A. Lobule of the supramarginal.
6–6. Bent, or angular.
7–7. Upper external temporal, or inframarginal.
8–8. Middle external temporal.
9–9. Lower external temporal, which is the same as the lower internal temporal.
10–10. Upper occipital.
11–11. Middle occipital.
12–12. Lower occipital.
α–α. First or upper external connecting.
β–β. Second external connecting.
γ–γ. Third external connecting.
δ–δ. Fourth or lowest external connecting.
17–17. Great marginal.
18–18. Callosal.
18′–18′. Quadrilateral lobule.
19–19. Middle internal temporal or uncinate.
19′. Unciform lobule or crochet.
20. Dentate (not shown in any figure).
ε. Place of lower internal connecting, here (as usual) concealed.
ζ. Place of upper internal connecting (present only in Quadrumana).
25–25. Occipital lobule.
26. Calcarine (FLOWER). Shown only in figure 17.

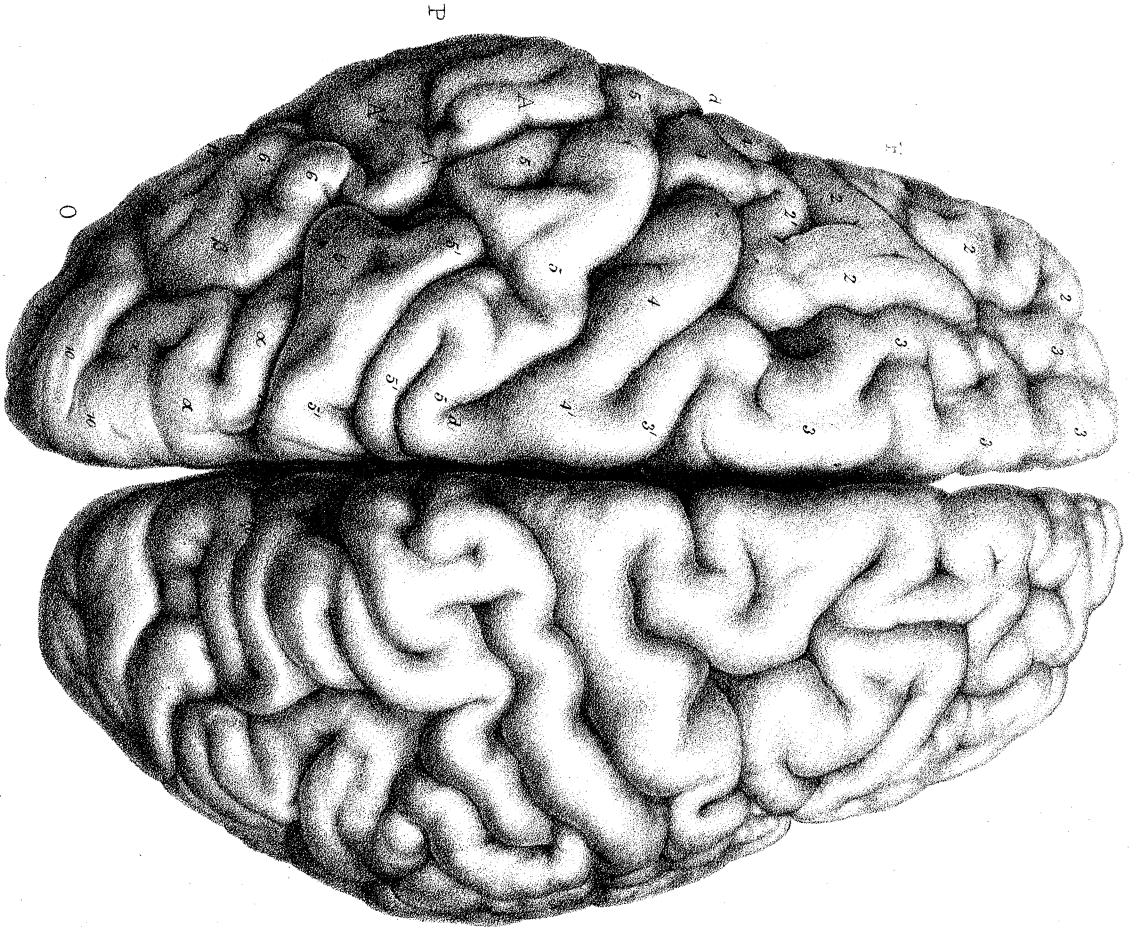


Fig. 1.

