H. P. Robarts Esqr.

with the authors best respects

PLATES OF THE BRAIN.

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IN EXPLANATION OF

THE PHYSICAL FACULTIES

OF

THE NERVOUS SYSTEM.

BY JOSEPH SWAN.

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PREFACE.

The principal object of this work has been the explanation of those parts which minister to the leading physical faculties of the nervous system. The peculiar arrangements in man required for promoting each faculty have been confirmed by the examination of the corresponding parts in several animals, and their physiological bearings have been substantiated by defining particularly the origins of nerves, and by tracing their distribution in organs whose functions are familiarly known.

On considering that some of the faculties of the nervous system are constantly, and others less frequently, in activity, and all of them, more or less, requiring the influence of the brain, it became necessary to determine not only the limits of the structures from which the nerves ministering to each arise, but their special relation to the brain itself. The investigations thus continued, have pointed out an especial centre for each leading faculty, and appropriate convolutions in a particular locality; they have also determined that one half of the larger portion of the fifth nerve belongs to the sensitive faculty, and the other half to the involuntary; and that the glosso-pharyngeal nerve and par vagum belong to the involuntary. The origin of the glosso-pharyngeal nerve and par vagum from the involuntary tract, not only readily accounts for their peculiar qualities, but gives a very sufficient reason for the combinations of the organs they supply with those under the influence of the fifth nerve.

As success depends very much on the condition of the brain and the mode of investigation, both these points require to be noticed. In several instances the brain was equally divided at the median line, and the convolutions forming the part of the summit overhanging the lateral ventricle were then removed; the inferior horn was laid open nearly to the bottom, and it was then placed in alcohol for two or more days, according to its bulk. When the two hemispheres were to be kept united by the smaller commissures and oblong medulla only, a similar mode was adopted, but the parts above the ventricles were not at first so freely removed; otherwise they would have fallen asunder and have overstretched important textures. When a degree of firmness had been produced by the alcohol, the dissection was begun. By an early commencement, the difference between the grey and white matters was more plain, and the grey could be removed for showing successfully the course of the white fibres. Many of the brains had undergone a considerable degree of hardening before any part was removed; but when they had been rendered very firm, the colour had faded, and the difference between the grey and white matters had become almost undistinguishable by the naked eye, and their proper separation consequently uncertain. When the parts had been much divided, and especially when it was required that the two hemispheres should be kept united, quills of a moderate thickness were passed through the convolutions, underneath the structures exposed for observation, and in some instances a further support from a piece of card was found necessary. As the surface is often very uneven, and requires very frequent changes of position for allowing the light to fall advantageously on it, the preparation was kept on a folded cloth, placed on the palm of the left hand. A large spear-pointed couching-needle rather blunt, was found to be the most convenient instrument, for by pressing it gently on a part it made the course of the fibres apparent, and was also sufficient for removing the surrounding matter. A smaller couching-needle, also blunt, was used in contracted cavities, and a sharper one when a clearer division was required. A scalpel with a very thin blade was found to make extensive sections more satisfactorily than one of larger dimensions, and its thin handle with rounded corners, proved very useful for separating the epithelium and clearing surfaces of loose particles. The mode of dissection was in a considerable degree like that for the nerves, but much more time was necessarily required than is usually devoted to the brain, which, of all parts, is the most delicate and intricate, and therefore reasonably claims a corresponding careful degree of manipulation.

6, Tavistock Square, 1853.

INTRODUCTION.

The nervous system appears generally in accumulations of grey and white matter, invested by finer or thicker membranes, and in connection with more or less fluid or solid matters. Each kind has a general character in animals, but the colour of the grey may be more or less faded, and the texture of the white more or less attenuated and translucent; nevertheless, by appropriate variations, further modified by peculiarities of the circulating fluids, their condition in the higher animals becomes suited to the requirements of the lower. As these materials are very loose or soft, they are contained in a membranous tissue, strong enough for giving them the form of centres and tracts of communication, and for preserving their integrity and free action during the various exercises and changes of position of the body. The pia mater appears only as an external covering, and a conductor to the blood-vessels; but it combines the grey particles, and assumes a resemblance of the arachnoid on its becoming connected with the white matter. There is thus a gradation of vascularity, so that both are supplied with peculiar capillaries, and modifications of the nutritious fluids, according to their different structure and functions.

When the grey particles are separated from each other, they appear globular or angular, and varying in size; they probably form separate organs, and are encircled by belts of fine filaments of the pia mater, and are thus placed in open cells. They are so copiously supplied with blood, that Ruysch denied their presence, by stating they consisted only of a mass of vessels, variously modified and contorted. They possess an exciting influence. Their molecular form allows them to be aggregated in larger or smaller quantities, but makes them low conductors of impulses.

Recent medullary matter is composed of slender semi-transparent filaments, which communicate in forming meshes. The membrane investing them conducts the capillaries for nutrition and exhalation. It is less copiously supplied with blood than the grey; and on account of this difference, its approximation with the grey requires a modification of the pia mater and capillaries. It appears in points at its approach to the grey, and each point becomes connected with a congeries, and not with a single grey particle. It is chiefly employed in the formation of tracts, commissures, and nerves. Its continuous and homogeneous form, and disposition in lines, as well as its peculiarity of composition, give it a readier power of conducting impulses than the interrupted molecular conformation of the grey.

One kind of matter and membrane would not suffice for the varied powers of the centres of the nervous system. The grey might allow some communication of impulses between its particles, but they would be of a peculiar kind, and not proper for forming combinations with the organs of the body. White alone, on the contrary, would be so capable of impression, that however it might be modified by intricately arranged fibres, it would not suffice for more than the very simple nervous system of the lowest animals. A primary or superior power was, therefore, required as in the grey matter, and a secondary or conducting one as in the white; both, however, being capable of forming combinations with each other: so that, by varied proportions and forms of arrangement, not only subordinate centres, but agreeable and proper means of communication for allowing a co-operation with the intellect may be produced.

Notwithstanding the similarity of appearance in sections of the recent brain, its several parts are so constructed, that they can perform different functions, and convey impulses with precision and without confusion. These properties are produced through the different degrees of conducting power of the matters composing it, and through the varied forms of combination; and, therefore, as each centre is different from the others in contact with it, it cannot convey impulses to the others. The centres of particular faculties are further made more or less independent by furrows, by intervening membranes, by the round or oval eminences, cells, or pouches, in which fibres turn into them in a circular or spiral form, or radiate in them amongst grey matter.

The hemispheres of the brain correspond with the two halves of the body. The convoluted or plain surface of each hemisphere, composed of innumerable grey particles in a continuous stratum, seems qualified for containing a uniform agent, and constituting the sensory for the manifestation of the intellect. Three distinct faculties are also perfected in the sensory, as the sensitive, the voluntary, and the involuntary. Each faculty requires its own peculiarity of structure for the development of its powers, and for forming a proper connection with the sensory and the organs of the body. Each hemisphere contains eminences for enlarging the power of the faculties, and for harmonising some peculiar properties with the capacity of the intellect, and the modified functions of the organs of the body; their variation or absence does not take place in any regular descent from man, but according to the construction of the animal, and the particular condition of faculties necessary for maintaining its prescribed place in the economy of nature. Tracts are required for connecting the sensory with the oblong and spinal medulla, and for forming communications between different regions for complex purposes. Commissures are required for sympathy between the two hemispheres for producing a reciprocal consent between corresponding parts of each, especially for the purposes of the intellect; otherwise, as the two hemispheres would be separate, except at the oblong medulla, and at the perforated structure around the infundibulum, there would indeed be centres for each side of the body, but they would want the necessary combination for the single purposes of the intellect and will. When the brain is small, a thicker fornix in proportion to its size, and the slight connection of the two hemispheres in the median line at the summit, together with the transverse commissures at the base, are sufficient; but when the hemispheres are very large, an extensive great commissure is also required, not only for combining them in sympathy, but for a mutual mechanical support.

Some of the forms of the brain and its centres are for mechanical, and others for functional power. Although the mechanical may vary on account of the necessary shape of the skull, they may, in some instances, be intended for promoting, at the same time, the offices of the brain itself. The round or oval shape of the exterior portion of each hemisphere is conjoined with the arched construction of the oval receptacles. This provision gives not only a fundamental firmness to the hemisphere, but allows the slender fibres, traversing the grey matter of the striated body, to be securely collected into tracts for the formation and disposition of the convolutions, and for a harmonious combination between the intellect and the voluntary muscles. The thin partition between the external and internal oval receptacles allows, externally, only the attachment of the small convolutions forming the island: and, internally, the white fibres traversing the grey matter of the striated body; and as the striated body has a free surface in the lateral ventricle, all chance of pressure, or other interference with the functions of its intimate delicate structure is thus precluded.

The surface of the brain is nearly smooth in the lower classes of animals, and in some of the smaller examples of mammalia; in many of the largest of this class it has narrower and more numerous convolutions, and broader and fewer ones in others. If the white matter of the convolutions was split, so that they could be spread out, they would form a more or less wide surface according to their breadth and number. In several instances when they have been gradually extended by accumulating fluid in the ventricles, their functions have been continued for a long period. This condition could not have been generally adopted without a great increase of the bulk of the head and other parts, which would have incapacitated the animals for agility and activity. The folding of the brain into convolutions admits therefore a size of the skull in proportion to the rest of the frame.

As there is an absence of convolutions in so many examples of mammalia, and in all the classes beneath them, and in numerous instances only a very slight inferiority of the instinctive faculties; it may be a question whether more than mechanical convenience attaches to their presence, and particularly to their form. If they were only intended for accommodating the brain to the cavity of a peculiarly shaped skull, one form might have sufficed; although, therefore, some modification of function probably attaches to each kind, it is not presumed that every convolution, whether broad or narrow, acts individually or separately for the production of a distinct faculty; but that the grey matter of the broad kind combined in a thick stratum has higher powers than an equal quantity of the thinner of the narrow spread over a large surface. The thicker the stratum of grey matter covering them, the more copious are their accompanying capillary vessels, and the more liable are they to assume a high degree of activity whenever they are excited. Their ordinary condition is not very plethoric, but it probably is much less so after the excitement has subsided, and then assumes that of congested veins, and causes debility, which requires repose, and leads animals to repair to their dens and holes. In the same manner the smooth brain of smaller animals, if the stratum of grey matter be thick, may excite fierceness or flight, and then yield to exhaustion and sleep. Numerous narrow convolutions allow a more extensive envelopment of the grey matter by the pia mater, and a much thinner distribution of capillaries; they favour a more equable and continuous circulation without much change from excitement to depression, except on some occasional but very strong impulses; they promote an almost unceasing activity and wakefulness necessary for the support of many animals, especially the larger kinds of herbivorous ones. As a great bulk of brain is liable to disorder or injury in the exercise of large animals, broad convolutions coincide with a great elasticity and lightness of tread, and numerous narrow ones with heavy and violent motions.

If the convolutions of the cerebellum were split and spread out, they would create a much thinner surface than those of the brain treated in a similar manner. It could not be thus placed in the skull, unless it were in small quantity as in amphibia, and had as in them a tape-like or a hollow globular form. In birds and mammalia its quantity is too great to be accommodated in this expanded condition, and therefore it is folded into lobes for a convenient and safe disposition in the portion of the cavity of the skull allotted to it. Its changes of external form are very little in birds, but in mammalia are more remarkable than those of the brain; probably, however, only a slight modification in directing their influence to particular tracts of the brain and oblong medulla is thus produced. When the cavity of the skull is wide for containing the brain, there are more extended lateral lobes and smaller middle ones forming the vermiform processes. When the skull is narrower, there is not room for such wide lateral lobes; the vermiform processes are then larger. The inferior vermiform process may be divided into more or fewer transverse portions on account of the motions of the head and neck, and variously-shaped lobules may exist for conveniently filling the space allotted to them—a circumstance to be particularly noticed in small skulls, when the bone is required to be light, and the cavity surrounded by a semicircular canal is not filled up by the petrous bone, but is occupied by an elegantly-formed slender lobule. The centre of the cerebellum keeps the median line of the brain, so that it belongs equally to the two hemispheres, but its grey surface is not there interrupted as in the brain. It constitutes a concentration of excitable power which proceeds from its intrinsic composition in the conjoined thin plates of grey and white matter. It does not appear to be the originator of any faculty, as no one is absent, when it is very diminutive. From its similarity of composition it is calculated for co-operating with the brain generally during any state of activity, but particularly during the voluntary impulses: so that its injury or removal disturbs, weakens, or paralyses the usual energy of muscles, whose voluntary tracts are especially connected with the corresponding injured lobes.

When all the parts of the brain and nervous system have been enumerated, there would remain a great deficiency in their means of agency, unless the organs of the body were noticed along with them. In almost every animal some difference of perception is derived from the quality of the circulating fluids, from the vascular arrangements, and from the mode of construction of each organ of the body. Impulses made on any of the senses, either alone or in conjunction with those proceeding from the state of the assimilative, the respiratory, and reproductive organs, influence the sensory and incite it to determine the action of one or more sets of voluntary muscles, for compassing the intention of the incitement. Unconnected with the impulses made by the organs of the body, the faculties of the intellect alone in animals are few.

Observations might be made respecting the uses of particular forms existing as modifications for preserving the order and harmony of the whole brain in accordance with the varied faculties and the construction of the body in animals, but they would lead too far beyond the intention of this Introduction.

THE PHYSICAL FACULTIES OF THE NERVOUS SYSTEM.

On dividing the oblong medulla in different directions, it seems as if the parts composing it are so intimately combined, that they cannot act separately. When, however, each part is carefully traced from or to the brain, it exhibits a proper character from which it derives peculiar qualities. There is a sufficient agreement between the several parts for a vital coaptation and for nourishment by modifications of the same blood-vessels, but not for interfering with each other in the performance of their respective functions.

The oblong medulla has posteriorly on its central part the posterior pyramidal bodies, and the surface extending upwards from them is the floor of the fourth ventricle constituting the continuation of the sensitive tract, and giving origin to the sensitive nerves. On its anterior central part the anterior pyramidal bodies are placed; these give origin to motive nerves, and form the continuations of the voluntary tracts. In the middle surface between the sensitive and voluntary tracts, the involuntary tract is placed; it resembles a large ganglion, and forms a case containing cells of interwoven grey and white matter; it gives origin to nerves especially concerned in vital involuntary functions. Besides the preceding parts there are the restiform bodies, situated laterally, and between these and the anterior pyramidal the olivary bodies. The breadth and thickness of the oblong medulla depend not only on the quantity, but on the greater or less extension, of the matter forming the several tracts. In mammalia the lower part generally approaches the size of the spinal cord, but it may be very large when the spinal cord is small, as in the porpoise, and in many birds.

Any description of the parts contained within the limits usually ascribed to the oblong medulla must be very imperfect, as most of them are continued beyond it, and form peculiar communications with the brain for the completion and extension of their functions. Accordingly it becomes necessary to treat of each of the principal parts separately as a distinct organisation, and to consider the oblong medulla only as a means of combination for a mutual support in their transit, and of attachment to the nerves at their origins.

From the posterior pyramidal bodies in man, the sensitive tract extends to the floor of the fourth ventricle. It is continued upwards at the base of the quadrigeminal bodies, and forms a thick cord, and assumes some resemblance of a ganglion just before the geniculate bodies, and behind the posterior commissure it passes outwardly across the posterior margin of the thalamus underneath the optic tract, and posteriorly to the involuntary tract. It expands underneath the epithelium lining the ventricle. Numerous fibres, the anterior of which are the largest, spread out in ascending to pass through apertures at the outer side of the great commissure to their appropriate convolutions situated on the outer side of the summit of the brain. There is a slight difference in the direction of the fibres; some of them pass to the surface of the posterior horn underneath the epithelium, and others on the surface of the inferior horn as it winds round the outer margin of the crus of the brain. Some of the deeper fibres become combined with the convolutions bordering on the inferior horn. The more superficial fibres spread immediately beneath the epithelium, are of a finer texture, and are connected with nearly the whole length of the optic tract, and with the roots of the olfactory nerve. The sensitive tract below the quadrigeminal bodies becomes more flattened and less thick. Posteriorly to the annular tubercle it gives origin to one half of the larger portion of the fifth nerve, and a little lower, at the side of the fourth ventricle, it gives origin to the auditory nerve. From the posterior pyramidal bodies it is extended on the posterior surface of the spinal cord.

Each anterior pyramidal body in man represents a voluntary tract, and after forming combinations in the annular tubercle with layers of the inferior pedicle of the cerebellum, becomes a crus of the brain. On entering the hemisphere it appears as if the greater portion of it were immediately separated into innumerable threads radiating freely amongst the grey matter in the internal oval receptacle, which forms the base of the striated body. The anterior and larger portion of it spreads out beneath the grey matter of the surface of the striated body, to be combined with the inner attached side of the great commissure, and sends off tracts to be covered with grey matter for forming the convolutions of the anterior and median side of the hemisphere. The second portion of the crus, which is less than the first, and the third, which is the least, after forming some combinations with the more exterior portion of the grey matter, becomes inserted into a perpendicular stratum of white matter which forms the partition between the internal and external oval receptacles; the more central part of this partition is very thin, and concave internally; its upper margin is thick, and forms the upper boundary of the oval receptacles; the under margin is less thick, and forms the under boundary of the oval receptacles; and both are extended backwards into the large caudiform process. The external oval receptacle resembles the internal one, but acquires wider dimensions in approaching the surface of the hemisphere, and has several low convolutions placed in it, which are described as forming an island in the fissure of Sylvius. White tracts enter these low convolutions anteriorly from the anterior descending portion of the upper margin, and posteriorly from the under margin of the external oval receptacle. The upper margin of the internal oval receptacle, as well as that of the external one, becomes combined with the outer attached side of the great commissure, and sends off tracts to be covered with grey matter for forming the convolutions, on the outer and upper and anterior surface of the hemisphere. The under margin of the internal oval receptacle is especially connected with the second division of the crus, and sends a large tract to the inferior convolutions of the inner and inferior portion of the anterior lobe. The caudiform process communicates with the posterior roll of the great commissure, and sends large tracts downwards and forwards to constitute the inferior margin of the external oval receptacle, and give off smaller tracts to be covered with grey for forming the convolutions on the surface of the middle lobe. The caudiform process also sends off tracts on the median side to be covered with grey for forming the convolutions on the inner surface of the posterior lobe, and other tracts outwardly to be covered with grey for forming the outer convolutions of the posterior lobe.

