**On the minute structure of the brain in the chimpanzee, and of the human idiot, compared with that of the perfect brain of man : with some reflections on the cerebral functions / by James Macartney.**

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Macartney, James, 1770-1843.
Royal College of Surgeons of England

**Publication/Creation**

Dublin : Printed by Graisberry and Gill, 1842.

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ON THE

# MINUTE STRUCTURE OF THE BRAIN

IN THE

# CHIMPANZEE, AND OF THE HUMAN IDIOT,

COMPARED WITH THAT OF

## THE PERFECT BRAIN OF MAN;

WITH

## SOME REFLECTIONS ON THE CEREBRAL FUNCTIONS.

BY

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ETC. ETC.

PRINTED IN THE TRANSACTIONS OF THE ROYAL IRISH ACADEMY, VOL. XIX. PART II.

ROYAL COLLEGE OF SURGEONS OF ENGLAND

DUBLIN:

PRINTED BY GRAISBERRY AND GILL,

PRINTERS TO THE ROYAL IRISH ACADEMY.

MDCCCXLII.

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ON THE

# MINUTE STRUCTURE OF THE BRAIN

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&c. &c.

MANY years ago I discovered, with only a common pocket lens, a reticulation of fine white fibres, immediately under the surface of the cerebrum, in birds. This first led me to believe that the medullary fibres, as they are called, extended farther, and were more subdivided than had been hitherto supposed. I have since been able to demonstrate to medical students, and to several teachers of anatomy, the existence of those filaments in every part of the brain, by simply moistening the substance of the organ, during the dissection, with a solution of alum in water, which has the effect of slightly coagulating, and rendering the finer filaments visible, which, in their natural condition, are transparent. By this means, I have shown that the filaments (which I prefer to call *sentient*, instead of *white* or *medullary*) everywhere assumed a plexiform arrangement, and that the most delicate and intricate plexusus were to be found inclosed in the grey or coloured substances of the brain. This fact proves the analogy between the coloured substances of the brain, and the ganglia of the nervous system, in which there is a close reticulation of nervous fibres. I have long been in the habit of considering the magnitude and form of the entire brain, and of its several parts, as being merely subservient to the number, extent, and connexions of the various plexuses, in which, and especially in those occupying the coloured substances, I believe the sensorial powers of the brain to reside.

A Chimpanzee (the pigmy of Tyson) having some months ago died in Dublin, and the dissection of it having been entrusted to Mr. Wilde, I proposed to him that I should undertake the examination of the animal's brain, in my own

manner. Tyson and others had described the bulk, shape, and external appearance of the different parts of this creature's brain, but the intimate structure had never been examined by any anatomist.

I shall now lay before the Academy an account of what I observed in the brain of the Chimpanzee, and likewise in those of two idiots; by which it will appear that the brain in the latter possesses a still lower degree of organization, than in the former animal.

### DISSECTION OF THE BRAIN IN THE CHIMPANZEE (SIMIA TROGLODYTES.—LIN.)

The *external form* bore so great a resemblance to the human brain, that, excepting the difference in size, the one might be mistaken for the other. The *convolutions* were as decidedly marked, and the proportions of the cerebellum to the cerebrum were exactly as in man. On the under surface of the brain I observed that the two white pea-shaped bodies, called *corpora candicantia*, were very indistinct; and they did not appear to be, as in man, the continuation of the anterior crura of the *fornix*. The *pons*, which unites the lateral lobes of the cerebellum, was, perhaps, rather flatter than in the human subject, and the fifth pair of nerves entered it, and passed for a little way distinctly, which is so remarkable in the sheep. The *pyramids* did not decussate to any extent; only two superficial bundles of fibres crossed. The *corpora olivaria* did not project distinctly, and the band which surrounds them was not observed. The structure internally of these bodies consisted of white filaments included in grey substance. The branches of the *arbor vitæ* were, perhaps, not so deep, but quite as numerous as in us. The white filaments composing the trunk were not so fine, nor so strictly interwoven, as in man, and therefore they were more easily distinguished. The *corpus fimbriatum* was a long shape, and appeared to be composed chiefly of grey substance, and wanted the denticulated edge. The part called *locus niger*, in the crura of the cerebrum, was a small, greenish-grey mass, of an irregular figure, and less than a pea, instead of the crescentic form, as in man; and it did not mingle with the white fibres of the crus. The *pineal* gland was large. It was removed in making a cast of the ventricles, and lost; it was not, therefore, ascertained whether it had any calcareous matter in it or not. The parts in the lateral ventricles corresponded very nearly with the same in man. The *soft com-*