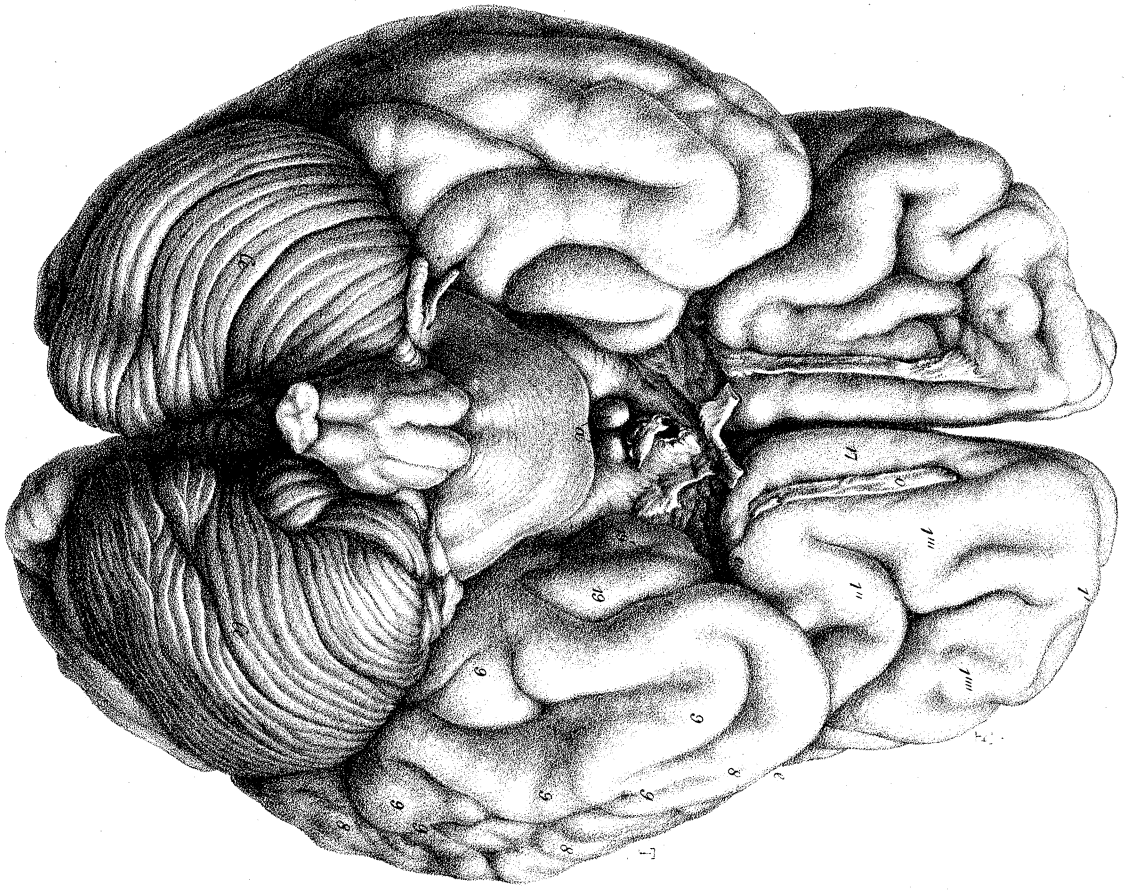


Fig. 2.

H. Watkins, phot.

Edwin M. Williams, lith.

Fig. 3.

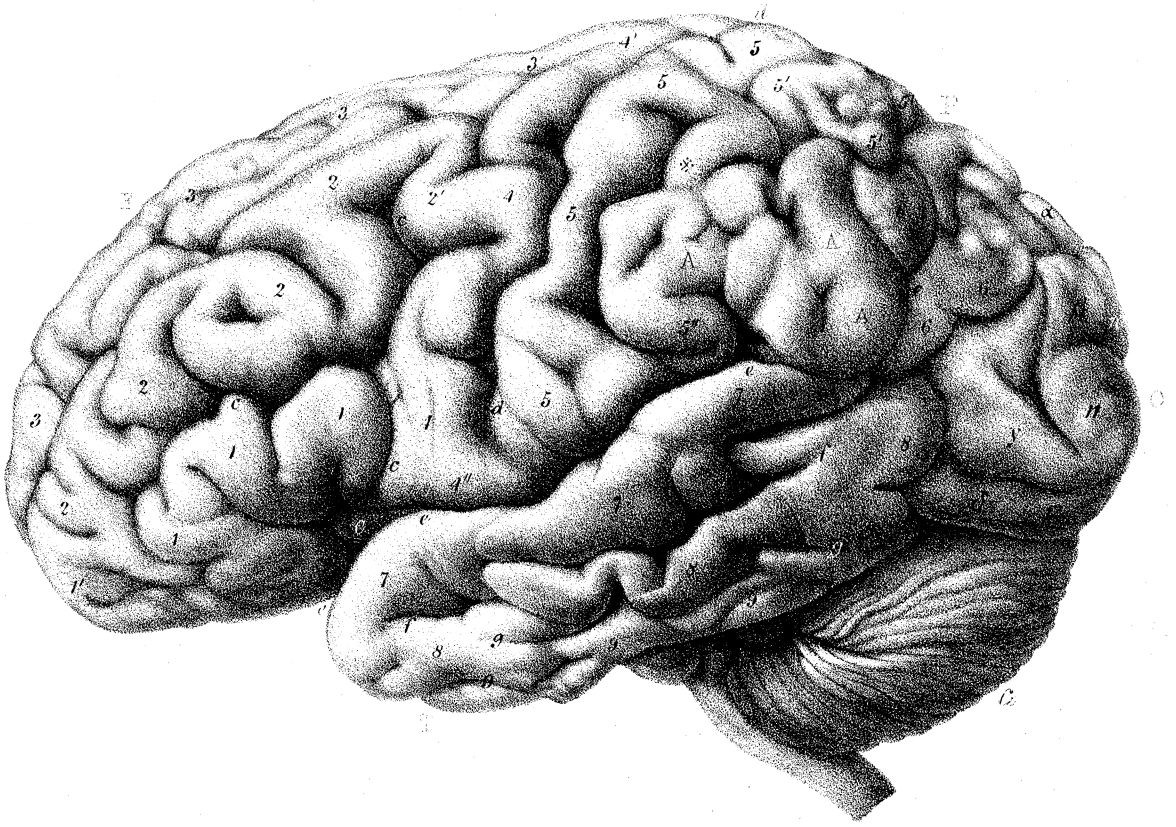
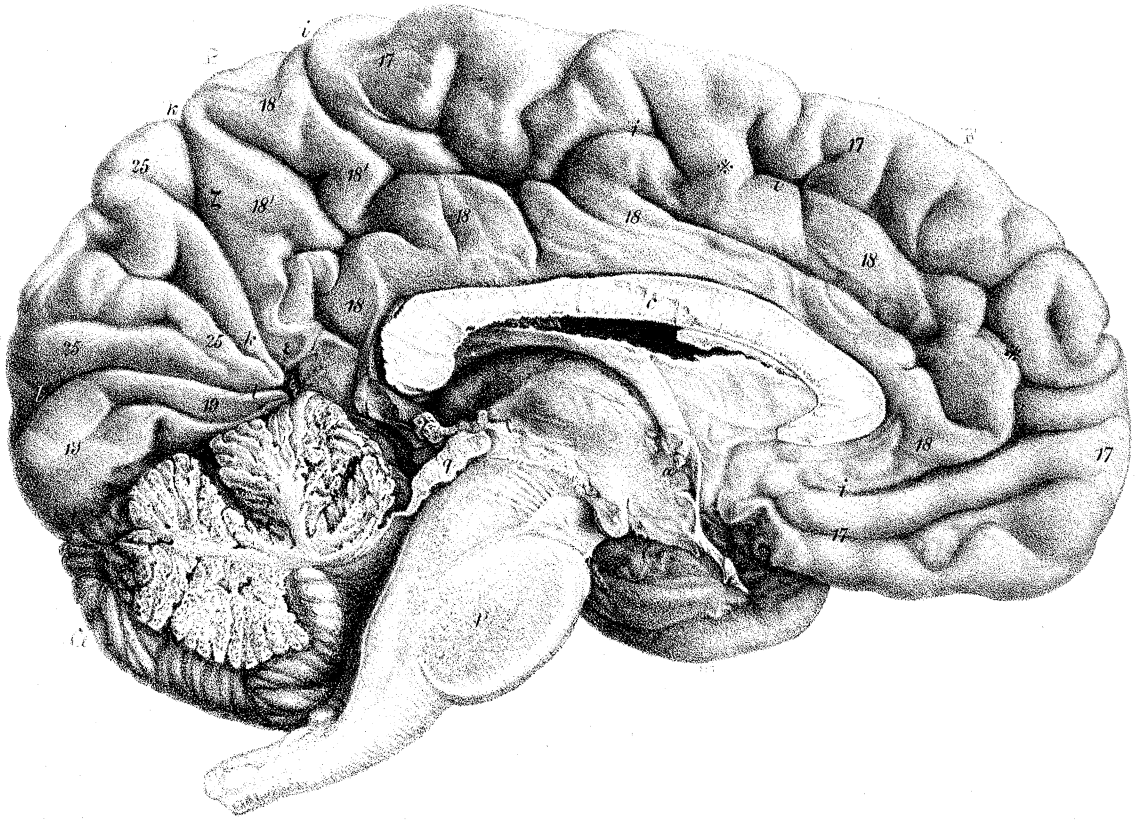