Each half of the involuntary tract in man begins at the ring on the inner side of the thalamus, and extends backwards through the upper or posterior surface of the corresponding crus of the brain; it is separated from its fellow by the sides of the passage from the third to the fourth ventricle. The ring, which is very distinct, is much smaller in proportion to the thalamus, and the soft commissure does not pass through it as in animals. The ring lies underneath the epithelium at the inner side of the thalamus between the posterior commissure above, and the posterior part of the mamillary eminence below. A large bundle of fibres originating from this ring is conducted across the thalamus and the narrow end of the striated body between the sensitive and voluntary tracts. It passes upwards between the fibres at the outer margin of the great commissure, and terminates in a convolution placed at the outer side of the summit of the brain towards the posterior part of the middle lobe. There does not appear to be any communication of the tract of each side through the great commissure, but they are combined in the oblong medulla at the lower parts of the crura near the annular tubercle, and placed between the voluntary tract anteriorly and the sensitive posteriorly. Near the lower end of the annular tubercle it becomes expanded laterally in giving origin to one half of the larger portion of the fifth nerve. At the lower margin of the annular tubercle the origin of the auditory nerve forms a slight connection with its posterior surface. It then becomes expanded in a broad and thick heart-shaped ganglion, the base being uppermost, and, after the removal of the anterior pyramidal, the olivary, and restiform bodies, the glosso-pharyngeal nerve and par vagum are seen firmly attached to it, and taking their principal origin from it. At the bottom of the oblong medulla the apex of this heart-shaped ganglion terminates in the continuation of the tract, which is extended throughout the spinal cord at the bottom of the deep anterior fissure, and becomes combined with both the anterior and posterior quarters of the cord. In the first dissections the involuntary tract was traced by taking out its internal parts, composed of pouches filled with interwoven grey and white matter, and leaving the cylinders which formed its external boundaries. This condition is represented in several of the plates.

The sensitive tract in mammalia is nearly the same as in man; it communicates with the quadrigeminal bodies, especially the nates; and just above these, in some animals, becomes uncovered, except by the epithelium, so as to resemble a large smooth nerve. It passes across the posterior part of the thalamus underneath the optic tract, and forms an expansion connected with the under surface of the epithelium lining the lateral ventricle; it communicates with the optic tract, and the white tract of the olfactory nerve. It sends upwards, between the two divisions of fibres proceeding from the outer margin of the great commissure, broad tracts to their appropriate convolutions situated at the outer side of the summit of the brain, and posterior to the convolutions belonging to the involuntary tract. It descends to the expansion forming the floor of the fourth ventricle, where it gives origin to one half of the larger portion of the fifth nerve and to the auditory nerve; it is then extended along the posterior surface of the spinal cord.

The voluntary tract in mammalia is larger or smaller, according to the size of the oblong medulla, and very similar to that in man. It undergoes a more simple change in the smaller annular tubercle in intermixing with the fibres of the inferior pedicles of the cerebellum; the crus passes above the optic tract and the olfactory nerve, and directly divides into innumerable threads, radiating freely amongst the grey matter contained in the receptacle forming the outer boundary of the striated body. The more anterior and inner threads beneath the surface of the striated body spread towards the inner attached side of the great commissure, and send off tracts to be covered with grey matter, for forming the convolutions at the anterior and median side of the hemisphere. The more outer threads, traversing the grey matter, become inserted into a perpendicular stratum of white matter, which is not near so thick as in man, and forms a receptacle which is more round and shallow, and the caudiform process, extending to the posterior lobe, much shorter and more slender. From its exterior surface, tracts pass off, which become covered with grey matter, for forming the convolutions on the outer attached side of the great commissure, and on the under surface of the brain.

The involuntary tract in mammalia is firmer than any other part of the brain. It begins in the thalamus at the ring by which the soft commissure communicates with each side of the brain. It is surrounded by the third ventricle, and its continuation downwards lies between the passage from the third to the fourth ventricle; in the fourth ventricle it lies immediately underneath the central part of the sensitive tract. At the ring it forms a large round or oval case of white matter, which in the centre is composed of oblong cells, plainly distinguished by the naked eye; and into these the fibres of the soft commissure enter for connecting the two sides. The ring is much larger in proportion to the entire tract than in man; the case is connected with the nucleus of white matter of the brain anteriorly, and with the tænia, and through this with the sensitive tract. From the posterior and outer side of this case, a large flat bundle of fibres passes through the narrow end of the striated body to particular or appropriate convolutions, placed towards the outer side of the summit of the brain nearly as in man, but they are more combined with the tænia. Both sides of the lower end of the ring and case become concentrated in a ganglion, which is soon joined by a corresponding one from the opposite side. The ganglion thus formed enlarges again towards the lower part of the annular tubercle, and becomes nearly as broad as the oblong medulla. The lateral extensions are much thinner than the centre, and afford a convenient origin to a considerable portion of the fifth nerve, and especially to the conical descending fasciculus of roots; the auditory nerve forms a slight connection with it. The glosso-pharyngeal nerve and par vagum take their principal origin from it. The tract becomes somewhat narrower as it descends, and at the bottom of the oblong medulla diminishes rather abruptly before its entrance into the spinal cord. All the surrounding parts may be removed, and the involuntary tract left alone with one half of the larger portion of the fifth nerve, the glosso-pharyngeal, and the par vagum originating from it. The narrow end, from the termination of the oblong medulla, is continued throughout the spinal cord, where it lies at the bottom of the longitudinal fissure, formed by the separation of the two anterior quarters, but projects somewhat into the posterior half of the cord. Some of the roots of the posterior nerves are seen tending towards it; but whether these communicate through it with the roots of the anterior nerves, must be left undetermined.

The sensitive tract, in its ascent from the spinal cord, is connected with the auditory nerve and half of the larger portion of the fifth; with the quadrigeminal and geniculate bodies, and with the optic tract through the fibres, spread on the descending horn of the lateral ventricle underneath the epithelium, some of which reach also to the roots of the olfactory nerve. It thus communicates with a portion of the origins of all the nerves of the senses, so that every special sense partakes in some degree of common sensation, and sympathises with the rest, and produces a feeling of integrity, even when one or more of the organs is deficient or mutilated.

There does not appear to be any communication of the sensitive tract of each hemisphere through the great commissure, but they are combined on the floor of the fourth ventricle, and probably also through the conjunction of the quadrigeminal bodies, which may contribute to the completion of the optic nerves, whilst their primary intention is the enlargement and the commissural requirements of the sensitive tracts. * The quadrigeminal bodies are as large when the optic nerves are absent or mere filaments as when they are of the usual size. By combinations through appropriate convolutions, the sensitive faculty forms an essential part of the sensory ; and, probably through it, not only the nerves of common sensation, but all those of the special senses, have their several variations of sense recognised and perfected either separately, when they relate to one, or in combination, when they relate to several qualities of the same object. In mammalia the convolutions thus approached by the sensitive tract are almost equal with the same in man. When, therefore, the nerves are of a size proportionate to the several organs, the sensations may be similar, but more or less exquisite according to the greater or smaller extent of the whole sensory.

The appropriate convolutions in man and in animals suffice for the ordinary sensations which may become very acute by excited changes in the sentient organs, even when the brain is very small. The spirit in which impulses are, however, recognised depends very much on the capacity and activity of the whole sensory, so that each impression in animals is principally noticed or not according to the state of the system with regard to the necessity of gratifying any of the habits and passions, but in man much more in respect of the intellect.

In the production of the peculiarities of the habits of animals, it is probable that there is a modification in the quality of the sensory, the nerves, the organs, and the blood. But one or more of the organs of the senses may be large or peculiarly formed, and its perceptions so acute as to make impulses conveyed from it to the sensory very disagreeable, unless they are moderated and subdued. In this manner many animals are kept secluded in the day, when the light appears to them so excessive as almost to paralyse their physical powers; but they are thus fitted for the night, when the slight degree of

* Serres Anatomie Comparée du Cerveau. Tome ii. p. 330.

light is available for the free functions of the elaborate organ, and is agreeable to the sensory, and sufficient for enabling them to provide food and take exercise. These natural disagreements would constitute disorders in man and many animals, and require a restoration of the too irritable brain or the excited organs.

The anterior pyramidal bodies bear a certain proportion to the spinal cord, and their fibres are continued to particular regions of the convolutions; they are therefore wider apart when the brain is large, and closer when the brain is more simple. According to their equality of size they have similar physical powers over the muscles. The comparatively slender band of fibres in man, in connection with a large group of convolutions, allows moderate physical powers, but motive impulses of a higher quality in connection with the superior intellect. The corresponding larger band of fibres in mammalia, in conjunction with a larger spinal cord and a much smaller group of convolutions, allows greater physical powers in connection with a lower quality of intellect.

As the sensitive and involuntary tracts have fixed localities in the sensory, and as the voluntary powers are so much under the influence of the intellect, it may be presumed that the centres from which the will proceeds are likewise placed in precise order in the sensory, and the impulses are directed by some tracts to the several regions of the body, and are combined by others for co-operating in complex motions. The occurrence of paralysis in the muscles of any single organ, or in those of a more extended region, favours this conclusion.

When the approaching size of the sensitive, voluntary, and involuntary tracts is observed, and the small extent of the appropriate convolutions of the sensitive and involuntary tracts, the large convoluted surface in man and some animals in proportion to the voluntary tracts is very remarkable; but when the surface of the brain is very limited, as in some of the smaller animals, the quantity allotted to each faculty appears much more nearly equal, and shows that large centres are not required for the more powerful voluntary acts, but for the more complex auxiliaries to a more extended intellect. A small brain suffices for the agency of the will, if the muscles, however large, are constrained by mechanical contrivances; for the will then appears not to be often exercised except when very strong impressions are made on the sensory either by the organs supplied by the involuntary nerves or those of the senses.

The appropriate convolutions of the involuntary tract are proportionate to its size independently of the greater or smaller extent of the whole sensory. By its connection with the sensory, its nerves derive a higher perceptive power for allowing the organs supplied by them to act in concert with sensitive parts and with voluntary muscles, not only for insuring a due replenishment of purified blood, but for a co-operation with the intellect in effecting changes of the voice and various acts requiring modified powers of the chest in the use of the limbs.

The involuntary tract is the source of a peculiar perceptive and irritable power manifested in the organs its nerves supply. Any moderate impulse is confined to the excited organ and its nerves; a more enduring one gradually and almost imperceptibly modifies the activity of the muscles subservient to it either through the nerves in connection with it, or through the convolutions, until a state agreeable to its perceptions is restored.

The few nerves given off by the involuntary tract perform very extensive and complex functions. Through the half of the larger portion of the fifth nerve, originating from it, it combines the nose and mouth and their appendages, and allows the local muscles to be excited either alone or in concert with other nerves and organs under its influence, as in taking food, and especially in sucking, and in respiratory functions. Through the glosso-pharyngeal nerve the back of the tongue and fauces are excited in swallowing; through the par vagum in concert with the glosso-pharyngeal nerve, the pharynx, the œsophagus, and the stomach have their powers exercised. Through the extension of the involuntary tract into the spinal cord and its probable connection with some of the roots of the spinal nerves, as well as through several plexuses formed between its nerves and the sympathetic, the muscles of the chest and abdomen are brought into action in consonance with the parts receiving its nerves, in sneezing, coughing, speaking, singing, and various modifications of the voice; also in ruminating, vomiting, and other acts of evacuation. Its nerves have a much higher quality from their direct communication with the sensory than the sympathetic from that effected only through other nerves. Its nerves and those of the sympathetic have their own peculiar properties and powers; their intimate combinations, however, denote an approximation of function, and especially as together they form the sources of energy in the processes of digestion and purification of the nourishment, in circulation and reproduction. The nerves of the involuntary tract actuate organs in the process of taking food, in digestion and respiration; whilst the sympathetic in combination with branches of the par vagum modifies the circulation and the secretions under the variations of those processes. The several plexuses formed between the sympathetic, the glosso-pharyngeal nerve and par vagum combine the viscera for the more passive consentaneous functions of the structures composing them, as for circulation, secretion, and perception. The associated actions for swallowing, breathing, and vomiting are produced more particularly by the glosso-pharyngeal nerve and par vagum through the involuntary tract and spinal cord and nerves; whilst those for the evacuation of the rectum, uterus, and bladder take place through the combinations between the hypogastric plexus and the sacral nerves, more particularly through the inferior extremity of the involuntary tract.

When any part of the involuntary tract is irritated for respiration or evacuation, all the muscles of the chest and abdomen can be at the same time excited by it through the fifth nerve, the glosso-pharyngeal and par vagum. It is not affected by the ordinary functions of parts supplied by the sympathetic nerve, but when very strong impulses are conveyed to it from this by the par vagum, it excites the spinal cord and nerves for producing the assistance of the muscles for vomiting or other evacuation. It is not affected by the ordinary functions of parts supplied by the spinal nerves; it therefore does not excite the simple reflex actions of the voluntary muscles, but they are produced through the sensitive nerves, or the contiguity of the appropriate convolutions of the sensitive to those of the voluntary.

Although the involuntary tract in man and the higher animals is almost entirely occupied in the simultaneous activity of the nerves of the two sides originating from it, and of those of the other centres controlled by it, it corresponds with the single process of one or more organs placed on the same or both sides of the body concerned in the nourishment and reproduction of the species. The halves of the two larger portions of the fifth nerve originating from it are principally for single purposes, whether in the mouth for sucking, or other modes of taking nourishment, or for speaking, and the various acts connected with respiration. The two trunks of the glosso-pharyngeal nerve are for the single action of the fauces in swallowing, and those of the par vagum for the single process of respiration, and their conjunction in the œsophagus for digestion in one or more stomachs. It actuates the nerves of both sides of the spinal cord simultaneously for promoting any single connected function of the viscera. If it be excited through the fifth nerve, as when the Schneiderian membrane of one side of the nose is irritated, the muscles supplied by both sides of the spinal cord are implicated in sneezing. If one trunk of the par vagum be injured, both sides of the spinal cord act for increasing respiration, or producing vomiting. When a single viscus, or any portion of the intestines, one kidney, one horn of the uterus, or one side of the bladder or rectum become irritated, both sides of the spinal cord are irritated for expulsive acts.

Every kind of irritation has its own power over the organs supplied by the fifth, the glosso-pharyngeal, the par vagum, and sympathetic nerve, and each region of the involuntary tract receives its proper impulses through them, and evokes a special expulsive action; as of sneezing, by irritation of the Schneiderian membrane; of vomiting, by the mechanical excitement of the fauces, or by an emetic; of purging, by the mechanical or other irritation of the lower end of the alimentary canal, or by a cathartic; or of both purging and vomiting, by a very irritable condition of the viscera, or the nervous system. Through the difference of the structure of the organs, and the peculiarity of the several nerves, and their modes of conjunction in plexuses; the nose, the glottis, the stomach, the upper or lower portion of the alimentary canal, the bladder, and reproductive organs, can, through the involuntary tract, influence the spinal cord and its nerves, so as to determine a sufficient action of the muscles for obviating the continuance of irritation, and for securing the completion of their functions.

Some of the roots of the posterior bundles of the spinal nerves are seen tending to the posterior surface of the involuntary tract, and as the anterior quarters of the spinal cord are in contact with the anterior surface of the involuntary tract at the bottom of the deep fissure, it might seem that there was thus a ready way of communication between the anterior and posterior roots of the nerves through the involuntary tract. It is, however, probable that the posterior origins of the spinal nerves are similar to those of the larger portion of the fifth nerve, especially as the accessory arises from the posterior portion of the oblong medulla and spinal cord in close alliance with the roots of the par vagum, and from the posterior bundles of the cervical nerves before they have left the sheath of dura-mater, and is thus composed of fibrils from both the sensitive and involuntary tracts like the larger portion of the fifth nerve. The accessory nerve frequently gives off the posterior bundle of filaments instead of the spinal cord for forming the suboccipital nerve. If, therefore, the accessory nerve after a conjunction with other spinal nerves is capable of influencing these for respiratory functions through an impulse derived from the involuntary tract, it may be presumed that the fifth either alone or in connection with its smaller portion, or in connection with the hard portion of the seventh, has power over the respiratory actions of the facial and other muscles, and that the posterior spinal nerves can control the muscles of the chest and abdomen through such fibrils as particularly communicate with their motive nerves. In the same manner the phrenic nerve derives its power for exciting and controlling the actions of the diaphragm.

The appropriate convolutions of the several faculties, in particular localities, are not entirely separate, but are remarkably distinct in man and many animals; they allow a special, but limited, influence of the sensory. By their combination with neighbouring convolutions, they admit of a co-operation and sympathy, so that in sleeping and waking, in consciousness or unconsciousness, or with a sound or unsound intellect, their powers are promoted, especially if any of the processes on which vitality instantly depends, are seriously impeded. It is further probable that the communications of the convolutions ministering to the intellect are also capable of influencing the appropriate convolutions of the tracts of the physical faculties. This additional power of incitement is not, however, requisite for any of the strictly vital functions, but only for the conventional ones of speaking, singing, and various other complex voluntary operations. The mode of conjunction of the appropriate convolutions of the several tracts with neighbouring ones is similar as to situation in man and animals ; their greater or less distinctness on the surface probably makes only a slight difference, for when the brain has an even surface, there is no apparent deterioration of functions.