*missure* was particularly strong, and held distinct white filaments. The *linea semilunaris* was faintly marked. The two anterior of the *tubercula quadrigemina*, called *nates*, were the smaller. The *fourth ventricle* was much prolonged into the lateral lobes of the cerebellum. The *grey substance* on the floor of the ventricle was not raised into the appearance of two ganglia, and there were no *white striæ*. The sentient or white filaments formed looser or less complicated plexuses, wherever they were examined, than in man, and I could not discover any of the delicate *arborescent filaments* in the base of the *corpora striata*.

### DISSECTION OF A FEMALE IDIOT, WITH EXTRAORDINARY BRAIN.

The whole mass of the brain was small, but the front part did not recede. The *convolutions* were rather small, but sufficiently deep for the size of the brain. The *lobes* of the *cerebellum* were not the one-third of the usual size. The *gyri* were scarcely distinguishable, and the divisions were few and shallow. The *arbor vitæ* had but two principal branches, and the sub-divisions of these were few. The anterior part of the lobes was supplied by two clusters of membranous cells, filled with red jelly or albuminous fluid, such as we find substituted for the brain in acephalous fœtuses. The *corpus fimbriatum* was indistinct, wanted the denticulated margin, and the proper structure interiorly, and was not half the proper size. The *pons* was exceedingly small, and its internal structure obscure. The *pyramids* were parallel cylindric forms, and did not appear to decussate. The *corpora olivaria* had little prominence, and the coloured substance was deficient. The *locus niger* was imperfectly formed, and not of a dark colour. The *corpora striata* were very small, as also the white filaments contained in them. The *pineal gland* was rather of a large size, and contained a cluster of round soft bodies, in place of the calcareous granules. In fine, the character of the whole brain was imperfection of intimate structure. The plexuses were not intricate, and the grey substances pale, and not in sufficient quantity. This person had been a patient in the Whitworth Hospital. The account I received of the state of her intellect from the house pupil was, that she was foolish, and that he could never get a rational answer from her. She was extremely ugly, with projecting jaws and teeth, and an idiotic countenance. She was an unmarried woman, but not a virgin, notwithstanding the great deficiency in her organ of amativeness.

DISSECTION OF THE BRAIN OF A MALE IDIOT.

The *cerebrum* was small, and the anterior lobes especially so. The *cerebellum* projected beyond the posterior lobes of the hemispheres. The *convolutions* of the cerebrum were small, particularly those of the anterior lobes on the *left side*,—they were so imperfectly developed, and so closely connected to each other, that they had more the appearance of a tuberculated than of a convoluted surface. The *olfactory nerves* were small, and very deficient in grey substance, indeed all the coloured parts of the brain were rather pale. The *pyramids* could scarcely be distinguished, being extremely small, and confounded in the projection of the corpora olivaria; they did not appear to decussate; the one on the left side was particularly small. The left hemisphere of the brain was smaller than the one on the right side. The *tubercula quadrigemina* were of an equal size, and a grey colour on their surface. The *pineal gland* was large, semi-transparent, and contained very little of the gritty matter. On the surface of the *left* crus of the cerebrum there was a green tinge observed, which, on being cut into, proved to be the *locus niger* in a disorganized and nearly dissolved state. There were no *white striæ* in the fourth ventricle. The *plexus* of white filaments at the roots of the *olfactory nerves* was very plain on the *right* side, but very imperfect on the *left*. The *brain* was tolerably firm. The *spinal marrow* was hard, and the *cerebellum* was soft. The structure, as well as form of the parts in this brain, was imperfect throughout, but most remarkably so on the left side; the want of agreement between the two sides would necessarily impair the functions of the brain.