Fig. 4.



H. Watkins, phot.

Edwin M. Williams, lith.

Fig. 5.

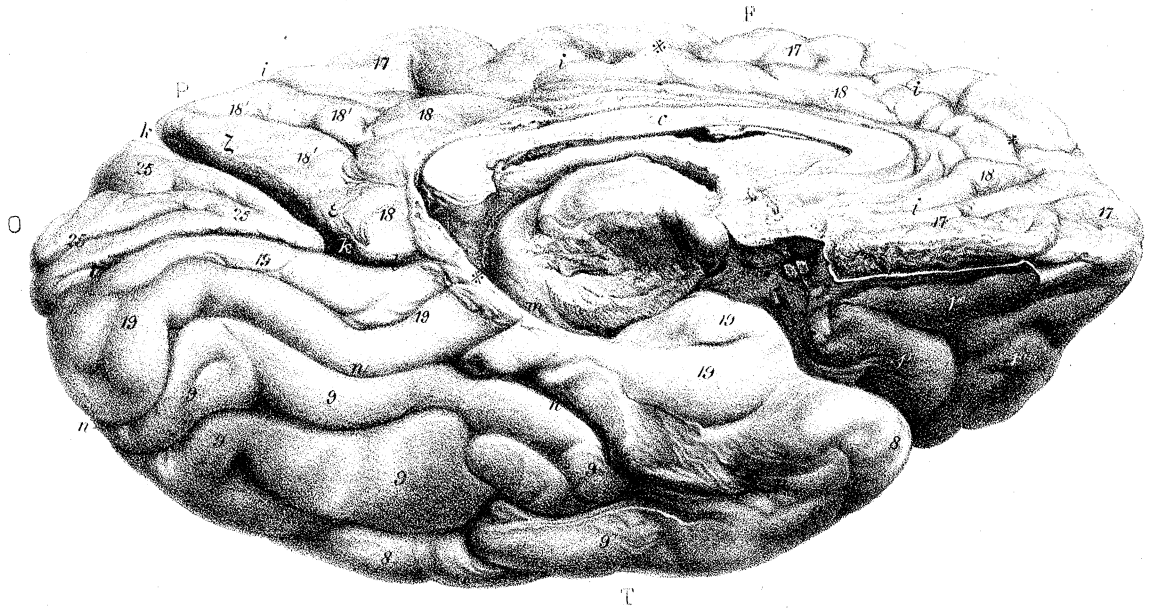
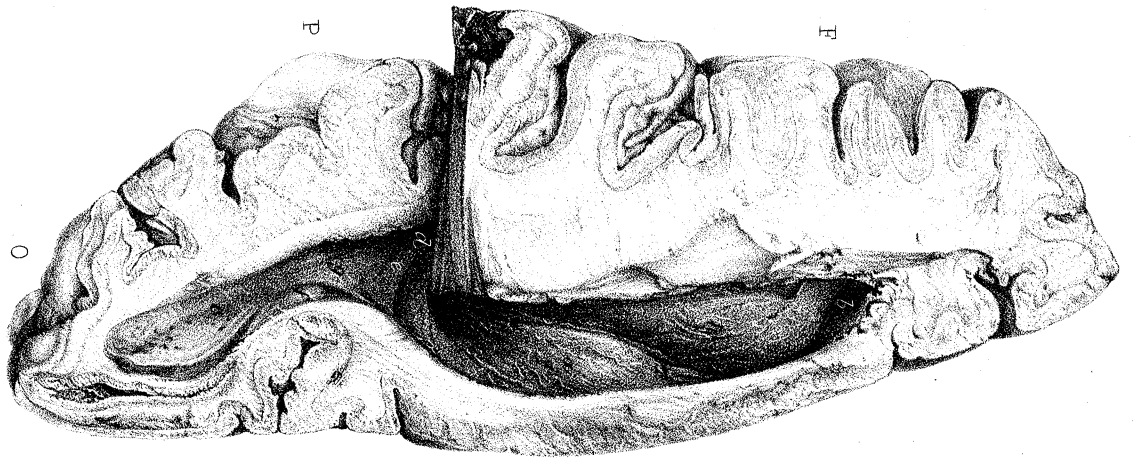