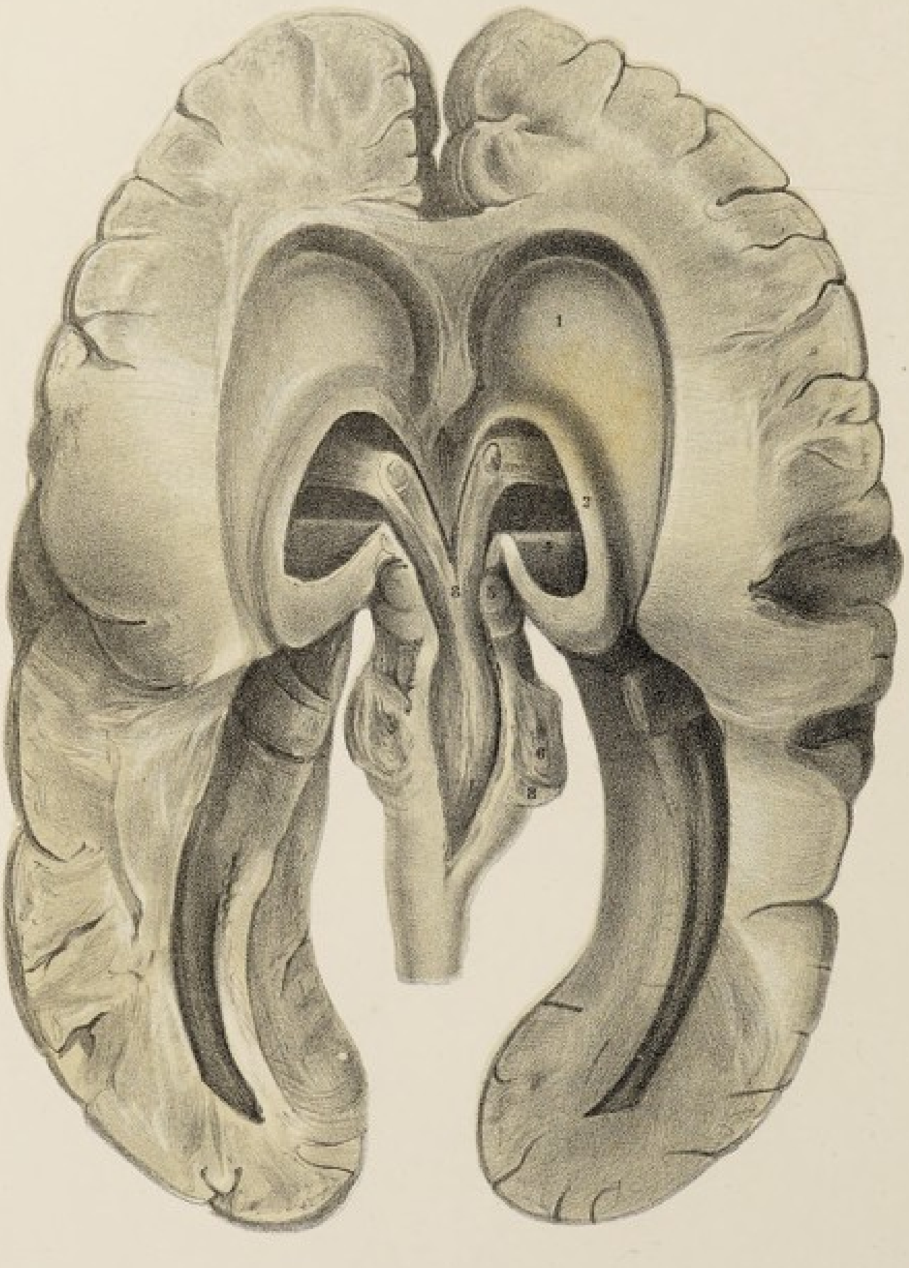
As the sensitive, voluntary, and involuntary faculties have convolutions on the same side of the brain, and all communicate for complex functions, and as each hemisphere is complete in itself, it must be determined that not only the tracts of the voluntary faculty cross, but those of the sensitive and involuntary.

It is presumed that all the tracts leading to the roots of the voluntary nerves cross through the anterior portion of the annular tubercle and oblong medulla, and all the sensitive nerves through the sentient tracts and quadrigeminal bodies and the floor of the fourth ventricle, and the involuntary tracts at the median line in the oblong medulla. The spinal cord is not complete in itself, but only in accordance with the faculties it derives from the brain. The two sides are not required to cross, the impulses from the sensitive, voluntary, and involuntary tracts, by crossing in the oblong medulla suffice for controlling it.

Whether the brain be large or small, the crura pass to its hemispheres in a similar manner, and when a larger intellect is required, there is an increase in the upper portion of the hemispheres, which must be combined in a particular manner through the great commissure. The great commissure is not, therefore, a necessary continuation of the crura of the brain, but only an adjunct, when the superior region is large. The parts situated below the great commissure and the tracts of the cerebellum must cross at the oblong medulla, and if the superior portion of the hemispheres crossed through the great commissure, there would be two crossings which must cause confusion, and prove to be a variation from the small brain whose surface reaches only just above the lateral ventricle, it must therefore be rather concluded that there is only a simple combination through the great commissure.

Some of the crossing fibres of the voluntary tracts are very distinct. The sensitive tracts of the two sides are so combined as to make any crossing difficult of detection, but as the optic cross, it may be presumed that a similar disposition is required in the other sensitive nerves. There is no appearance of crossing in the olfactory nerves; it may, however, take place through the perforated structure, and through their communication with the sensitive tracts; but much is not required, as the same odours are conveyed to corresponding parts of both at once, and the respiratory organs of both sides are also very similar and in action together with them at the same time. The optic cross in correspondence with the voluntary nerves of the eyes, otherwise the conjoint actions could not be completed in the same hemisphere of the brain, nor be associated with the limbs in complex operations; the sensation of the fingers or other parts for conjunction in the same purpose would also cross, and if the ears act in harmony with the eyes and limbs, they must be combined in the same manner.

In considering the condition of the infant, many actions seem to be completed by exercise after birth; but in animals, which are born perfect, and can immediately use all their faculties, it must be concluded that everything relating to mechanical power both for simple and associated actions has been provided for in the brain and nervous system in conjunction with the organs of the body, and that some conventional ones related to the intellect have alone been left to be perfected by exercise. In some born with parts not fully developed, all the functions of the nervous system and the organs depending on it are well performed in a short time, and are completed with their growth and not by mere exercise.



L. Aldous Delt.

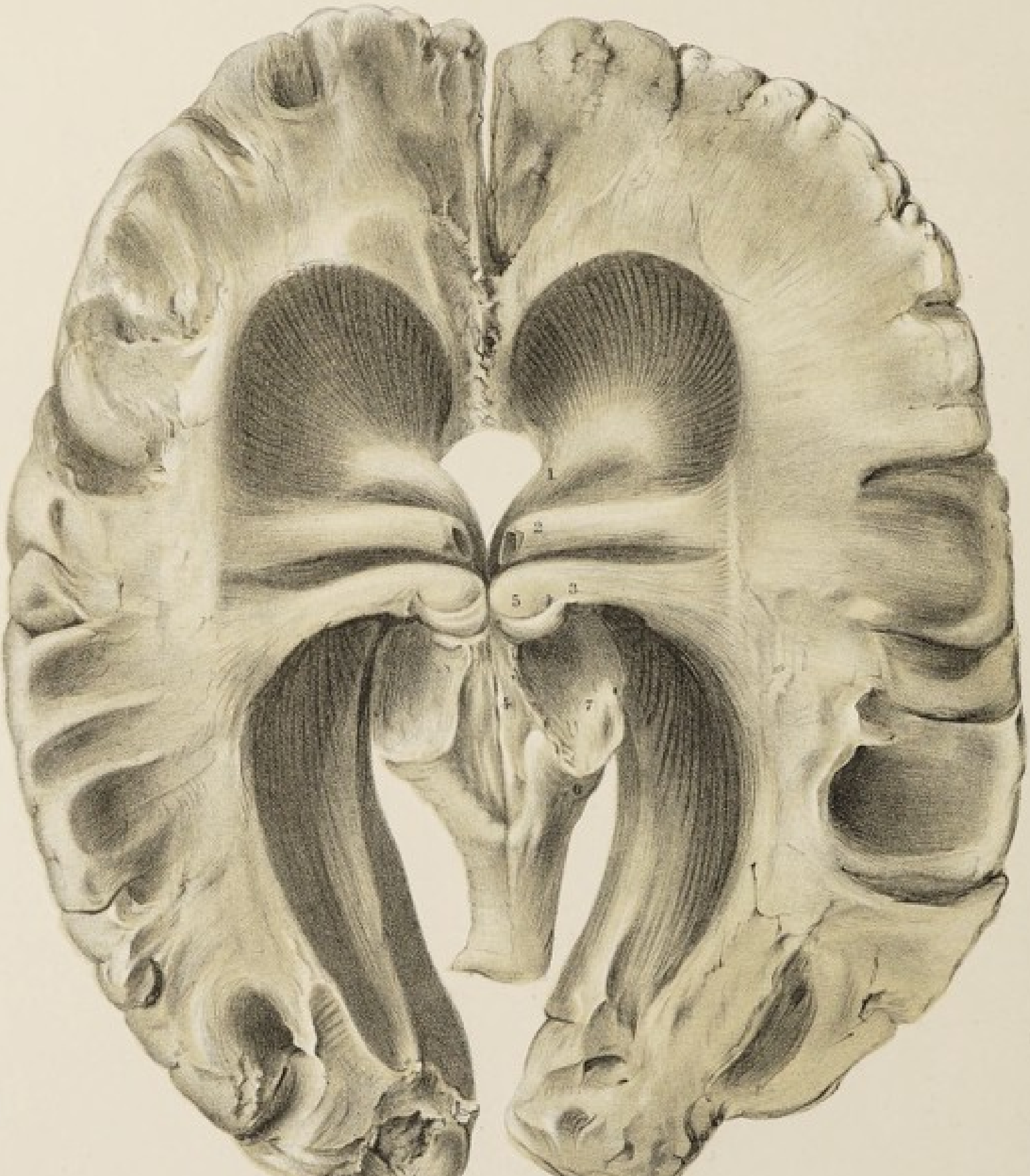
M & N. Hanhart lith et Impt.

LONDON, PUBLISHED BY LONGMAN & Co 1853.

PLATE I.

In the preparation of the human brain, from which this plate was taken, the summit below the great commissure and the fornix have been removed: the inner portion of each thalamus, nearly as far as the tænia, has been cut away for showing the situation of the sensitive and involuntary tracts in their course to their respective convolutions. The median connection of the sensitive tract has been divided nearly throughout the oblong medulla, for the purpose of exposing the continuation of the involuntary tract to the spinal cord.

1. Striated body.
2. Thalamus.
3. Involuntary tract.
4. Sensitive tract.
5. Quadrigeminal bodies.
6. Crus of the cerebellum.
7. Great hippocampus in the descending horn of the lateral ventricle.
8. Auditory nerve.



L. Aldous delᵗ

M & N. Hanhart lith et Impᵗ

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PLATE II.

In this preparation of the human brain, the summit and fornix have been removed, also the surface of each striated body, thalamus and optic tract. The quadrigeminal bodies have been left entire and in their places. The anterior pedicles of the cerebellum have been removed for exposing the surface of the sensitive tract alone, as it lies in the fourth ventricle. The connection of the sensitive tract with the quadrigeminal bodies, and its extension across the thalamus, have been shown. The infundibulum, and the perforated structure surrounding it at the base of the brain, have been removed for exposing the larger portion of the crus of the brain ascending towards the grey matter forming the upper surface of the striated body. The outer margin of the brain is placed lower than it is in nature; for after the parts were separated, it became necessary to pass quills through the two hemispheres by way of security, and thus the outer margin has been lowered and the inner raised.

1. Crus of the brain ascending towards the striated body, and dispersing its inner fibres through the grey matter forming the upper surface.

2. Involuntary tract from the ring to the great commissure.

3. Sensitive tract sending fibres to its appropriate convolutions, and beneath the epithelium of the inferior horn of the lateral ventricle.

4. Sensitive tract on the surface of the fourth ventricle.

5. Quadrigeminal bodies.

6. Auditory nerve.

7. Stem of the pedicles of the cerebellum.

Fig. 1.

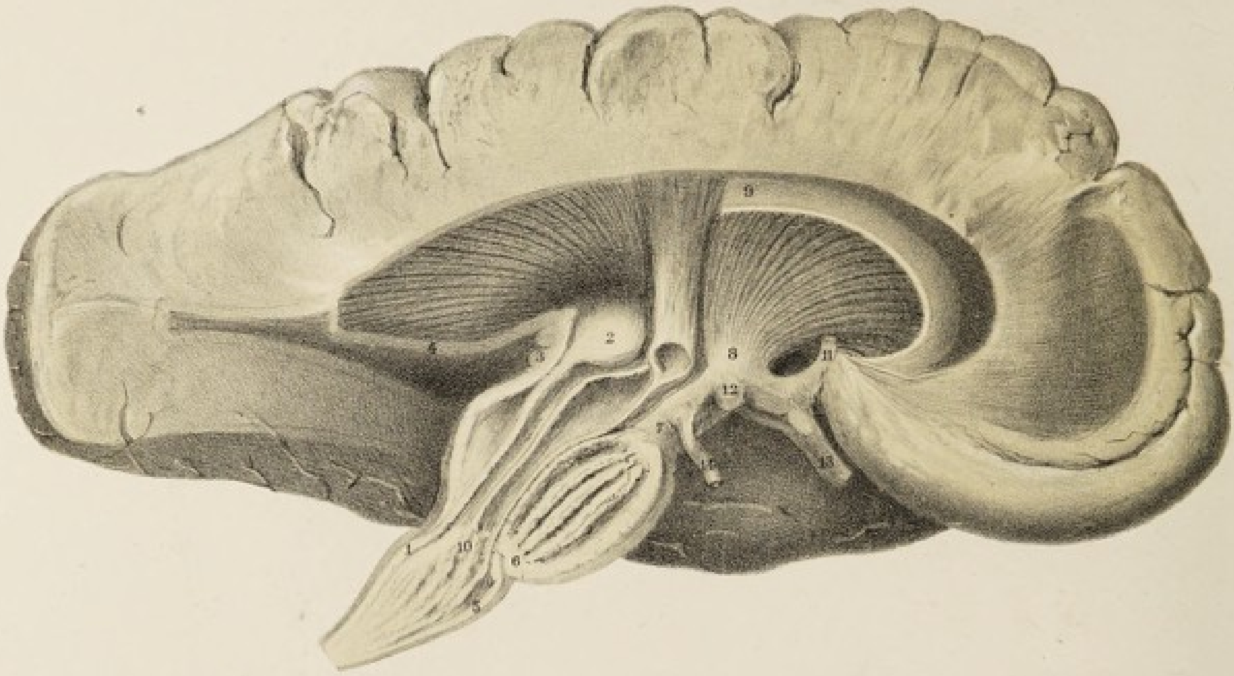

Fig. 2

L. Aldous Delt.

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PLATE III.

FIGURE I.

This preparation of the human brain was made after a perpendicular section in the median line. The more internal convolutions forming the summit have been removed; most of the inner margin of the great commissure has been removed; the remaining portion overhangs the outer side of the lateral ventricle, and the outer, or transverse, extremities of the sensitive and involuntary tracts. The inferior horn of the lateral ventricle has been laid open nearly to the bottom; the fornix, the great hippocampus, and the cerebellum have been removed.

1. Sensitive tract.

2. Ganglion, formed by the sensitive tract; the continuation of the fibres proceeding from it are seen tending across the thalamus underneath the optic tract.

3. Quadrigeminal bodies and epithelium turned aside.

4. Edge of the epithelium tending to the inferior horn of the lateral ventricle; it has been removed more anteriorly for showing the fibres of the sensitive tract leading to the posterior and inferior horns.

5. Anterior pyramidal body forming the voluntary tract, which is separated into layers in the annular tubercle, and conjoined in the crus of the brain.

6. Separation of the anterior pyramidal body in the annular tubercle.

7. Crus of the brain.

8. Anterior portion of the crus of the brain passing across to be combined with the grey matter forming the surface of the striated body, and then proceeding towards the great commissure.

9. Outer margin of the striated body; the narrow end, which covered part of the involuntary tract, has been removed.

10. Involuntary tract, situated between the sensitive tract and the voluntary, as this

proceeds through the anterior pyramidal body, the annular tubercle, and the crus of the brain. Its parietes resemble a cylinder laid open, and connected with many large cells, from which the white matter forming the smaller cells and the contained grey matter have been removed. At the superior part it forms a ring, from which fibres are continued across the narrow end of the striated body. Its appropriate convolution, which is in a direct line with it, is very apparent.

11. Anterior crus of the fornix.

12. Mammillary body.

13. Optic nerve.

14. Third nerve.

FIGURE II.

This preparation was made after a perpendicular section of the human brain in the median line. The oblong medulla and spinal cord have been removed. The lateral ventricle has been laid open throughout, and the whole of the epithelium removed, as well as the surface of the thalamus and striated body. The great commissure has been entirely removed for showing the involuntary tract and part of the sensitive ascending to their respective appropriate convolutions on the outer side of the summit of the brain. It differs from the preceding figure, inasmuch as more of the inner layer, proceeding from the anterior portion of the crus of the brain after its connection with the striated body, has been removed.

1. Sensitive tract sending many large bundles of fibres towards the convolutions on the outer side of the summit of the brain, and also spreading numerous fibres over the posterior and inferior horns of the lateral ventricle.

2. Voluntary tract or crus of the brain. Its fibres are seen as they pass through the grey matter of the striated body.

3. Involuntary tract proceeding from the ring across the thalamus and the narrow end of the striated body. Part of the white matter proceeding from the anterior portion of the crus of the brain has been removed, but not enough for showing it all the way to its appropriate convolution on the outer side of the summit.

4. Margin of the anterior horn of the lateral ventricle.

5. Margin of the posterior horn of the lateral ventricle.

6. Margin of the inferior horn of the lateral ventricle.

7. Anterior commissure.

Fig 1.

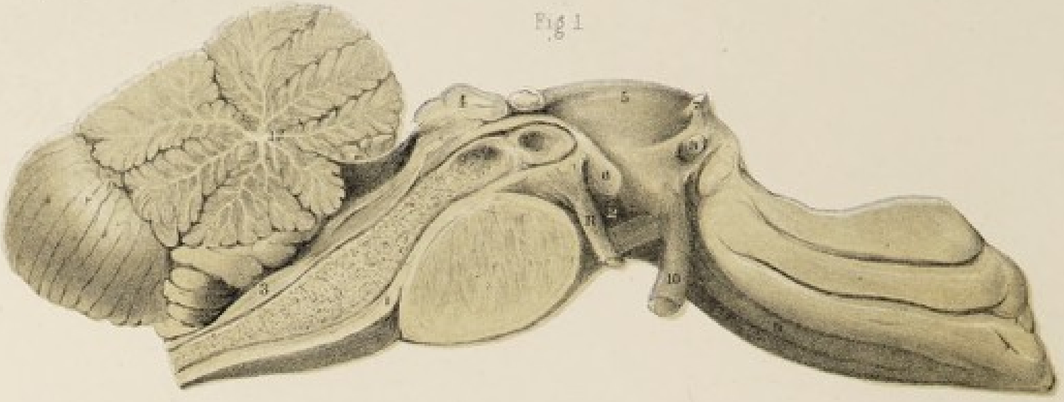


Fig 2.

Fig 3.

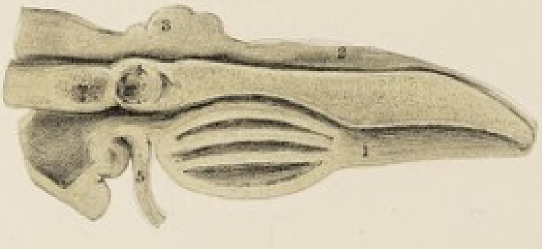


Fig 4.

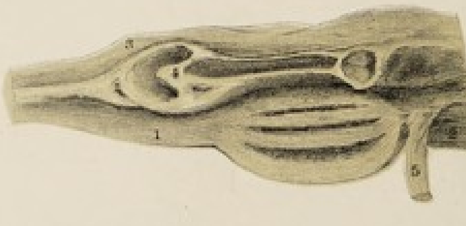


Fig 5.