The first deviations from the perfect brain of man appear to be with respect to the following parts:—The *locus niger, the corpus fimbriatum, the white striæ in the floor of the fourth ventricle, the decussation of the pyramids, the distinction of the anterior crura of the fornix, the corpora olivaria, the degree of intermixture of the sentient or white filaments in the arbor vitæ, the corpora candicantia, and the existence of calcareous granules in the pineal gland.*

It is remarkable, that many of these parts are not found in the first stages of fœtal life, and some of them not until after birth. The pineal gland, according to Meckel, is not perfect until the seventh year of infancy. The same parts, also, first decline, and ultimately disappear in animals, according to their scale of organization; and further, it is chiefly with respect to these parts, that varieties

of structure are observed in the brains of different rational human beings. I have found many deviations from the ordinary structure in subjects, without being able to ascertain what peculiarities of character belonged to them when alive; but in one instance, of a deaf and dumb person, the *white striæ* of the fourth ventricle (with which the auditory nerves communicate) were imperfectly formed, were not subdivided, and did not unite with each other. If, therefore, we can ever arive at correct notions of the functions of the brain, it must be by careful dissections of the interior parts of the cerebral organ, and by ascertaining the correspondence between the minute structure, and the endowments and dispositions of the different individuals; taking into account, at the same time, the influence of the various organs of the body, instead of ascribing to certain parts on the surface of the brain, distinct and often opposing faculties, as Gall and Spurzheim have done.

It seems to be particularly absurd to suppose that the cerebellum, a part evidently as highly organized, and of as much importance as the cerebrum itself, should be designed to produce merely the sexual instinct. In animals that have the lateral lobes of the cerebellum very small, or who want them altogether, this instinct is stronger than in man. In those instances which are known of the absence of a part, or one lobe, or the whole cerebellum, no want of the venereal appetite existed; and a case is related of a person in whom the sexual desire was so ungovernable, that mechanic restraint became necessary; and it was found, after death, that both lobes of the cerebellum were wanting in this person. In animals that propagate only at particular seasons of the year, the testicles and ovaries are singularly developed at those periods, and afterwards decline, while at the same time no change takes place in the cerebellum. The abolition of the sexual instinct, by the extirpation of the testes, or of the ovaries, puts it beyond all doubt that this impulse does not originate in any part of the brain.

It would appear that all instincts depend upon the condition and state of feeling in those organs with the functions of which they are immediately connected; thus, the maternal instinct (at least in mammiferous animals) is in a great measure the result of the tension of the mammary glands. As soon as this is removed, by the absorbents carrying off the milk, quadrupeds lose all care and anxiety about their young. The cerebral organ would, perhaps, of all others, be the most unfit for the generation of instincts. The brain is destined to direct or control instinc-

tive feelings, and therefore it cannot create them. If a person attempt to command any instinctive impulse to be felt, he will find it as impossible to do, as to rise from his chair, merely by willing it, without the aid of the muscles.

I have ascertained and demonstrated, by repeated dissections, that all the plexuses of the brain are continuous with each other; that no part of the nervous system is isolated; and, consequently, the different parts must exercise a mutual influence on each other. I have proved that the spinal nerves, as well as those of the brain, are not inserted in the same way as the roots of plants penetrate the earth, which has been heretofore believed, but that they are united with the parts from which they are supposed to arise, and that the spinal nerves form a chain of communication with each other, after they enter the spinal marrow. It is in consequence of the integrity of the whole nervous system, that the various sympathies, both natural and morbid, exist between the different organs of the body. If the continuity of the sentient or nervous filaments were to be intercepted at any one place, their functions would be arrested at that point, in the same manner as the division of a nerve destroys sensation and voluntary motion in the parts to which the nerve is sent.