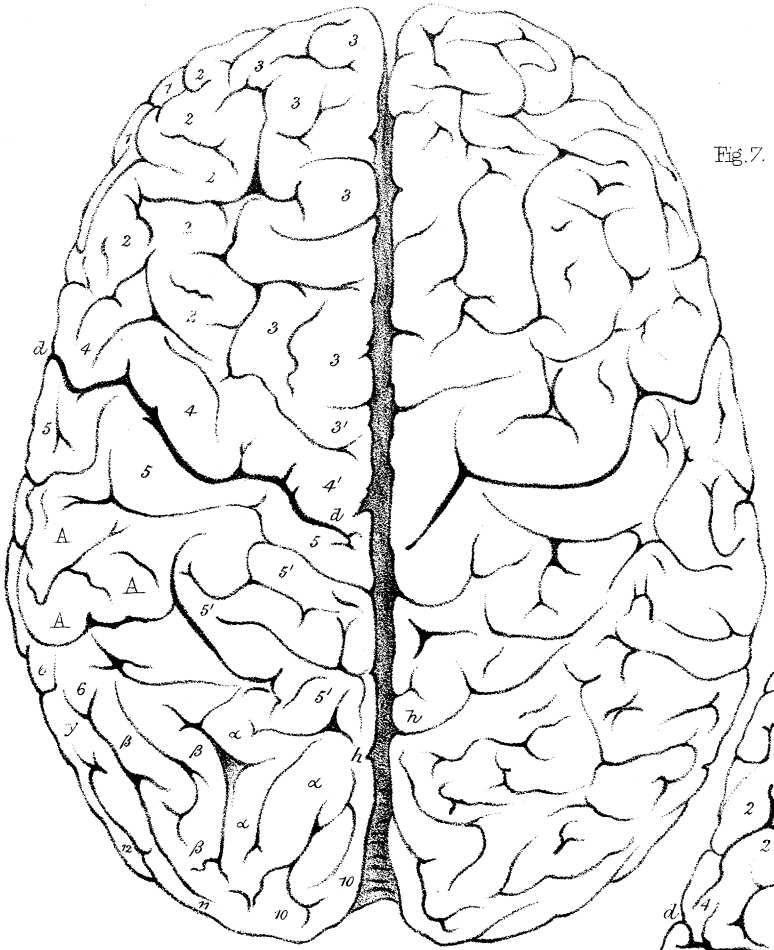
Fig. 6.



H. Watkins phot.

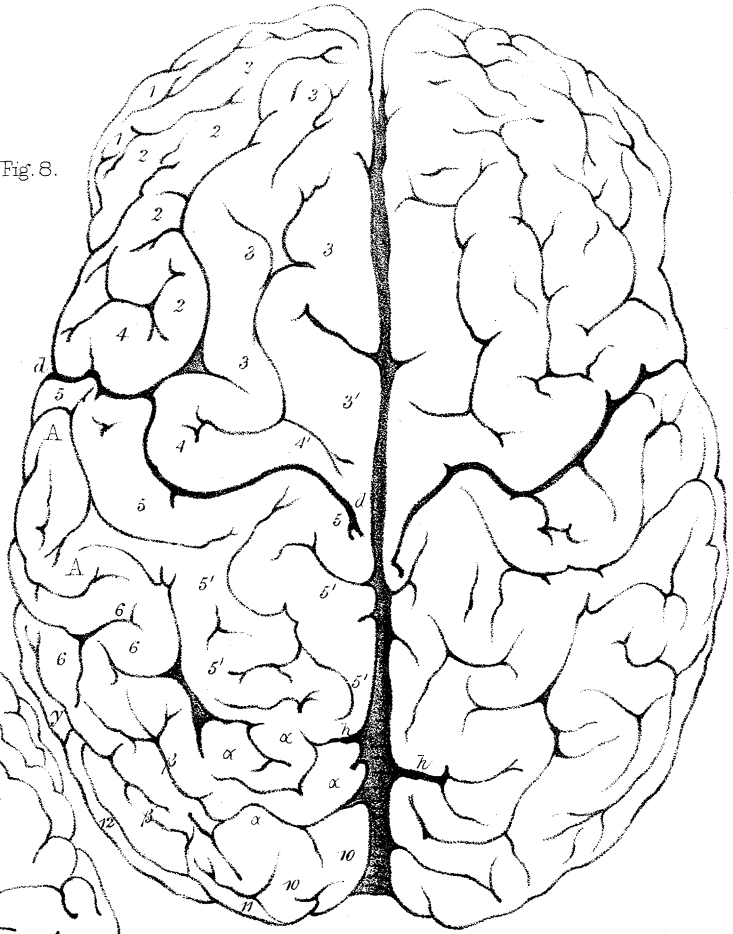
Edwin M. Williams, lith.