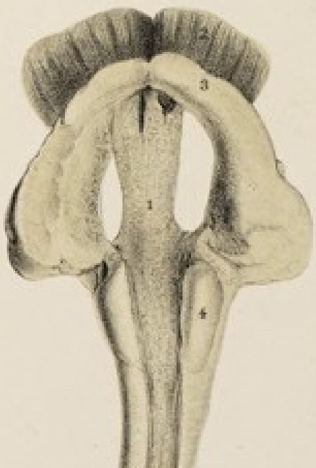
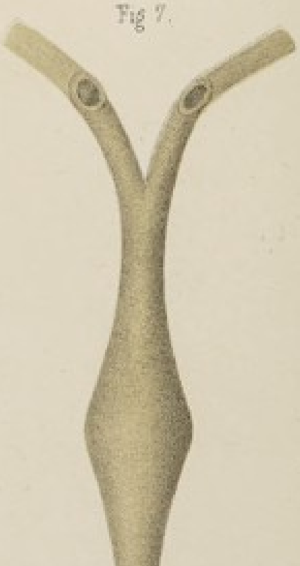


Fig 6.

Fig 7.



L. Aldous Delᵗ. M & N. Hanhart Lith et Impᵗ.

LONDON, PUBLISHED BY LONGMAN & Cº 1863.

PLATE IV.

FIGURE I.

After a perpendicular section of the human brain, most of the summit has been removed; half of the cerebellum has been left; the layers of the anterior pyramidal body in the annular tubercle have not been separated. The involuntary tract has been slightly separated from the sensitive and voluntary tracts, and the epithelium in the side of the third ventricle has been partially removed for showing the ring of the involuntary tract and a pouch below, from which the softer matter has been taken out.

1. Voluntary tract or anterior pyramidal body passing to the annular tubercle.
2. Crus of the brain.
3. Sensitive tract.
4. Quadrigeminal bodies.
5. Thalamus.
6. Mammillary body.
7. Anterior crus of the fornix.
8. Anterior commissure.
9. Olfactory nerve.
10. Optic nerve.
11. Third nerve.
12. Division of the vermiform processes of the cerebellum.

FIGURE II.

After a perpendicular section of the human brain, the summit has been removed, and the preparation placed somewhat obliquely, with the base upwards. The sensitive, the voluntary, and involuntary tracts have been separated, and the soft matter has been removed from the pouches of the involuntary tract.

1. Voluntary tract or anterior pyramidal body, separated into layers in the annular tubercle.

2. Crus of the brain passing to the striated body.

3. Sensitive tract.

4. Section of the quadrigeminal bodies.

5. Ring of the involuntary tract sending fibres upwards to cross the thalamus and the narrow end of the striated body; its continuation downwards shows the pouches from which the soft matter has been removed, and its entrance into the spinal cord.

6. Olfactory nerve.

7. Third nerve.

8. Spinal cord.

FIGURE III.

A perpendicular section of the human oblong medulla and spinal cord has been made. A considerable part of the sensitive and voluntary tracts has been removed from the median plane for the purpose of leaving the involuntary tract raised, and showing it with greater distinctness.

1. Voluntary tract or anterior pyramidal body dividing into layers in the annular tubercle.

2. Sensitive tract.

3. Quadrigeminal bodies.

4. Involuntary ring; some of the central soft matter of the tract passing upwards from it towards the narrow end of the striated body has been removed. In its descent to the spinal cord it appears solid.

5. Third nerve.

FIGURE IV.

A perpendicular section of the human oblong medulla and spinal cord has been made. Part of the sensitive and voluntary tracts has been removed from the median plane for the purpose of leaving the involuntary tract raised, and showing it with greater distinctness; the soft matter has been removed from its pouches.

1. Voluntary tract or anterior pyramidal body dividing into layers in the annular tubercle.

2. Crus of the brain.

3. Sensitive tract.

4. Involuntary tract.

5. Third nerve.

FIGURE V.

In this preparation of the human brain the crura of the brain are seen, and the anterior surface of the oblong medulla and spinal cord. The pyramidal bodies have been removed, and a great part of the annular tubercle.

1. Involuntary tract descending into the spinal cord at the bottom of the deep fissure.
2. Crus of the brain.
3. Margin of the annular tubercle.
4. Olivary body.
5. Spinal cord.

FIGURE VI.

This is a posterior view of the same preparation.

1. Involuntary tract descending into the spinal cord. The soft matter has been removed from its interior, so that it has at the upper part the appearance of two cylinders, part of the parietes of one of which has been cut away.
2. Stem of the pedicles of the cerebellum.
3. Part of the quadrigeminal bodies.

FIGURE VII.

This preparation gives the appearance of the involuntary tract of the human brain, after its separation from the surrounding parts for showing its general shape and size.

Fig 1

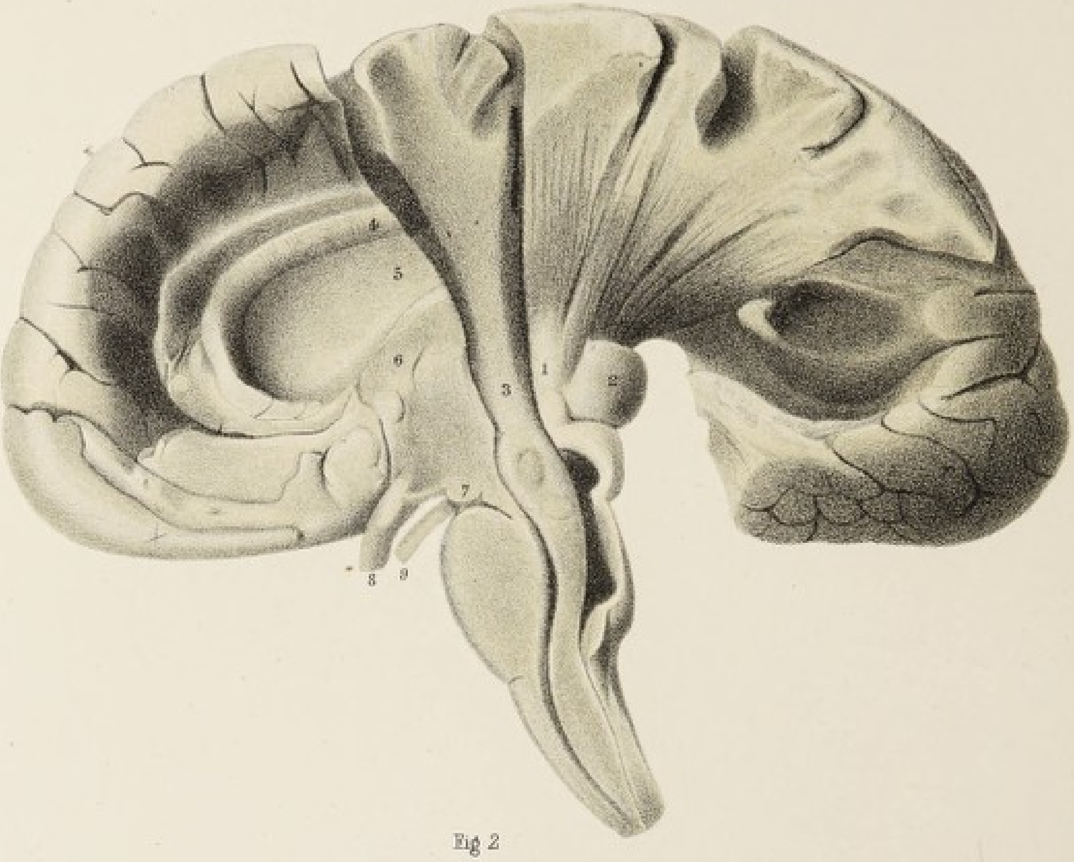
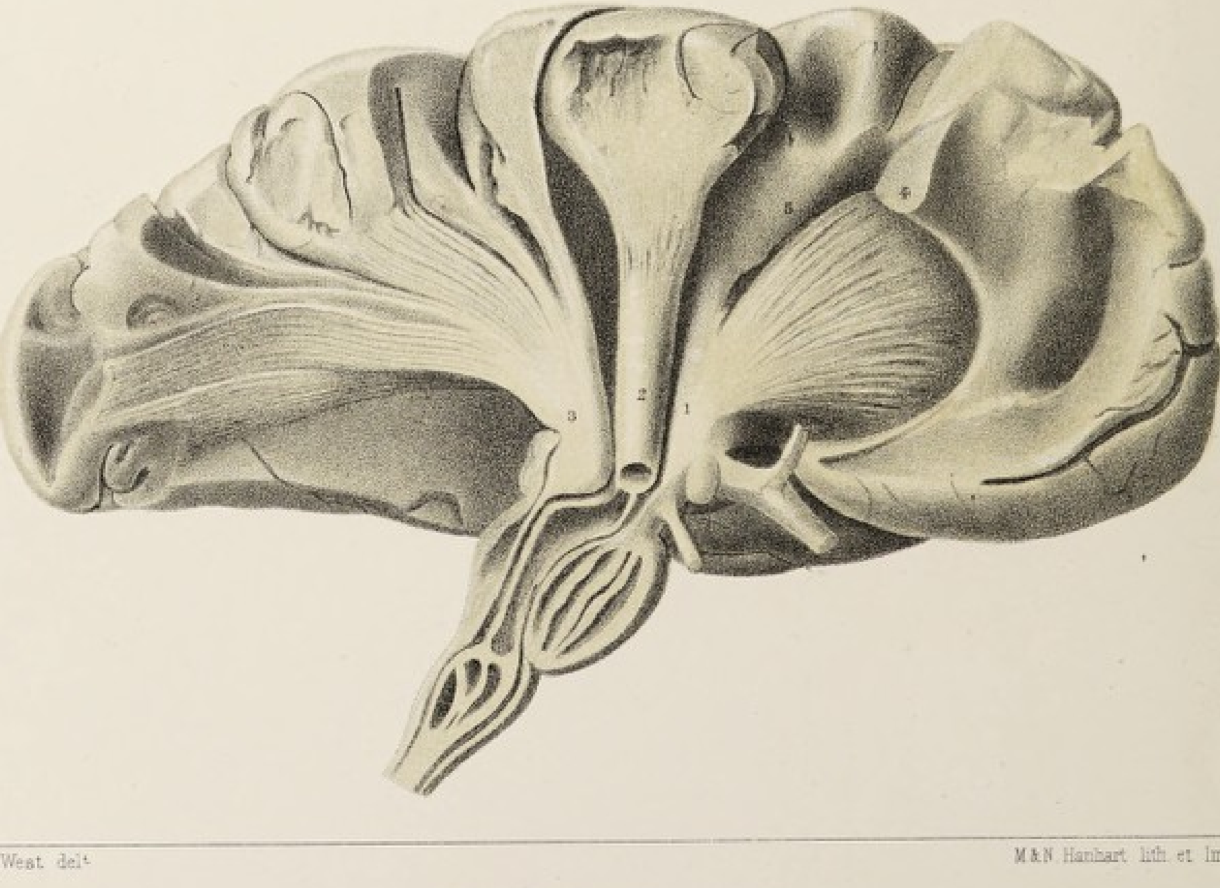


Fig 2



E. West del.t   M&N Hanhart lith et Imp.t

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PLATE V.

FIGURE I.

After a perpendicular section of the human brain in the median line, the greater portion of the fornix has been removed; also much of the median edge of the great commissure, and some of the convolutions, nearly the whole of the thalamus, and the narrow end of the striated body have been removed. The sensitive and involuntary tracts have been exposed throughout from the spinal cord to their respective convolutions near the outer side of the summit of the brain.

1. Sensitive tract; it is seen ascending at the outer margin of the great commissure to the convolutions on the outer side of the summit of the brain.

2. Optic tract.

3. Involuntary tract; it is seen passing upwards at the outer side of the great commissure to its convolutions on the outer side of the summit of the brain.

4. Inner edge of the great commissure, with some of the convolutions at its inner attached margin.

5. Striated body; the narrow end has been removed.

6. Anterior crus of the fornix.

7. Mammillary body.

8. Optic nerve.

9. Third nerve.

FIGURE II.

The preparation of the human brain, from which the first figure in the third plate was taken, has been further dissected. The whole of the great commissure has been removed, and the epithelium in the descending horn of the lateral ventricle. A portion of the most prominent part of the junction of the anterior division of the crus of the brain with the striated body has been removed for showing its continuation behind or exterior to the involuntary tract, where it joins the white matter on the outer attached side of the great commissure. The involuntary tract has been traced to its appropriate convolutions. The several portions of the sensitive tract have been traced to their respective convolutions, and the descending fibres in the inferior horn of the lateral ventricle have been further separated.

1. Anterior division of the crus of the brain passing underneath the surface of the striated body ; some of it has been removed for showing a portion of it passing exterior to the involuntary tract, for joining the white tracts proceeding from it to the outer attached margin of the great commissure.

2. Involuntary tract passing to its appropriate convolution.

3. Sensitive tract ; several parts of it are seen passing to their respective convolutions, and the rest continued underneath the epithelium of the posterior and inferior horns of the lateral ventricle.

4. Inner layer of white matter passing over the sensitive and involuntary tracts at the inner attached margin of the great commissure.

5. Outer layer of white matter passing at the outer side of the sensitive and involuntary tracts to the outer attached margin of the great commissure.

Fig 1

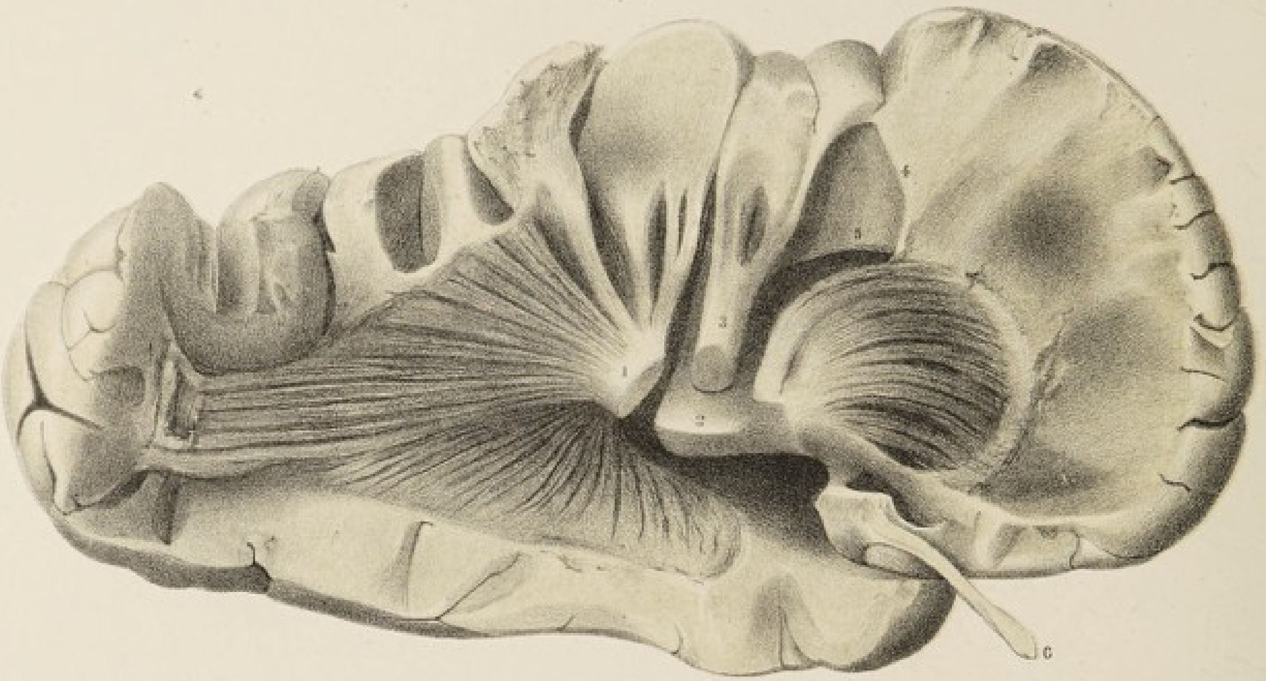

Fig 2

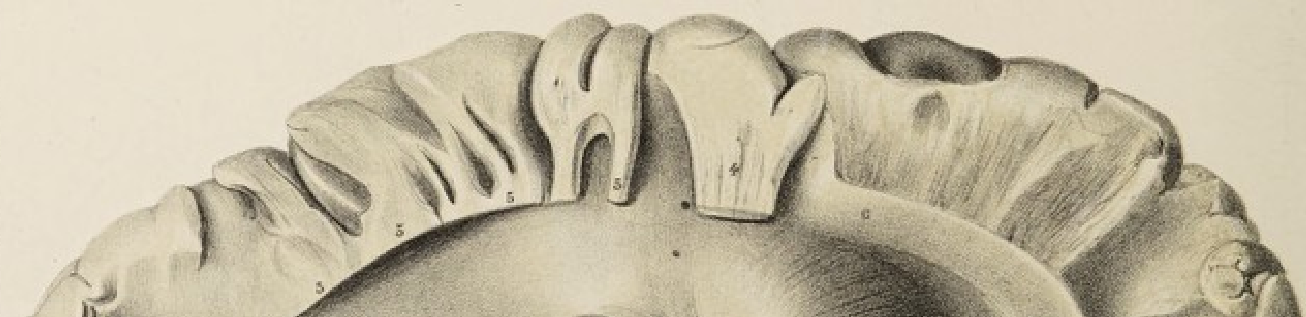

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PLATE VI.

FIGURE I.

The preparation from which the second figure in the third plate was taken has been further dissected. The ends of the sensitive, the voluntary, and involuntary tracts have been shortened. The involuntary and sensitive tracts have been traced to their respective convolutions.

1. Sensitive tract.
2. Voluntary tract.
3. Involuntary tract.
4. Cut edge of white matter, which was continued at the inner attached side of the great commissure.
5. Margin of the internal oval receptacle of the striated body.
6. Olfactory nerve.

FIGURE II.

After a perpendicular section of the human brain a large portion of the great commissure, the fornix, and great hippocampus have been removed; the surface of the striated body has been removed, and the whole of the sensitive and involuntary tracts as far as the convolutions, for the purpose of showing the white matter proceeding from the crus of the brain to form tracts for the convolutions.

1. Crus of the brain.
2. Fibres of the crus of the brain passing underneath the surface of the striated body to the great commissure and the anterior and upper margin of the oval receptacle. When the grey matter and radiating fibres of the crus of the brain in the striated body are carefully removed, the extent of the internal oval receptacle and its termination backwards in the caudiform process are well observed.

3. Caudiform process extended from the posterior margin of the internal oval receptacle, and proceeding from the more outward white fibres of the crus of the brain passing through the grey matter in the internal oval receptacle; it forms stems for the convolutions placed at the outer and under surfaces of the hemisphere.

4. Involuntary tract cut short near its appropriate convolutions.

5. Sensitive tract cut short near its appropriate convolutions.

6. Cut edge of the great commissure.

Fig. 1.