Some anatomists, it is true, have supposed that the various reticulations of the nerves, and the intermixture of the filaments of the brain, were merely to bring them into contact, and that there was no incorporation of the sentient substances. This opinion is consequent upon another, as ill supported by facts; namely, that there is a subtile or nervous fluid, which carries impressions made on the nerves to the brain, and thus causes sensation; and that the same fluid, proceeding from the brain to the muscles, produces voluntary motions. It has never been, however, attempted to explain how this imaginary fluid could become the instrument of sensation or volition, more than the sentient substance itself. For my part, I am satisfied with the knowledge of the undoubted fact, that the peculiar matter which exists in the nerves, and the white filaments of the brain, is endowed with the *power* of *feeling*—a power perfectly distinct from every other in nature; and I think it is equally obvious that the various modifications of sensorial function we observe are the result, and require for their production, the multitude of subdivisions and re-unions that take place in the sentient filaments of the brain and nerves. Voluntary motion appears to me to be the natural consequence of the connexion between the central part of the nervous system, and the muscles which move in obedience to the will or desire of the individual.

PLATE 1

Fig 1

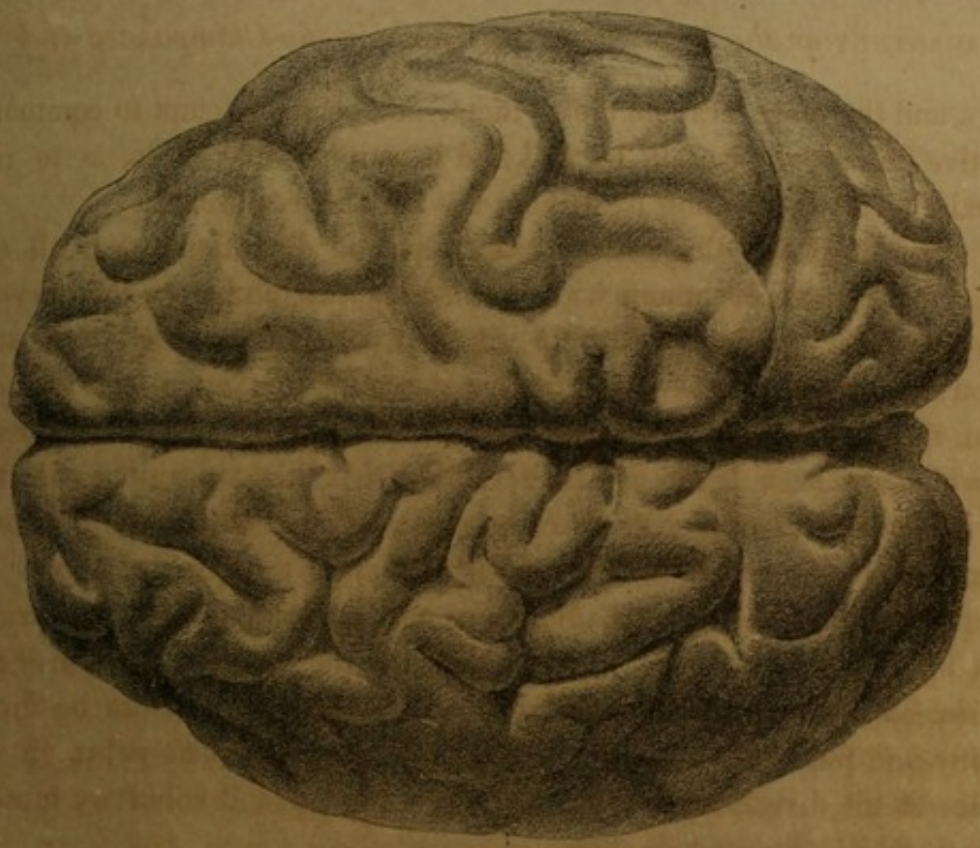

Fig 2

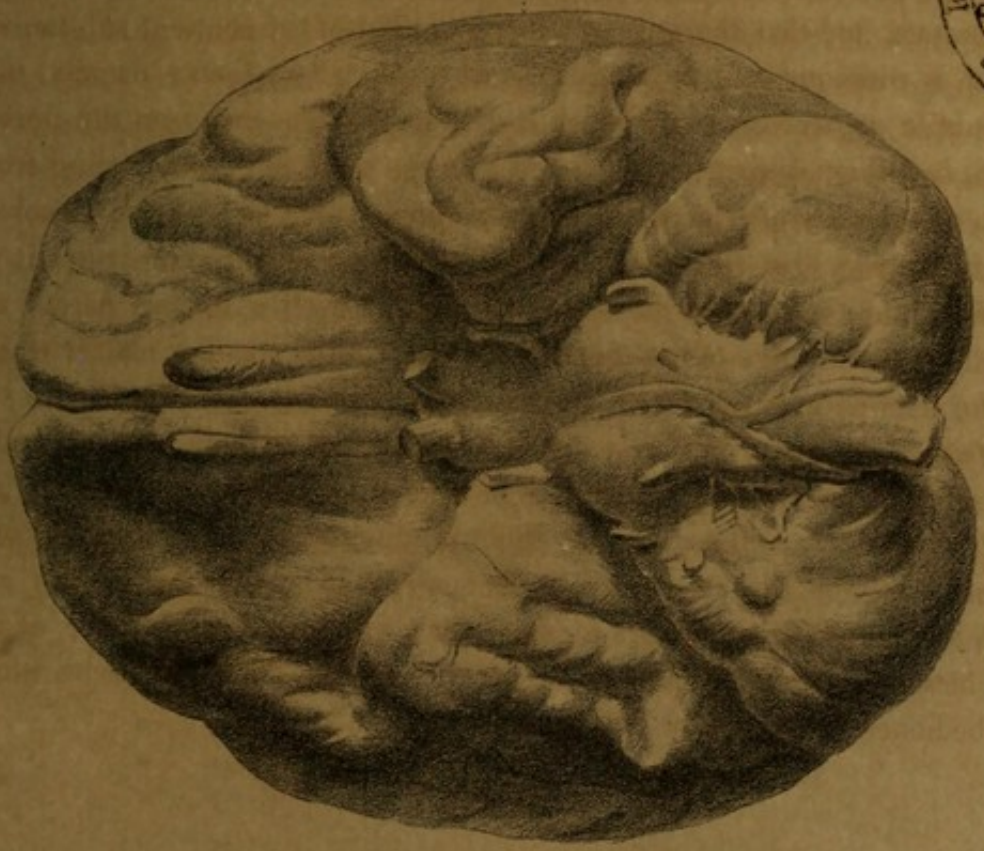

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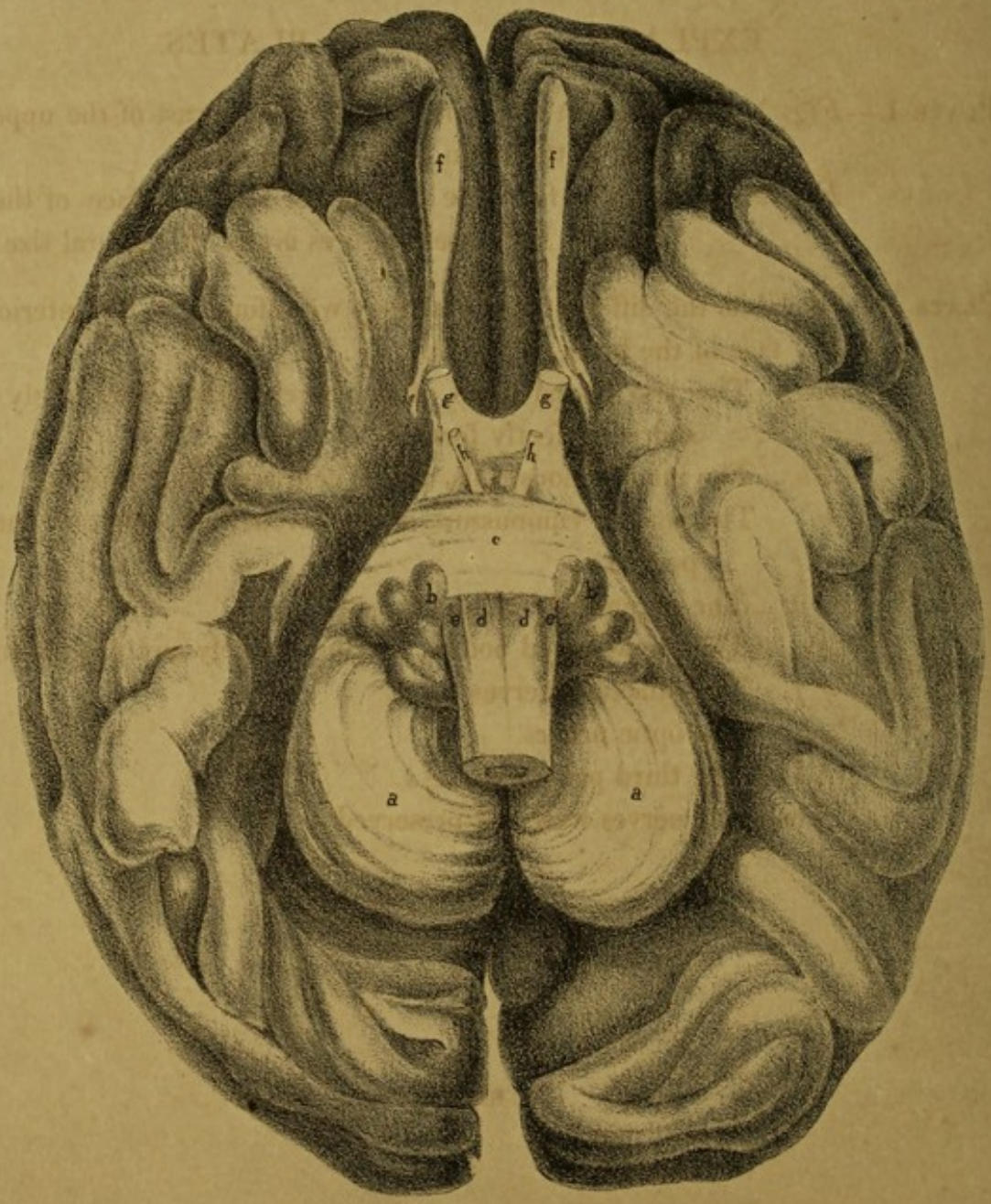
PLATE 2.

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## EXPLANATION OF THE PLATES.

PLATE I.—*Fig.* 1. Was drawn from an accurate plaster cast of the upper surface of the brain of the Chimpanzee.

*Fig.* 2. Was taken from the cast of the lower surface of the same brain. Both these figures are of the natural size.

PLATE II. Exhibits the different parts as they were found on the inferior surface of the brain of an idiot.

*a a.* The two lateral lobes of the cerebellum, exceedingly small, and imperfectly formed.

*b b.* The membranous cells, which held a reddish fluid.

*c.* The pons or commissure of the cerebellum, also small and imperfect.

*d d.* The pyramidal bodies.

*e e.* The olive-shaped bodies, making scarcely any projection.

*f f.* The olfactory nerves.

*g g.* The optic nerves.

*h h.* The third pair of nerves.

The other nerves were not preserved.

THE END.