Fig. 7.



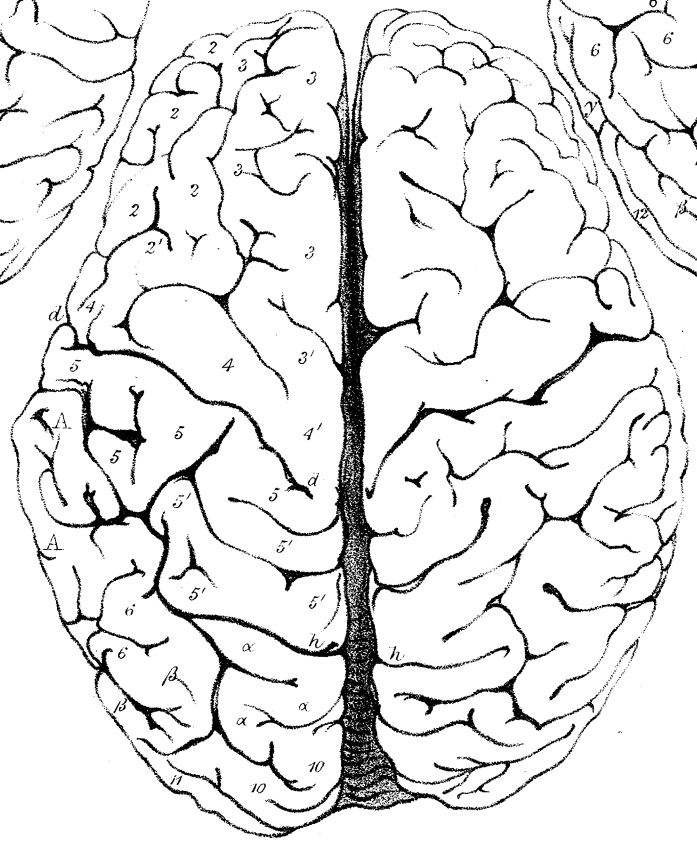
European.
(recent.)

Fig. 8.



Hottentot Venus.
(restored.)

Fig. 9.



Bushwoman.
(preserved.)

Edwin M. Williams, lith.

H. Watkins, phot.

Fig. 10.

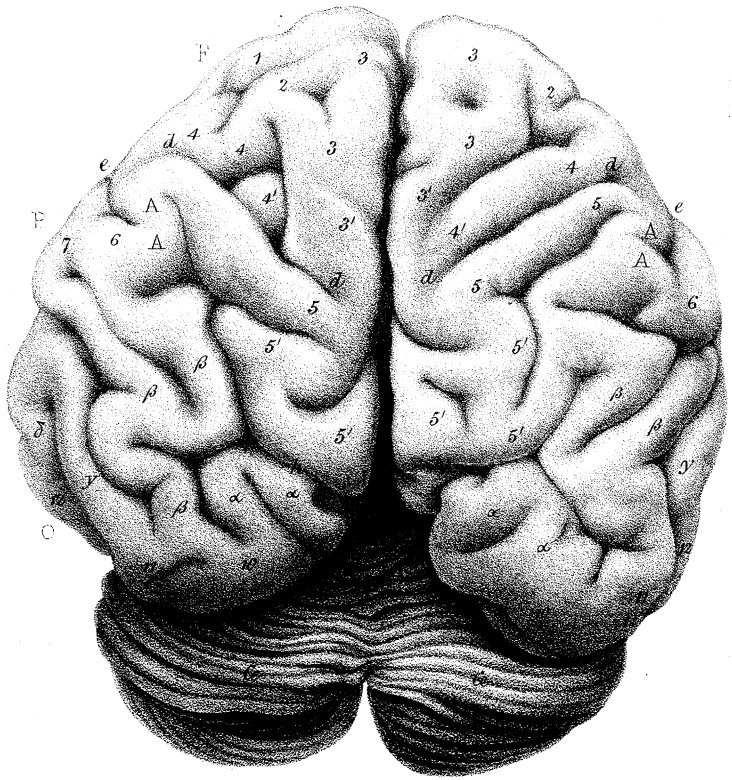


Fig. 11.