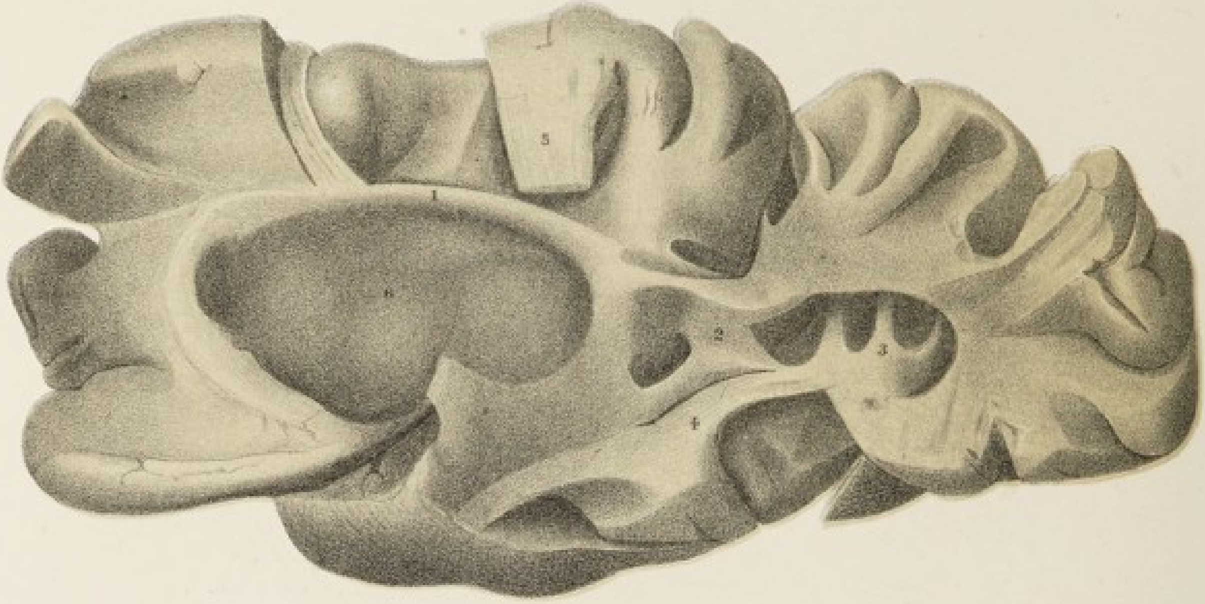

Fig. 2

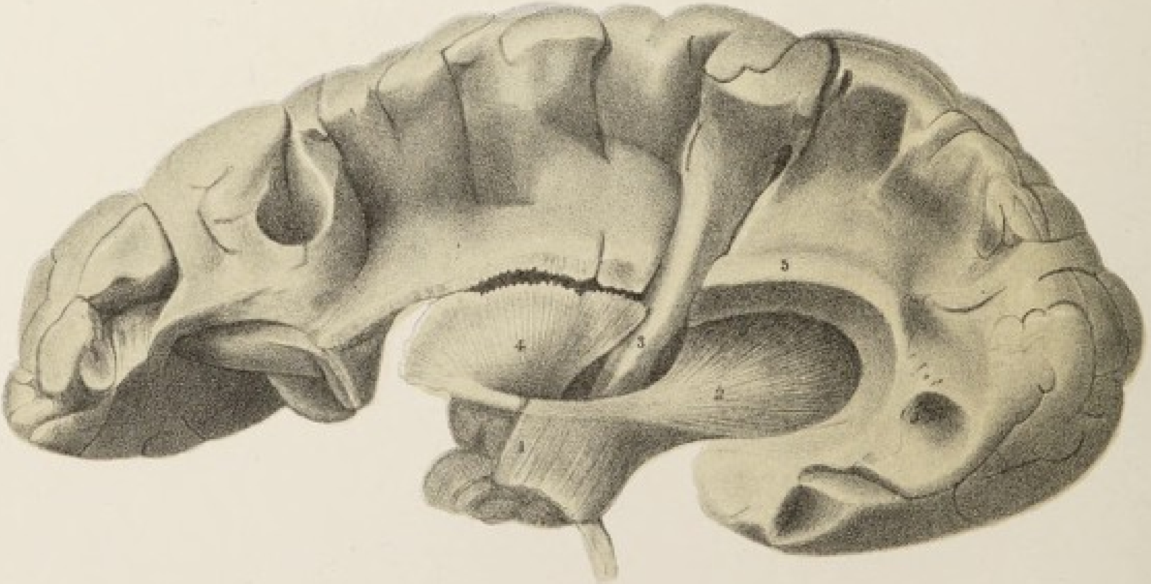

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PLATE VII.

FIGURE I.

This preparation was made from the opposite half of the human brain forming the second figure of the sixth plate. All the grey matter and white fibres proceeding through the striated body have been removed for showing the extent of the internal oval receptacle. From the anterior and upper margin of the internal oval receptacle stems of white matter are seen passing to the convolutions at the anterior and outer surface of the hemisphere. From the caudiform process stems are seen passing to the convolutions on the inner surface of the posterior lobe, but some of the inner part of the caudiform process has been removed for showing the beginnings of the stems passing to the convolutions at the outer surface of the posterior lobe, and to the middle lobe.

1. Anterior margin of the oval receptacle with which some of the white tracts proceeding through the anterior surface of the striated body communicate, and give off white stems for forming the convolutions at the anterior and outer surface of the hemisphere.

2. Caudiform process proceeding from the posterior margin of the oval receptacle, and sending off several stems for forming convolutions on the inner surface of the posterior lobe of the brain.

3. Stems passing from the caudiform process to the convolutions on the outer surface of the posterior lobe of the brain, and to the middle lobe.

4. Stem passing from the caudiform process downwards and forwards to the convolutions of the middle lobe of the brain.

5. Involuntary tract near its appropriate convolutions.

6. Internal appearance of the thin partition between the internal and external oval receptacles.

FIGURE II.

After a perpendicular section of the human brain in the median line, the exterior convolutions have been removed, also the descending horn of the lateral ventricle. The thin partition between the internal and external oval receptacles, and the posterior portion of the upper margin, have been removed; also part of the crus of the brain and of the fibres radiating through the grey matter of the striated body in the internal oval receptacle, for showing the outer surface of the involuntary tract proceeding to its appropriate convolutions, and for showing the sensitive tract, which, in its course to its appropriate convolutions, has been divided horizontally.

1. Crus of the brain.

2. Fibres of the crus of the brain radiating through the grey matter of the striated body; the posterior part has been removed for showing the transit of the involuntary and sensitive tracts.

3. Involuntary tract proceeding to its appropriate convolutions on the outer side of the summit of the brain.

4. Sensitive tract; it is divided horizontally; its fibres are seen tending to their appropriate convolutions on the outer side of the brain.

5. Upper margin of the external oval receptacle.

Fig 1.

Fig 2.

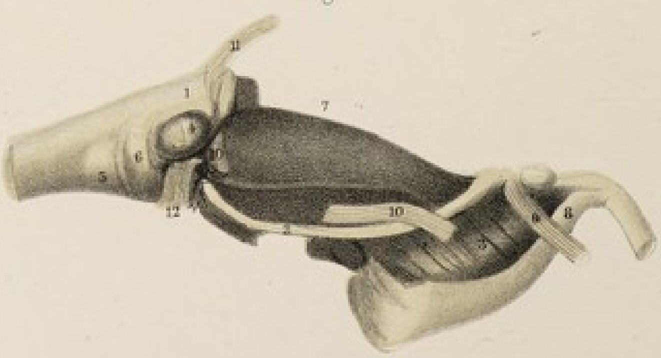

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PLATE VIII.

FIGURE I.

After a perpendicular section of the human brain, the exterior convolutions have been removed, also the part of the descending horn of the lateral ventricle which crosses the upper portion of the crus of the brain as it passes towards the anterior point of the middle lobe. The partition between the internal and external oval receptacles has been removed for exposing part of the radiation of the fibres of the crus of the brain contained in the internal oval receptacle.

1. Anterior or largest division of the crus of the brain proceeding to radiate in fibres underneath the grey matter forming the surface of the striated body.

2. Smallest or posterior division of the crus of the brain; this with the second division, after radiating in threads in the more exterior grey matter of the striated body in the internal oval receptacle, is inserted into the perpendicular stratum of white matter forming the superior and inferior margin of the internal oval receptacle, and extended backwards into the caudiform process.

3. Edge of the expansion of the sensitive tract in the descending horn of the lateral ventricle; the corresponding part forming the continuation is seen in 4 of the eleventh plate.

4. Edge of the optic tract and epithelium.

5. Geniculate body.

FIGURE II.

After a perpendicular section of the human brain, the greater portion of the annular tubercle has been removed. The involuntary tract has been exposed, and the half of the larger portion of the fifth nerve arising from it has been left at its attachment; but a longer loose piece of this nerve has been also left in contact with the cut edge of the annular tubercle. The arciform process extending from the anterior pyramidal body to the restiform body is seen very much defined, and as if it existed in the place of the lower part of the olivary body, which is prominent at its upper part, but much shorter than usual. This marked combination shows that a relation exists between the anterior pyramidal, the olivary, and restiform bodies.

1. Anterior pyramidal body.

2. Cut edge of the annular tubercle.

3. Crus of the brain.

4. Olivary body; part of the ninth nerve is seen originating in the furrow between the pyramidal and olivary bodies.

5. Restiform body.

6. Arciform process extending from the anterior pyramidal to the restiform body.

7. Involuntary tract.

8. Optic tract and nerve.

9. Third nerve.

10. Half of the larger portion of the fifth nerve; the upper piece is loose and broken off; the lowest piece is attached to the involuntary tract.

11. Sixth nerve.

12. Glosso-pharyngeal nerve and par vagum arising from the involuntary tract.

Fig 1.

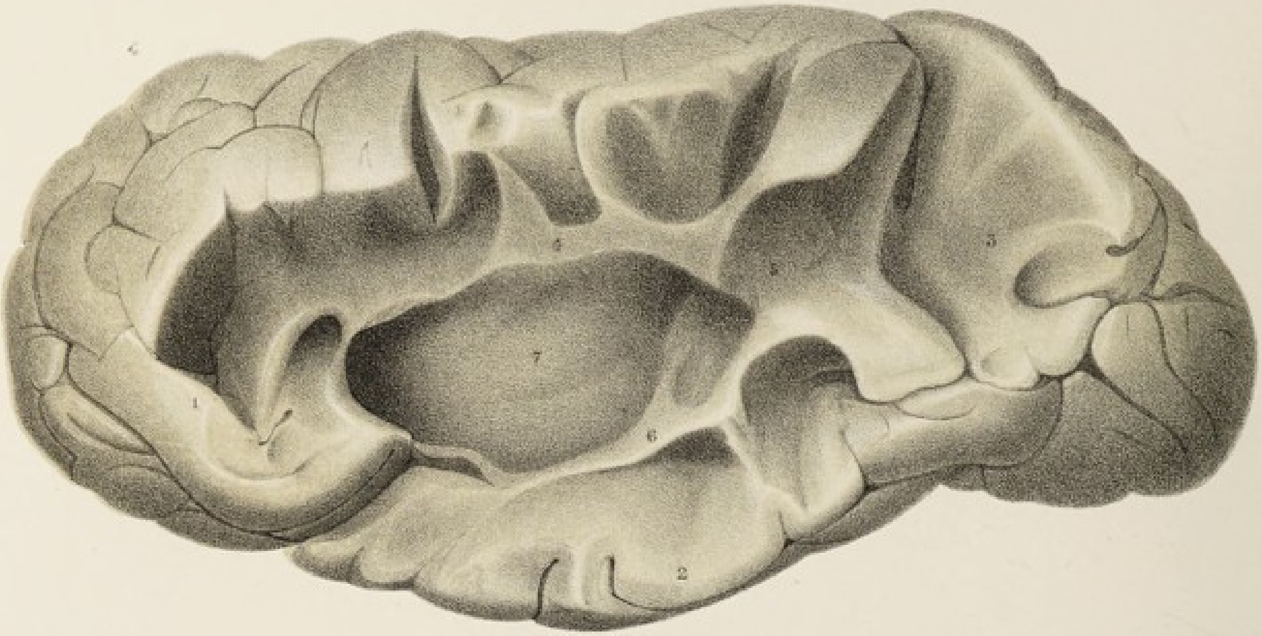

Fig 2.

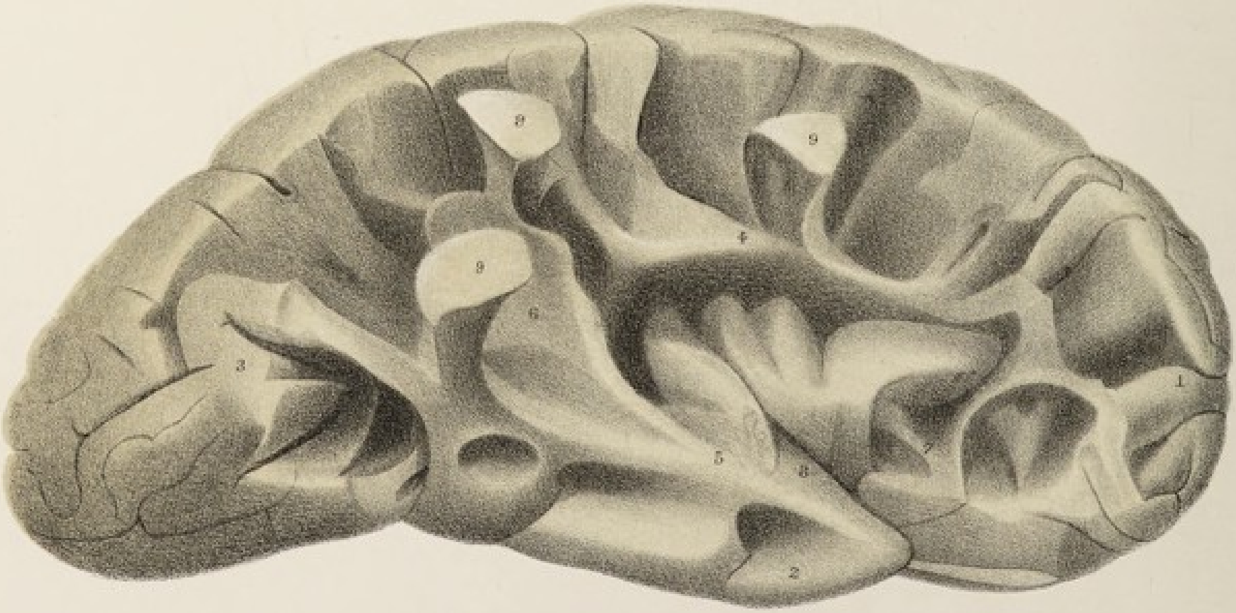

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PLATE IX.

FIGURE I.

After a perpendicular section of the human brain, part of the outer surface has been removed for showing the external oval receptacle in which the low convolutions forming the island are contained.

1. Anterior lobe of the brain.
2. Middle lobe of the brain.
3. Posterior lobe of the brain.
4. Upper margin of the external oval receptacle which sends off tracts to be covered with grey matter for forming the convolutions on the outer surface of the anterior and middle lobes of the brain.
5. Caudiform process; at this point it communicates with, or is joined by, the exterior corner of the posterior roll of the great commissure; it sends tracts backwards to be covered with grey for forming convolutions in the posterior lobe, and then sends a tract forward to join the inferior margin of the external oval receptacle.
6. Inferior margin of the external oval receptacle. The white matter is derived from the middle and posterior divisions of the crus of the brain, and is joined outwardly by a descending tract from the caudiform process for giving off tracts to be covered with grey for forming convolutions of the middle lobe.
7. Appearance of the outer surface of the partition of the oval receptacles.

FIGURE II.

After a perpendicular section of the human brain, the external convolutions have been removed for showing the external oval receptacle containing the low convolutions; also the manner in which the stems of white matter proceed to terminate in convolutions.

1. Anterior lobe of the brain.

2. Middle lobe of the brain.

3. Posterior lobe of the brain.

4. Upper margin of the external oval receptacle sending tracts to the convolutions on the outer and upper portion of the brain, and others forwards and downwards to the convolutions of the outer portion of the anterior lobe.

5. Lower margin of the external oval receptacle passing from the caudiform process and forming the principal stem at the inner and ascending edge of the middle lobe, from which tracts pass to the convolutions.

6. Caudiform process.

7. Stem passing from the descending portion of the upper margin of the external oval receptacle to the low convolutions forming the island.

8. Stem passing from the under margin of the external oval receptacle to the low convolutions forming the island.

9. Portions of convolutions left for showing the stems passing to them.

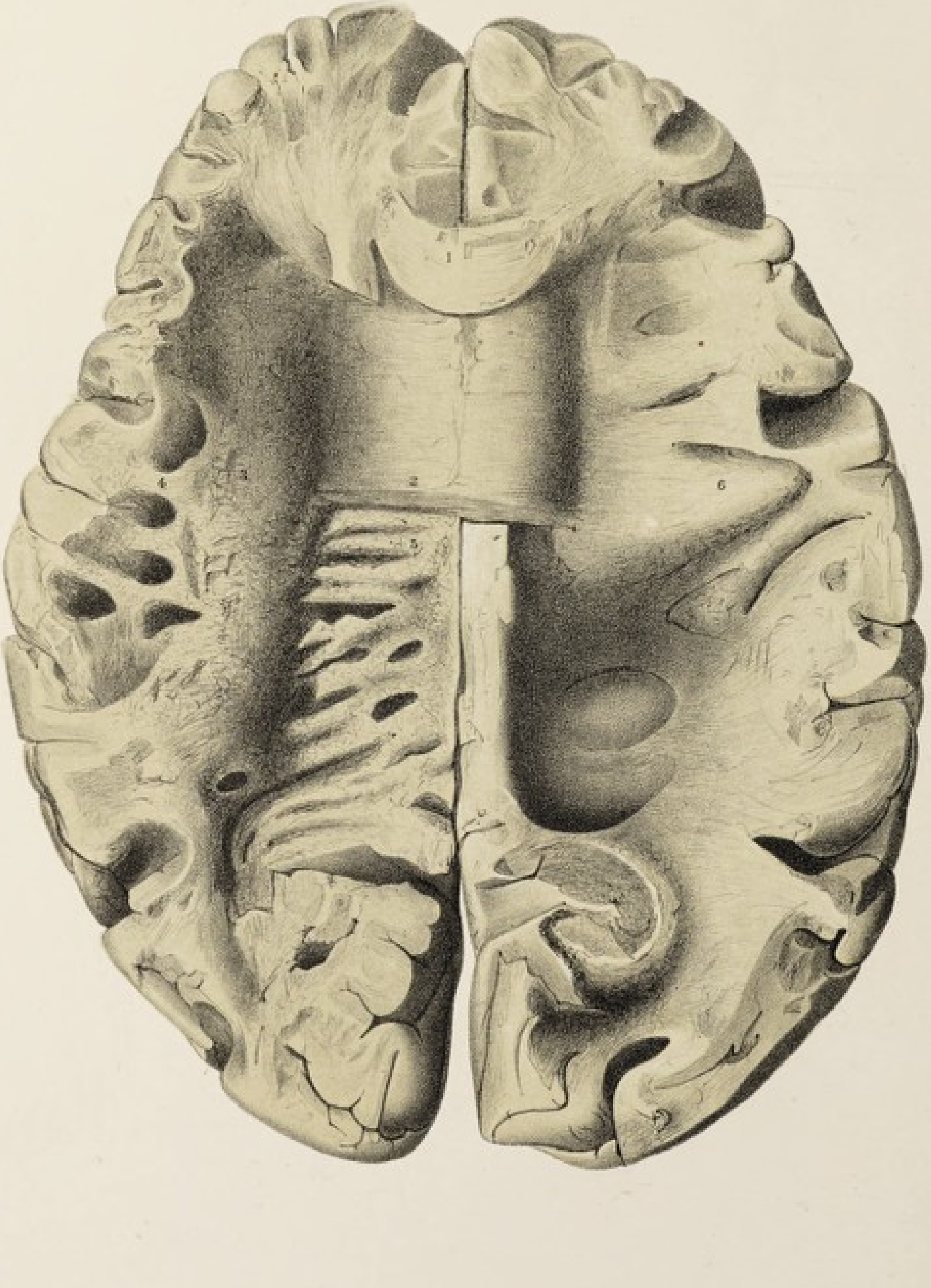

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PLATE X.