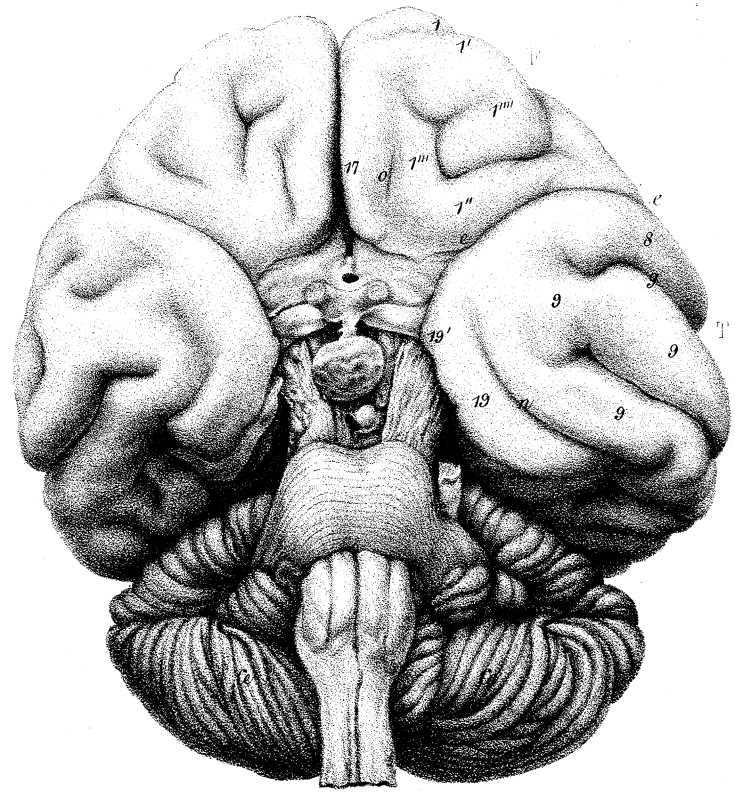


Fig. 12.

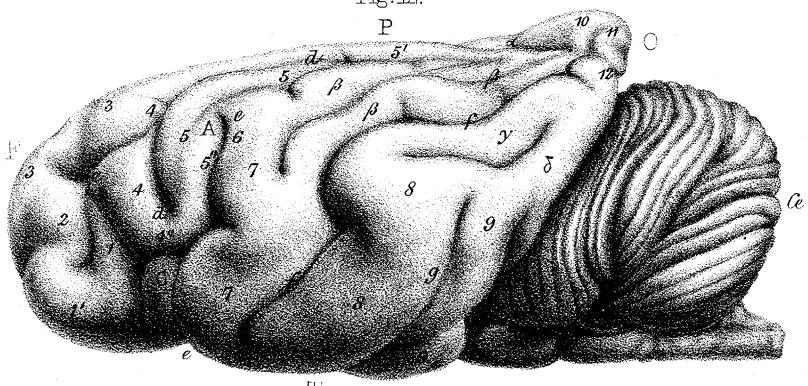
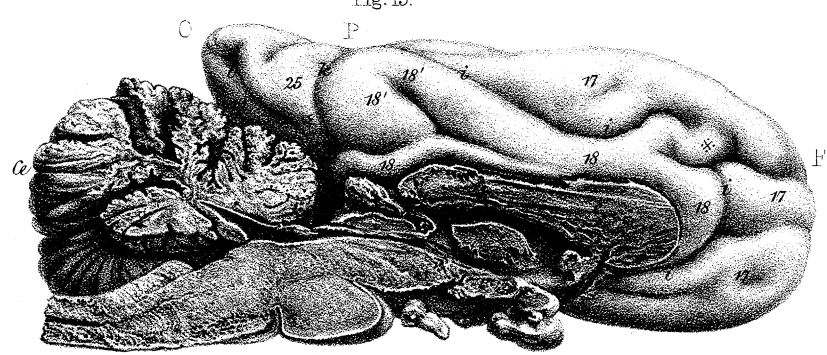


Fig. 13.



Edwin M. Wilkins, lith.

H. Watkins, phot.

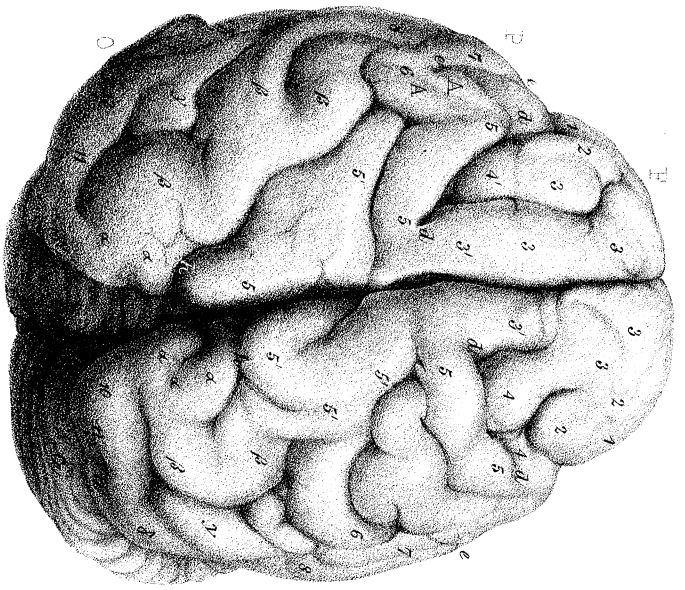


Fig. 14.