This plate represents a horizontal section of the human brain placed on its summit. A large portion of the great commissure has been removed posteriorly. On the left side many of the white stems are seen separated, both on the outer and inner attached side of the great commissure, as they are tending to the convolutions. Other stems which passed between them have been taken away. On the right side towards the outer margin of the great commissure broad layers of white matter in some places are seen passing between or interlacing each other.

1. Anterior roll of the great commissure.

2. Great commissure; the posterior tract has been removed.

3. Fibres passing through the striated body.

4. Stems passing to the convolutions on the outer attached side of the great commissure, and leaving spaces between them for the passage of other stems which have been removed.

5. Stems passing from the inner attached side of the great commissure to the convolutions, and leaving spaces through which other stems were conducted.

6. Planes of fibres interlacing each other, so as to make it appear that the great commissure has more extensive communications with the convolutions than the size of the attached edge would indicate.

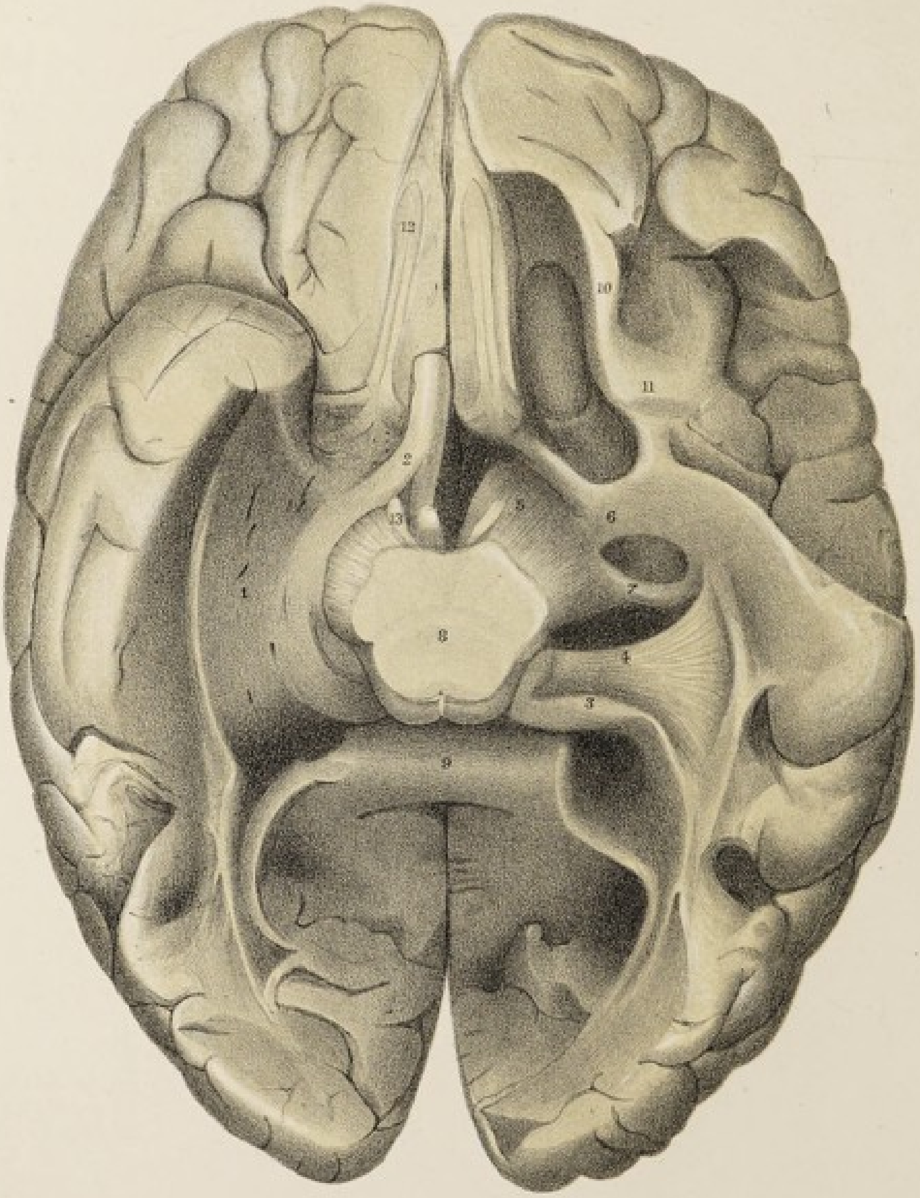

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PLATE XI.

This plate represents the base of the human brain, from which the inferior surface of the middle and posterior lobes has been removed, and the anterior portion of the right middle lobe; the annular tubercle has been cut away near its connection with the crura of the brain. On the left side the roof of the descending horn of the lateral ventricle has been exposed, and its connection with the outer side of the optic tract. On the right side the epithelium of the roof of the descending horn of the lateral ventricle has been removed, as well as a great part of the optic tract. The expansion of the sensitive tract is seen, but its anterior part has been removed for showing the anterior division of the crus of the brain, passing up to the surface of the striated body; also the middle and posterior divisions of the crus of the brain communicating with the outer layer of the anterior division in the grey matter of the internal oval receptacle. The internal oval receptacle has been laid open at its inferior part, and the low convolutions forming the island are seen in the external oval receptacle.

1. Epithelium covering the roof of the left descending horn of the lateral ventricle.

2. Left optic tract.

3. Right optic tract cut off.

4. Expansion of the right sensitive tract; so much of it has not been removed, and therefore it comes more forward than that in 3 of the first figure of the eighth plate.

5. Anterior division of the right crus of the brain ascending to the upper surface of the striated body,

6. Middle division of the right crus of the brain; it is combined with the more exterior grey matter of the striated body in the oval receptacle, and sends one portion to the under margin of the internal oval receptacle, and another to the low convolutions in the external oval receptacle, and joins the perpendicular stratum of white matter which constitutes the parietes of the oval receptacles.

7. Posterior division of the right crus of the brain.

8. Annular tubercle cut off near its connection with the crus of the brain.

9. Posterior roll of the great commissure; at each corner it is seen communicating with the caudiform process proceeding from the posterior margin of the oval receptacles.

10. Margin of the lower part of the partition between the internal and external oval receptacles.

11. Low convolutions in the external oval receptacle forming the island.

12. Olfactory nerve.

13. Third nerve.

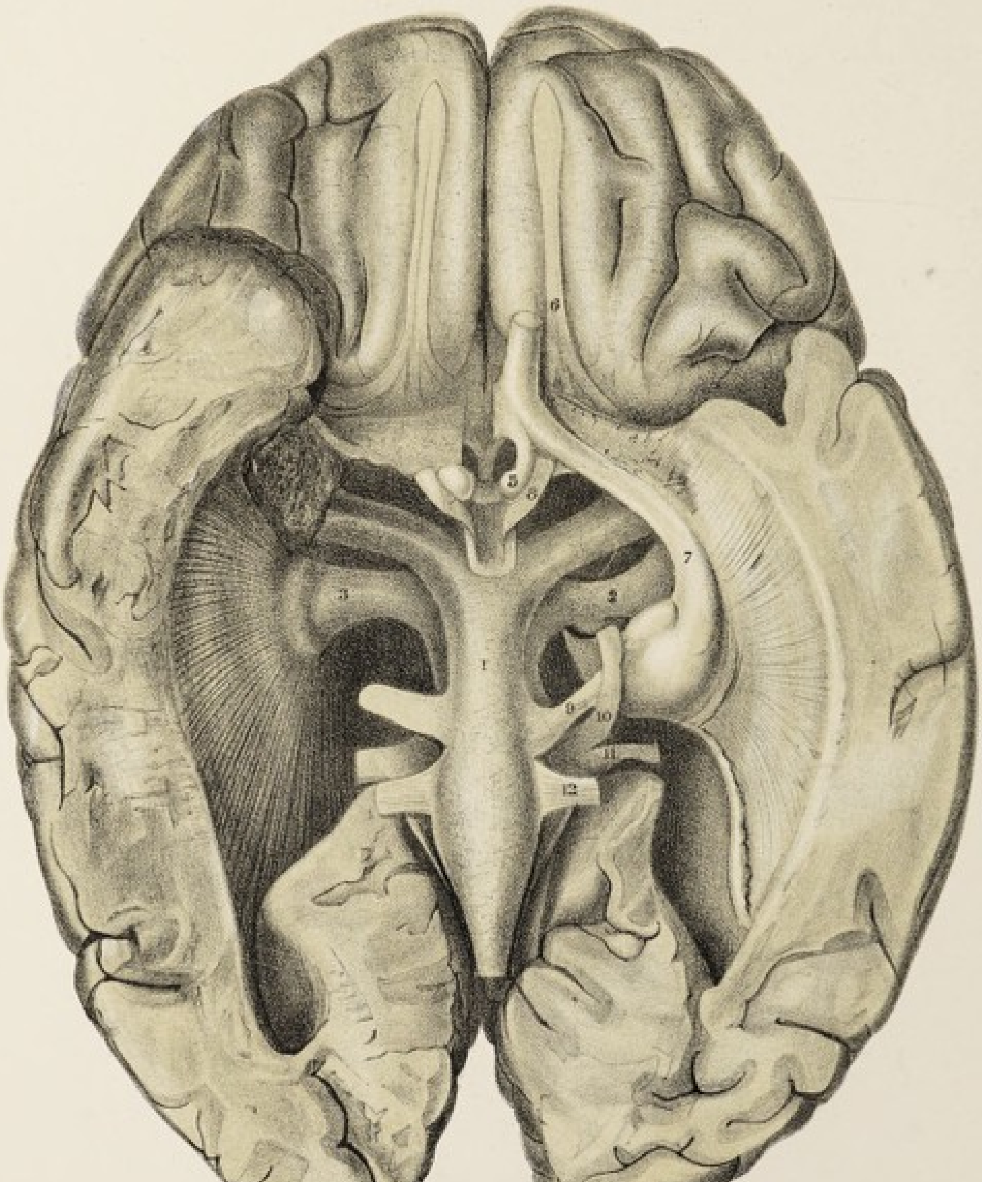

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PLATE XII.

THIS plate represents the base of the human brain, from which parts of the middle and posterior lobes have been removed. The whole of the annular tubercle and crura of the brain have been removed, as well as the anterior pyramidal and olivary bodies. On the left side, the optic tract and nerve have been removed. On the right side, part of the base of the descending horn of the lateral ventricle has been cut away. The epithelium has been carefully peeled off as far as the posterior horn, for showing the beautiful delicate fibres passing from the sensitive tract to the optic tract, and reaching forward as far as the roots of the olfactory nerve. These delicate fibres have been removed along with the optic tract on the left side, and the coarser fibres exhibited in the former plates have been shown. The involuntary tract is seen uppermost in this plate, dividing into two branches for forming a connection with each hemisphere of the brain; on each side the origin of one-half of the larger portion of the fifth nerve from it is seen, as well as the origin of the glosso-pharyngeal nerve and par vagum. The sensitive tract is seen beneath the involuntary, also dividing into two branches; it is separated at the oblong medulla for showing the distinct origin of the other half of the larger portion of the fifth nerve from it, and likewise the auditory nerve. On the left side, the origin of one-half of the larger portion of the fifth nerve from the sentient tract has been removed, but the auditory nerve has been preserved.

1. Involuntary tract.

2. Right branch of the sensitive tract, from which the finer fibres attached to the optic tract proceed.

3. Left branch of the sensitive tract from which the coarser fibres are proceeding.

4. Place at which the anterior portion of the left crus of the brain enters the striated body.

5. Mammillary eminence.

6. Olfactory nerve.

7. Optic tract connected with the fine fibres of the sensitive tract on the right side.

8. Third nerve.

9. Half of the larger portion of the fifth nerve arising from the involuntary tract.

10. The other half of the larger portion of the fifth nerve arising from the sensitive tract.

11. Auditory nerve arising from the sensitive tract.

12. Glosso-pharyngeal nerve and par vagum arising from the involuntary tract.

Fig 1.

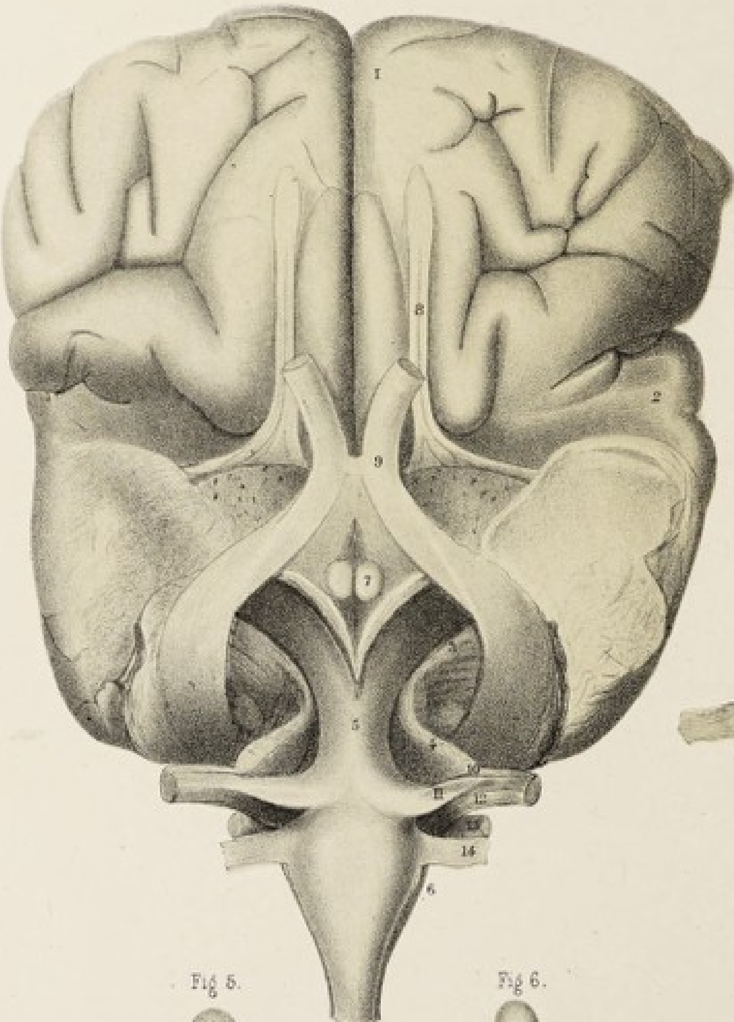

Fig 2.

Fig 3.

Fig 4.

Fig 5.

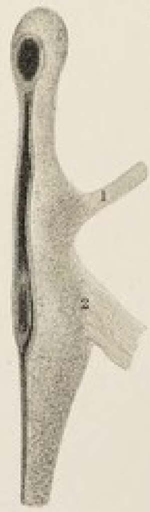

Fig 6.

Fig 7.

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PLATE XIII.

FIGURE I.

In this preparation of the human brain, a great portion of each crus of the brain has been removed, and nearly the whole of the annular tubercle. The anterior pyramidal, the olivary, and restiform bodies have also been removed. A great portion of each side of the anterior and middle lobes of the brain has been removed. The involuntary tract is seen distinctly as far as the optic tracts, but only the margin of the sensitive tract.

1. Anterior lobe of the brain.
2. Middle lobe of the brain.
3. Crus of the brain.
4. Part of the annular tubercle, to which the smaller portion of the fifth nerve, usually considered as the motive, is attached.
5. Involuntary tract, dividing into two branches for the two hemispheres of the brain.
6. Margin of the sensitive tract.
7. Mammillary body.
8. Olfactory nerve.
9. Optic nerve, commissure, and tract.
10. Smaller portion of the fifth nerve arising from the annular tubercle.
11. Half of the larger portion of the fifth nerve arising from the involuntary tract.
12. Half of the larger portion of the fifth nerve arising from the sensitive tract.
13. Auditory nerve arising from the sensitive tract.
14. Glosso-pharyngeal nerve and par vagum arising from the involuntary tract.

FIGURE II.

A perpendicular section of the human involuntary tract for showing the origin of the glosso-pharyngeal nerve and par vagum from it.

FIGURE III.

Anterior view of the human involuntary tract, from near the middle of the annular tubercle to the spinal cord. The restiform body has been turned aside for showing the origin of the glosso-pharyngeal nerve and par vagum from the involuntary tract.

FIGURES IV. V. VI. VII.

Each figure is taken from a separate perpendicular section of the human involuntary tract, for the purpose of showing the distinct origin of one-half of the larger portion of the fifth nerve from it, and likewise the origin of the glosso-pharyngeal nerve and par vagum.

1. Half of the larger portion of the fifth nerve.
2. Glosso-pharyngeal nerve and par vagum.

Fig 2.

Fig 1.

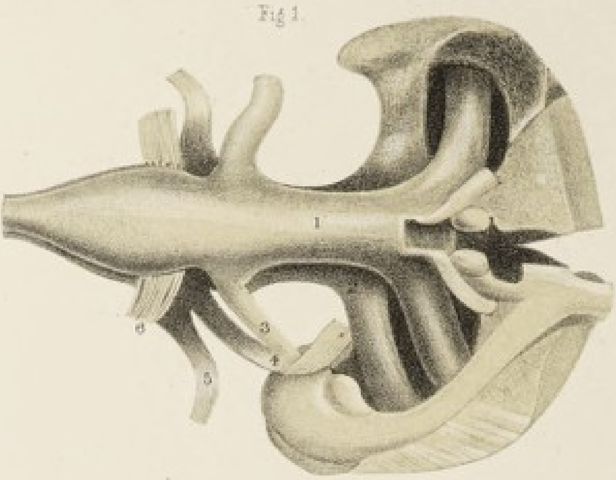

Fig 4.