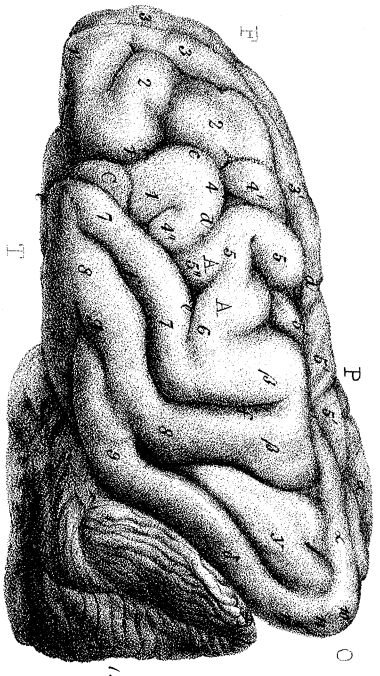


Fig. 16.

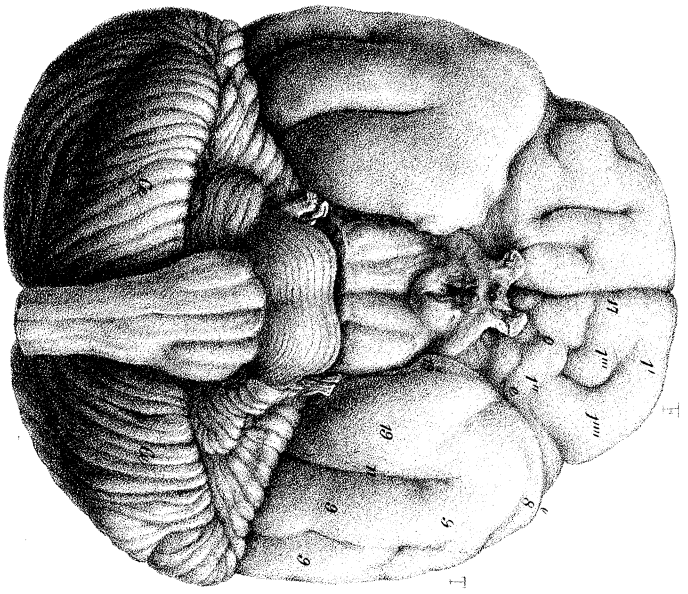


Fig. 15.

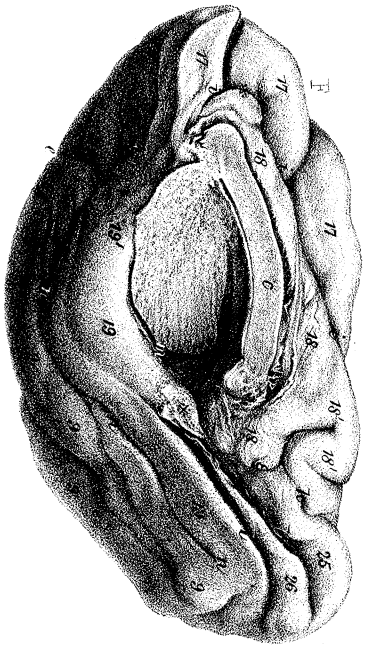


Fig. 17.

Fig. 18.

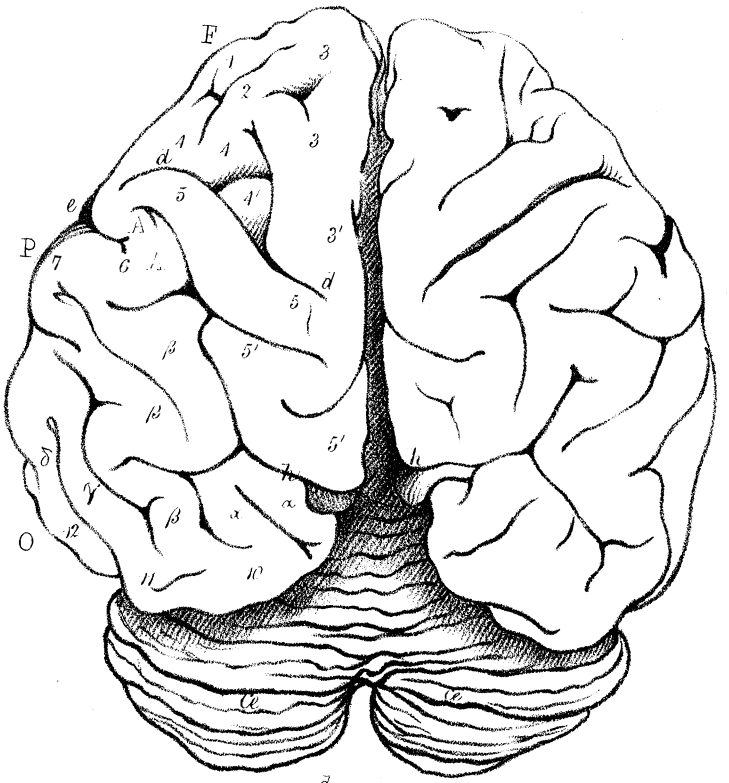


Fig. 19.