Fig 3.

Fig 6.

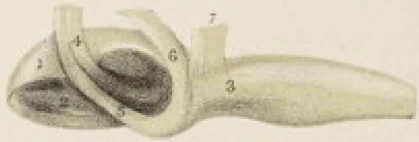

Fig 5.

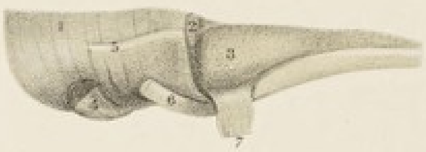

Fig 7.

Fig 8.

Fig 9.

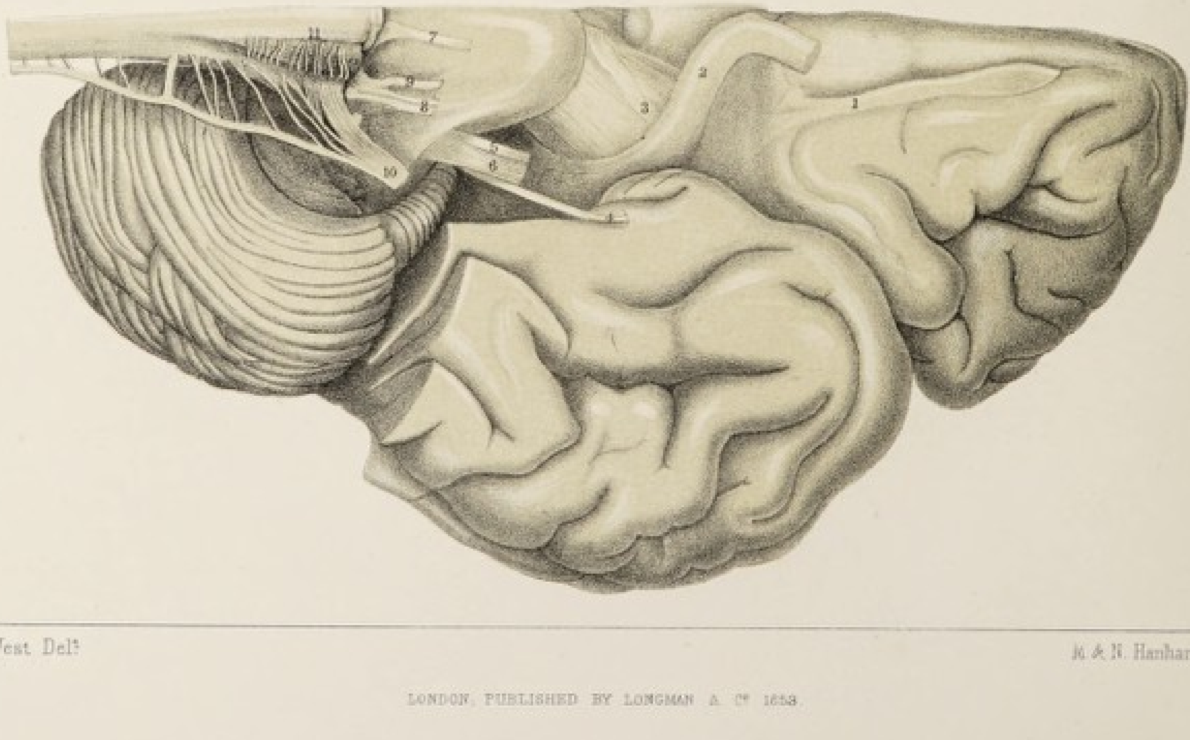

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PLATE XIV.

FIGURE I.

A LATERAL view of part of the base of the human brain, from which the twelfth plate is taken, for the purpose of seeing more distinctly the separate origins of the two halves of the larger portion of the fifth nerve.

1. Involuntary tract.
2. Sensitive tract.
3. Half of the larger portion of the fifth nerve arising from the involuntary tract.
4. Half of the larger portion of the fifth nerve arising from the sensitive tract.
5. Auditory nerve arising from the sensitive tract.
6. Glosso-pharyngeal nerve and par vagum arising from the involuntary tract.

FIGURE II.

The outer side of a portion of the human involuntary tract from which the glosso-pharyngeal nerve and par vagum arise; the sensitive half of the fifth nerve and the auditory have also a slight attachment to it.

1. Sensitive half of the larger portion of the fifth nerve.
2. Auditory nerve.
3. Glosso-pharyngeal nerve and par vagum.

FIGURE III.

The inner side of the same preparation.

1. Sensitive half of the larger portion of the fifth nerve.
2. Auditory nerve.
3. Glosso-pharyngeal nerve and par vagum.

FIGURE IV.

A lateral view of a perpendicular section of the human oblong medulla. All the parts have been removed except the involuntary tract, the restiform body, and a small portion of the sensitive tract.

1. Involuntary tract.
2. Restiform body.
3. Sensitive tract.
4. Half of the larger portion of the fifth nerve conjointly with the auditory arising from the sensitive tract, and having also a slight attachment to the involuntary tract.
5. Auditory nerve.
6. Glosso-pharyngeal nerve and par vagum.

FIGURE V.

A perpendicular section of the human oblong medulla and spinal cord. The pyramidal body and the olivary have been removed for showing the portion of the involuntary tract belonging to the oblong medulla, and the origin of the glosso-pharyngeal nerve and par vagum from it.

1. Annular tubercle.
2. Cut end of the anterior pyramidal body.
3. Involuntary tract showing the broad ganglion belonging to the oblong medulla.
4. Larger portion of the fifth nerve.
5. Sixth nerve.
6. Auditory nerve.
7. Glosso-pharyngeal nerve and par vagum.

FIGURE VI.

The outer side of the human annular tubercle has been removed for showing one-half of the larger portion of the fifth nerve originating from the involuntary tract, and the other half tending towards the sensitive tract conjointly with the auditory nerve. The restiform body is still remaining.

1. Annular tubercle.
2. Part of the involuntary tract covered by the annular tubercle.

3. Restiform body.

4. Half of the larger portion of the fifth nerve arising from the involuntary tract.

5. Half of the larger portion of the fifth nerve leading to the sensitive tract with the auditory nerve.

6. Auditory nerve.

7. Glosso-pharyngeal nerve and par vagum.

FIGURE VII.

In the same preparation the posterior surface showing the fourth ventricle is turned obliquely upwards for the purpose of exhibiting one half of the larger portion of the fifth and the auditory nerve originating from the sensitive tract, but forming also a slight connection with the involuntary tract.

1. Annular tubercle.

2. Involuntary tract covered by the annular tubercle.

3. Surface of the fourth ventricle or sensitive tract.

4. Half of the larger portion of the fifth nerve tending to the involuntary tract.

5. Half of the larger portion of the fifth nerve conjointly with the auditory originating from the sensitive tract.

6. Auditory nerve originating from the sensitive tract, and having a slight connection with the involuntary tract.

FIGURE VIII.

In the same preparation the restiform body has been removed, so that, besides a small portion of the annular tubercle, the involuntary and sensitive tracts alone remain.

1. Part of the annular tubercle.

2. Involuntary tract.

3. Sensitive tract.

4. Half of the larger portion of the fifth nerve arising from the involuntary tract.

5. Half of the larger portion of the fifth nerve arising from the sensitive tract.

6. Auditory nerve.

7. Glosso-pharyngeal nerve and par vagum arising from the involuntary tract.

FIGURE IX.

Part of the posterior lobe of the human brain has been removed; also a small portion of the cerebellum for giving a general view of the origins of the nerves.

1. Olfactory nerve.
2. Optic nerve.
3. Third nerve.
4. Fourth nerve.
5. Smaller portion of the fifth nerve.
6. Larger portion of the fifth nerve.
7. Sixth nerve.
8. Auditory nerve.
9. Hard portion of the seventh nerve.
10. Glosso-pharyngeal, par vagum, and accessary nerve.
11. Ninth nerve.

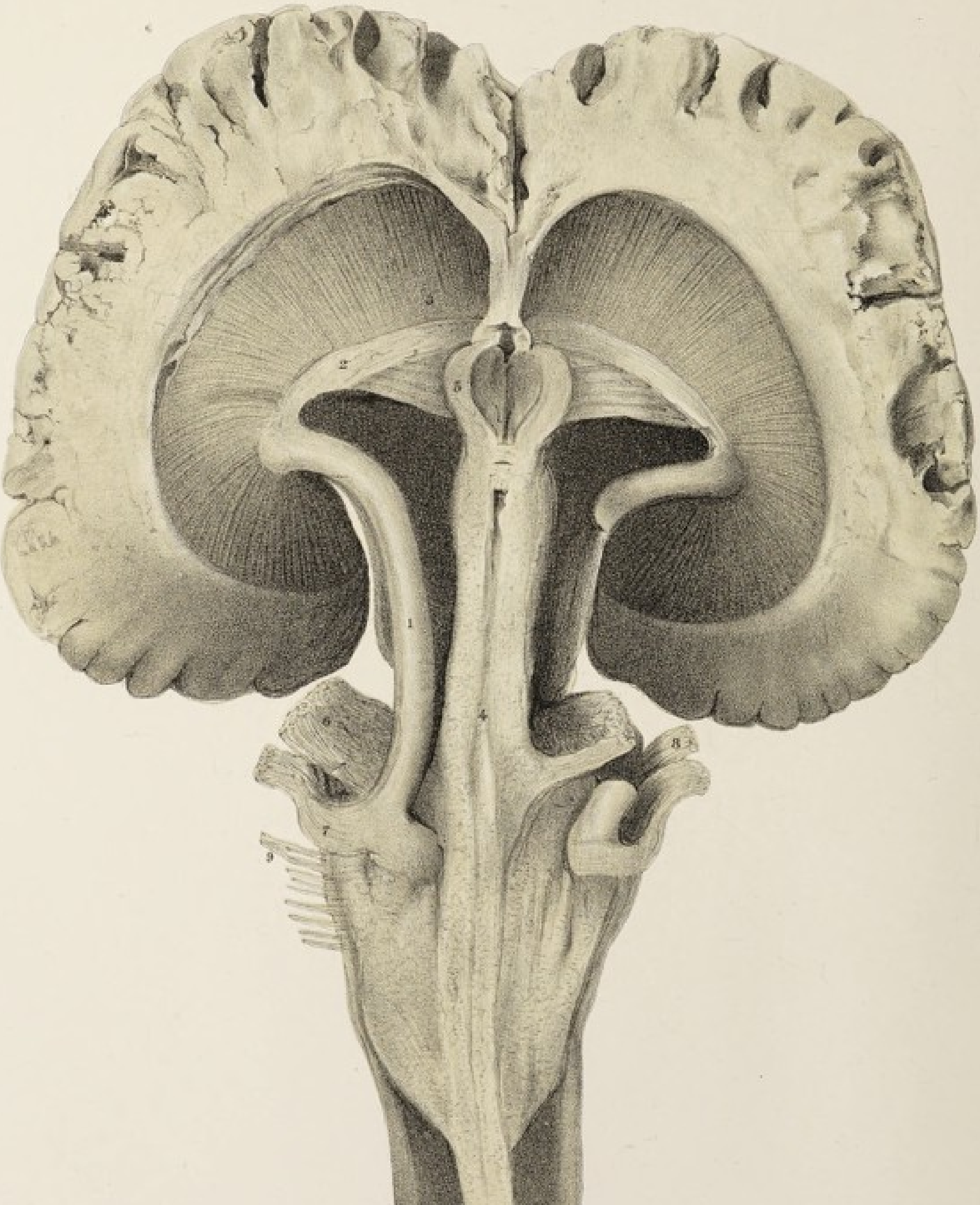

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PLATE XV.

In making this preparation of the brain of the horse, *equus caballus*, the great commissure was divided longitudinally, and the inner margin was removed with the convolutions proceeding from it to the summit of the brain. Part of the sensitive tract on the right side has been cut away, and the quadrigeminal bodies on both sides. The stems of the pedicles of the cerebellum have been almost entirely removed for showing the origins of the larger portion of the fifth nerve.

1. Sensitive tract; its fibres are seen spread on the posterior part of the lateral ventricle, and on the descending horn beneath the epithelium.

2. Tænia.

3. Continuation of fibres proceeding from the crus of the brain to pass through the striated body to the great commissure and convolutions.

4. Involuntary tract to which half of the larger portion of the fifth nerve is attached.

5. Ring of the involuntary tract sending fibres through the narrow end of the striated body.

6. Larger portion of the fifth nerve arising from the sensitive and involuntary tracts. On the right side the roots proceeding from the sensitive tract are loose, as the tract has been cut away at this part; but they are seen on the left side; and on both sides the origins from the involuntary tract are distinct.

7. Auditory nerve.

8. Hard portion of the seventh nerve.

9. Filaments of the glosso-pharyngeal nerve and par vagum extended from the involuntary tract.

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PLATE XVI.

In making this preparation of the brain of the horse, *equus caballus,* the great commissure was divided longitudinally, and the inner margin with the convolutions attached to it was removed. The convolutions also proceeding from the inner attached margin of the great commissure posteriorly have been removed for showing the ascent of the involuntary tract, and some of the fibres of the sensitive tract, to their appropriate convolutions on the outer side of the summit of the brain. The lateral ventricle was laid open throughout, and the fornix and great hippocampus removed. The cerebellum was cut away. The surface of the striated body was removed, also the surface of the thalamus, and its continuation into the optic tract. The quadrigeminal bodies were separated in the median line, and their connection with the sensitive tract shown.

1. Sensitive tract passing to its appropriate convolutions on the outer margin of the summit of the brain, and sending fibres beneath the epithelium of the lateral ventricle.

2. Quadrigeminal bodies communicating with the sensitive tract.

3. Tænia.

4. Continuation of fibres from the crus of the brain to pass through the striated body to the great commissure and convolutions.

5. Involuntary tract spreading out into a spade-shaped substance near the oblong medulla, and becoming narrower as it approaches the spinal cord.

6. Ring of the involuntary tract sending fibres through the narrow end of the striated body at the outer margin of the great commissure to its appropriate convolutions at the outer side of the summit of the brain.

7. Stem of the pedicles of the cerebellum.

8. Anterior pedicle of the cerebellum passing to the crus of the brain.

9. Auditory nerve.

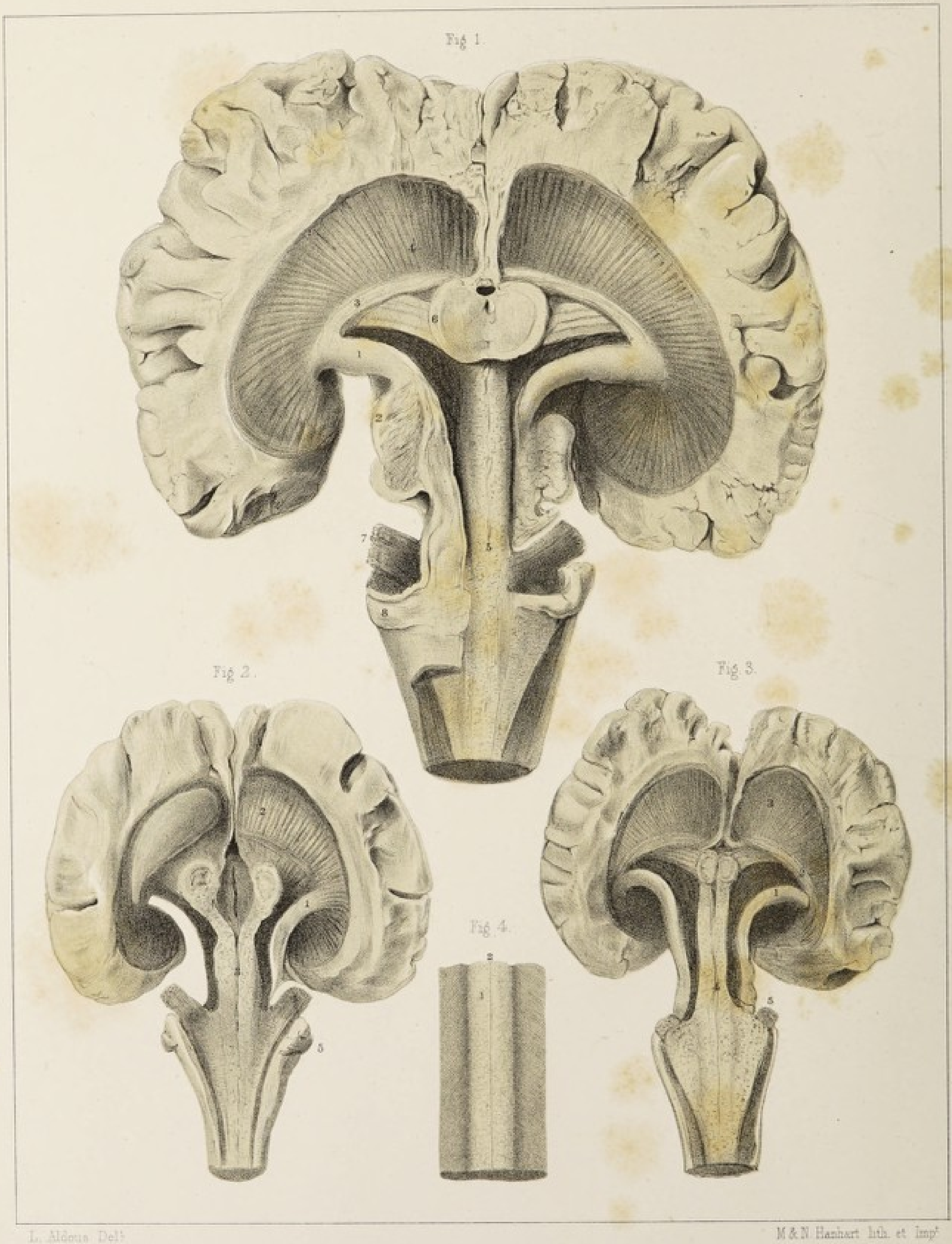

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PLATE XVII.

FIGURE I.

This preparation of the brain of the ox, *bos taurus*, was made in the same way as that of the horse in the fifteenth plate.

1. Sensitive tract. Its fibres are seen spread on the posterior part of the lateral ventricle and in the descending horn.
2. Quadrigeminal bodies communicating with the sensitive tract.
3. Tænia.
4. Continuation of fibres from the crus of the brain to pass through the striated body to the great commissure and convolutions.
5. Involuntary tract spreading into a spade-like substance near the oblong medulla, and becoming narrower as it approaches the spinal cord.
6. Ring of the involuntary tract sending fibres through the narrow end of the striated body.
7. Larger portion of the fifth nerve arising from the sensitive and involuntary tracts.
8. Auditory nerve.