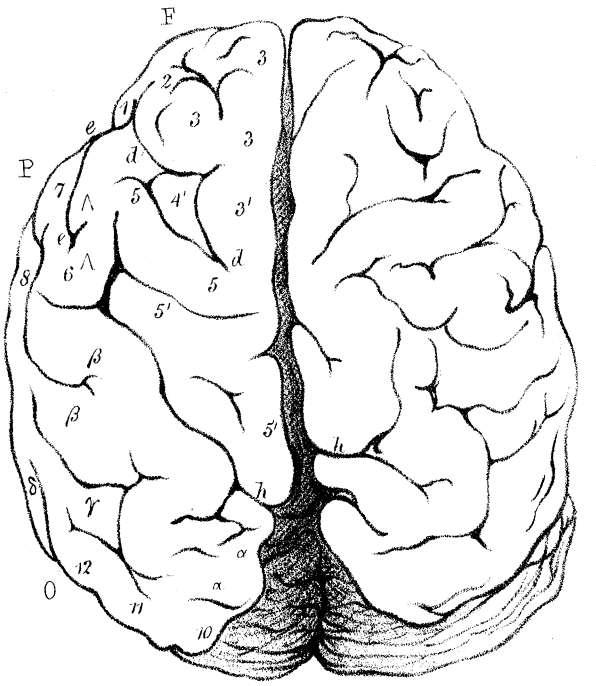


Fig. 21.

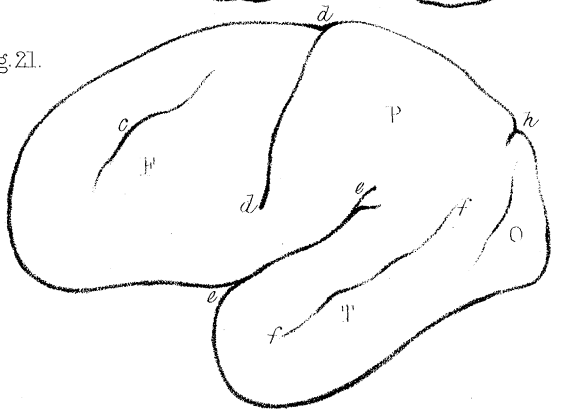


Fig. 20.

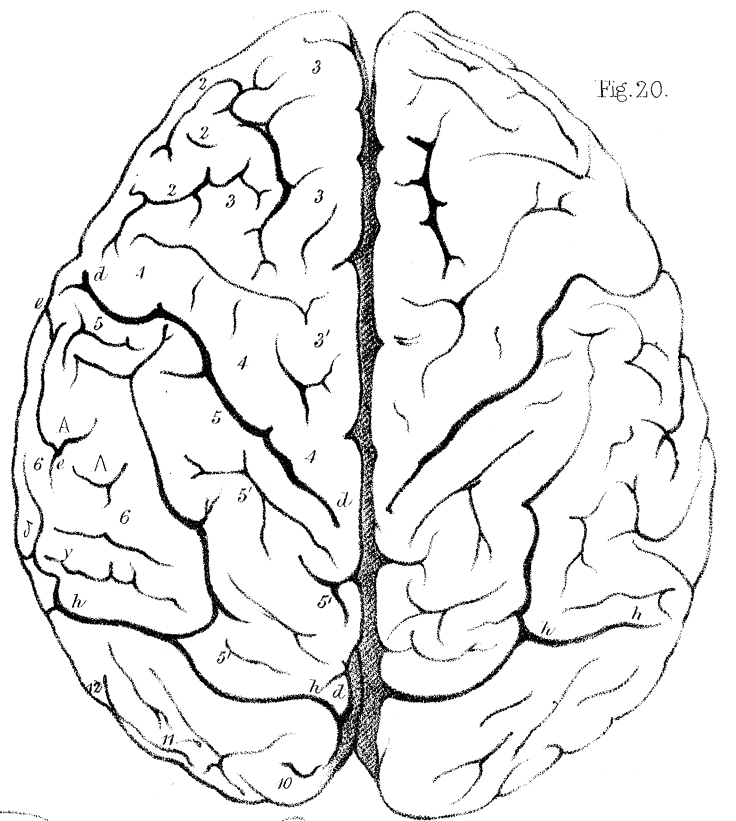
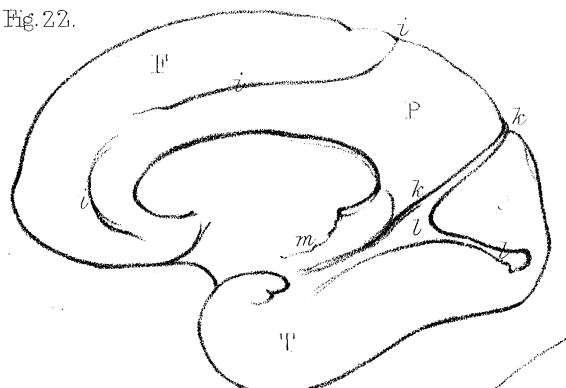


Fig. 22.



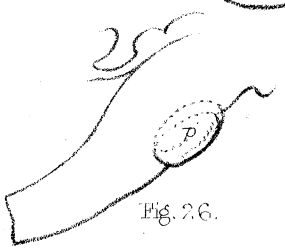


Fig. 26.

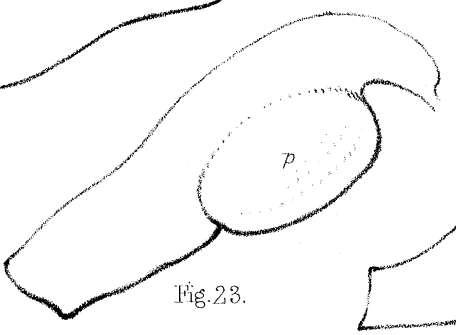


Fig. 23.

Fig. 24.

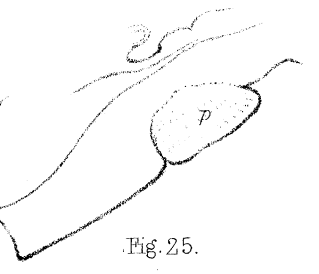


Fig. 25.