FIGURE II.

A similar preparation of the brain of the pig, *sus scrofa*. The striated body has been left perfect on the left side.

1. Sensitive tract.
2. Continuation of the crus of the brain through the striated body.
3. Involuntary tract.
4. Larger portion of the fifth nerve.
5. Auditory nerve.

FIGURE III.

A similar preparation of the brain of the sheep, *ovis aries*, except that the surface of each striated body has been removed for showing the white fibres passing from the crus of the brain.

1. Sensitive tract.
2. Tænia.
3. Continuation of the fibres of the crus of the brain through the striated body.
4. Involuntary tract.
5. Larger portion of the fifth nerve.

FIGURE IV.

A portion of the spinal cord of the ox, *bos taurus*, seen from the posterior surface for showing the continuation of the involuntary tract.

1. Involuntary tract.
2. Deep fissure between the anterior quarters of the spinal cord.

Fig 1

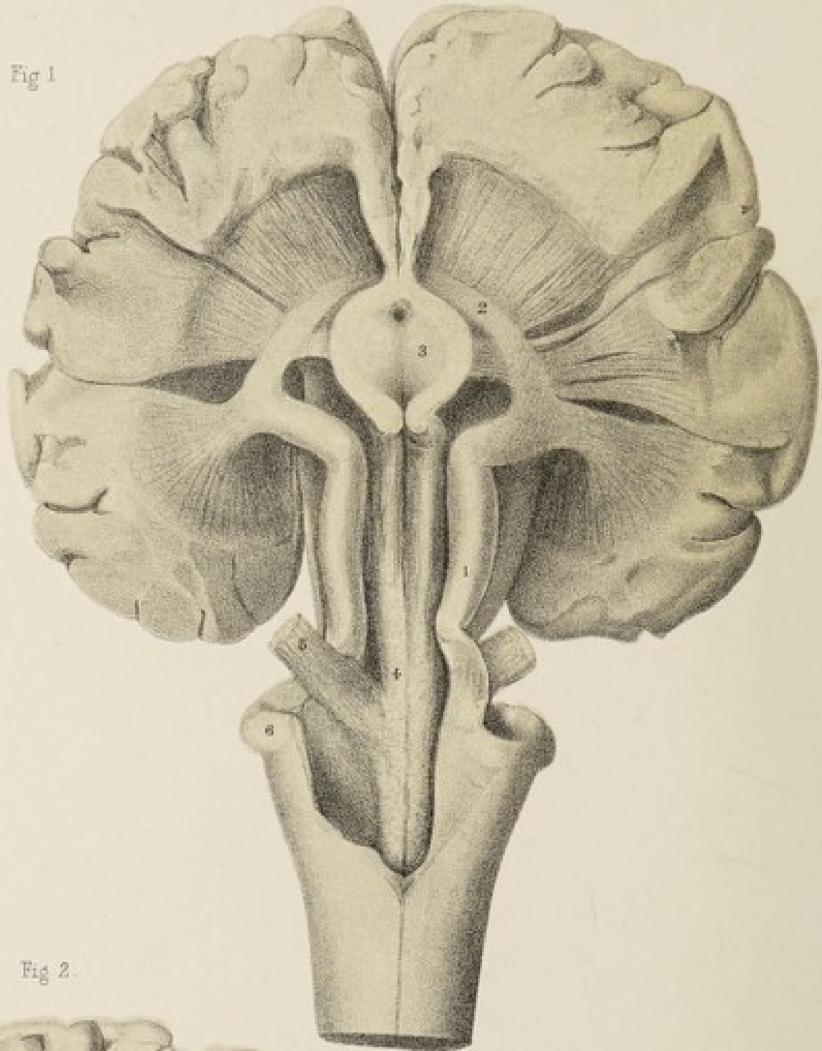

Fig 3

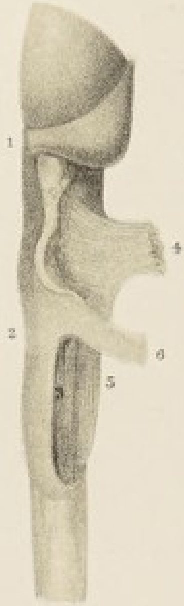

Fig 2.

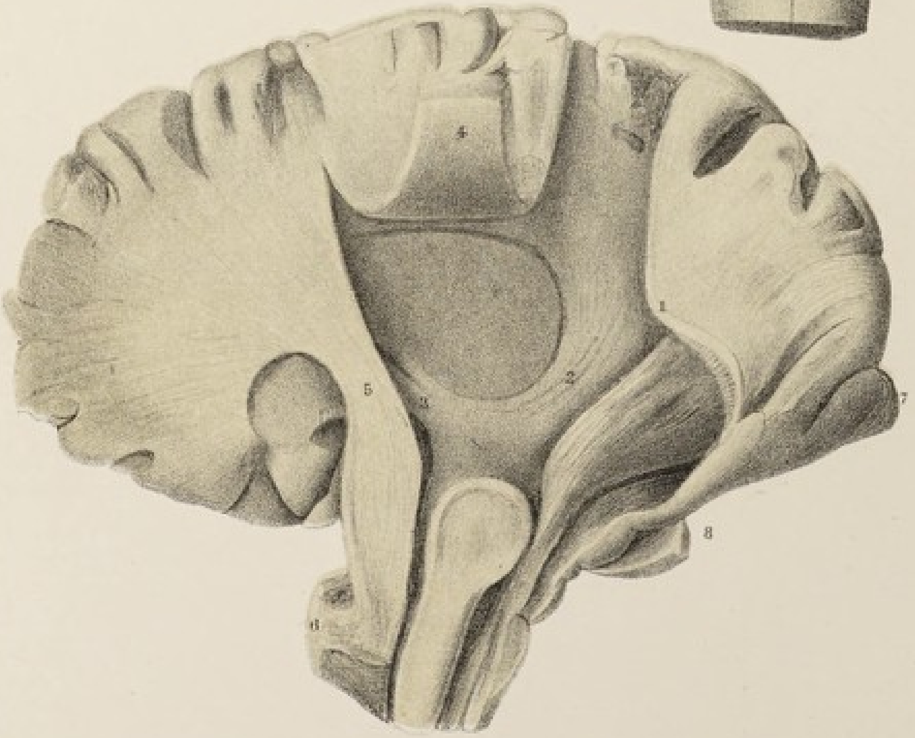

Fig 4

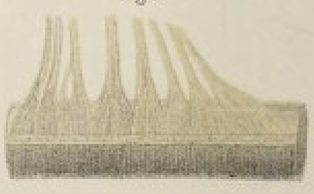

Fig 5

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PLATE XVIII.

FIGURE I.

The great commissure of the brain of the ox, *bos taurus*, was divided longitudinally, and its inner margin, with the convolutions ascending from it, was removed: the convolutions, also proceeding from its outer margin posteriorly, were removed for showing the terminations of the involuntary and sensitive tracts in their appropriate convolutions at the outer part of the summit of the brain. The preparation was, in many respects, made like those in the preceding plate. The quadrigeminal bodies have been removed. The two rings of the involuntary tract remain joined by the soft commissure. The involuntary tract is well seen in its passage from the oblong medulla to the spinal cord.

1. Sensitive tract.
2. Tænia.
3. Middle part of the rings of the involuntary tract joined by the soft commissure; the fibres are seen passing from the rings across the narrow end of the striated body to their appropriate convolutions on the outer side of the summit of the brain.
4. Involuntary tract passing at the lower end of the oblong medulla to the spinal cord.
5. Fifth nerve.
6. Auditory nerve.

FIGURE II.

A perpendicular section of the brain of the horse, *equus caballus*. A great part of the inner layer of the anterior division of the crus of the brain has been removed for showing the outer layer, joined by the second and third divisions of the crus of the brain, passing on the outer side of the involuntary and sensitive tracts, and forming a resemblance of the human external oval receptacle.

1. Part of the inner layer of the anterior division of the crus of the brain sending fibres through the striated body.

2. Second division of the crus of the brain joining the outer layer of the first division.

3. Third division of the crus of the brain joining the outer layer of the first and second divisions, and forming a resemblance of the human external oval receptacle.

4. Involuntary tract separated from its ring and passing to its appropriate convolutions. Part of the inner layer of the anterior division of the crus of the brain, and the convolutions attached to it, have been removed for this purpose.

5. Sensitive tract passing to its appropriate convolutions. Part of the inner layer of the anterior division of the crus of the brain and the convolutions attached to it have been removed for this purpose.

6. Quadrigeminal bodies.

7. Olfactory nerve.

8. Optic nerve.

9. Fifth nerve.

10. Auditory nerve.

FIGURE III.

A lateral view of the oblong medulla of the ox, *bos taurus*, for showing the origin of half of the larger portion of the fifth nerve from the sensitive tract, and the other half from the involuntary tract.

1. Quadrigeminal bodies.

2. Sensitive tract.

3. Involuntary tract.

4. Larger portion of the fifth nerve.

5. Descending part of the larger portion of the fifth nerve arising from the involuntary tract.

6. Auditory nerve arising from the sensitive tract.

FIGURES IV. V.

Preparations of the spinal cord of the ox, *bos taurus,* made by a perpendicular section in the median line, and tracing the roots of the posterior nerves towards the involuntary tract, which lies at the bottom of the deep fissure.

Fig 1.

Fig 2.

Fig 3.

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PLATE XIX.

FIGURE I.

A PERPENDICULAR section of the brain of the horse, *equus caballus*, seen from the median side. The great commissure and the convolutions ascending from its median side were removed; the lateral ventricle was laid open to its lowest extremity; the fornix, hippocampus, and cerebellum were removed.

1. Anterior pyramidal body.
2. Annular tubercle.
3. Crus of the brain.
4. Fibres ascending from the crus of the brain through the striated body.
5. Sensitive tract ascending to communicate with the quadrigeminal bodies, and terminate in fibres on the surface of the lateral ventricle underneath the epithelium. It is seen as far as the division of the fibres on the outer side of the great commissure, in its ascent to its appropriate convolutions on the posterior part of the outer side of the summit of the brain.
6. Quadrigeminal bodies.
7. Involuntary tract; it is seen after it has crossed the narrow end of the striated body, as far as the division of the fibres on the outer side of the great commissure, in its ascent to its appropriate convolutions on the outer side of the summit of the brain.
8. Stem of the pedicles of the cerebellum.
9. Olfactory nerve.

FIGURE II.

A similar preparation of the brain of the pig, *sus scrofa*.

1. Voluntary tract.
2. Sensitive tract.
3. Involuntary tract.

FIGURE III.

A similar preparation of the brain of the sheep, *ovis aries*.

1. Voluntary tract.
2. Sensitive tract.
3. Involuntary tract.

Fig 1.

Fig 4.

Fig 2.

Fig 3.

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PLATE XX.

FIGURE I.

A PERPENDICULAR section of the brain of the ox, *bos taurus*, similar to the preparations for the preceding plate.

1. Anterior pyramidal body.
2. Annular tubercle.
3. Crus of the brain.
4. Tænia.
5. Quadrigeminal bodies.
6. Sensitive tract; part of it is seen distributed underneath the ephithelium on the posterior and descending portions of the lateral ventricle. At the upper part it is seen as far as the division of the fibres on the outer margin of the great commissure in its passage to its appropriate convolutions at the outer side of the posterior part of the summit of the brain.
7. Involuntary tract; after it has crossed the narrow end of the striated body, it is seen as far as the division of the fibres on the outer side of the great commissure in its ascent to its appropriate convolutions on the outer side of the summit of the brain.
8. Stem of the pedicles of the cerebellum.
9. Olfactory nerve.
10. Third nerve.
11. Auditory nerve.

FIGURE II.

This preparation was made after a perpendicular section of the brain of the ox, *bos taurus*, as in that of the preceding figure; the great commissure was then cut away towards the middle and posterior parts for showing the ascent of the involuntary and sensitive tracts to their appropriate convolutions on the outer side of the summit of the brain.

1. Crus of the brain.

2. Part of the tænia.

3. Margin of the great commissure; the intermediate parts have been removed.

4. Sensitive tract; the great commissure has been removed for showing a considerable portion of it ascending to its appropriate convolutions at the outer side of the posterior part of the summit of the brain; also numerous fibres expanded on the surface of the posterior and inferior parts of the lateral ventricle.

5. Quadrigeminal bodies.

6. Involuntary tract, sending fibres from the ring across the narrow end of the striated body, and after the removal of the great commissure, showing their ascent to their appropriate convolutions at the outer side of the summit of the brain.

7. Annular tubercle.

8. Stem of the pedicles of the cerebellum.

9. Olfactory nerve.

10. Third nerve.

11. Fourth nerve.

12. Auditory nerve.

FIGURE III.

A perpendicular section of the brain of the ox, *bos taurus,* similar to that of the preceding figure; the fibres of the sensitive tract, spread on the surface of the lateral ventricle, have been more separated, and the oblong medulla has been cut shorter.

1. Crus of the brain.

2. Quadrigeminal bodies.

3. Margin of the great commissure; a considerable portion of it at the middle and posterior parts has been removed for showing the involuntary tract, and a great part of the sensitive passing to their appropriate convolutions.

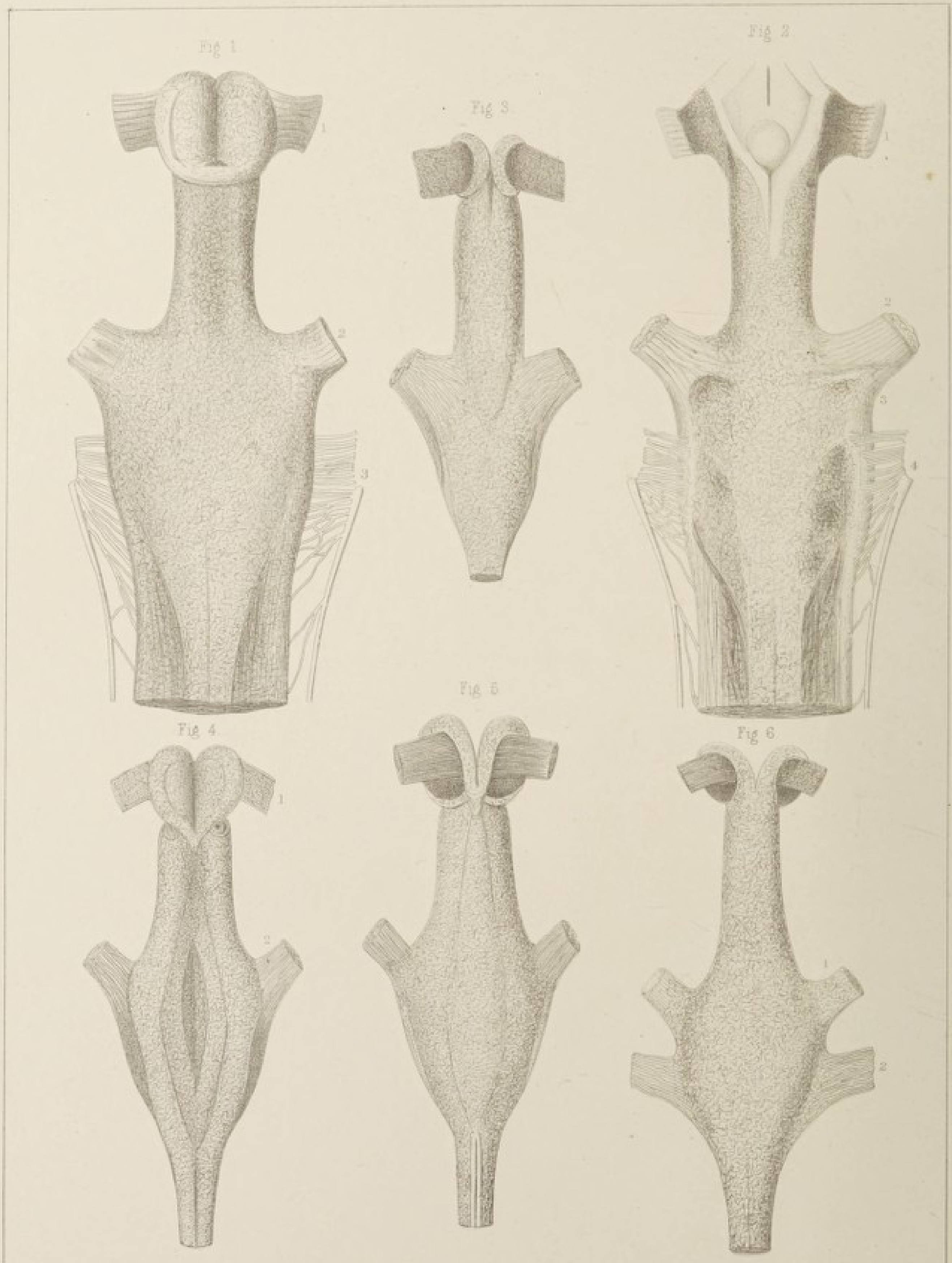
4. Sensitive tract; several portions of it are seen passing to the appropriate convolutions.

5. Involuntary tract, passing to its appropriate convolutions.

FIGURE IV.

A preparation of the spinal cord of the ox, *bos taurus,* made by a perpendicular section in the median line, and tracing the roots of the posterior nerves towards the involuntary tract, which runs at the bottom of the deep fissure.

PLATE XXI.



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M & N. Hanhart Lith. et Imp^t

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PLATE XXI.

FIGURE I.

A PREPARATION of the posterior or upper surface of the involuntary tract of the horse, *equus caballus.*

1. Fibres given off by the ring to pass through the narrow end of the striated body to their appropriate convolutions.

2. Half of the larger portion of the fifth nerve originating from the involuntary tract.

3. Glosso-pharyngeal nerve and par vagum originating from the involuntary tract.

FIGURE II.

The anterior or basal view of the same preparation.

1. Fibres passing from the ring through the narrow end of the striated body.

2. Half of the larger portion of the fifth nerve originating from the involuntary tract.

3. Descending roots of the larger portion of the fifth nerve originating from the involuntary tract.

4. Glosso-pharyngeal nerve and par vagum arising from the involuntary tract.

FIGURE III.

The anterior or basal view of the involuntary tract of the ox, *bos taurus,* showing the half of the larger portion of the fifth nerve and the descending roots arising from it.

FIGURE IV.

Posterior or upper view of the involuntary tract of the ox, *bos taurus.*

1. Fibres arising from the ring, and passing through the narrow end of the striated body to their appropriate convolutions.

2. Half of the larger portion of the fifth nerve and its descending roots arising from the involuntary tract.

FIGURE V.

Anterior or basal view of the same preparation.

FIGURE VI.

Anterior or basal view of another preparation of the involuntary tract in the ox, *bos taurus.*

1. Half of the larger portion of the fifth nerve originating from the involuntary tract.
2. Glosso-pharyngeal nerve and par vagum.

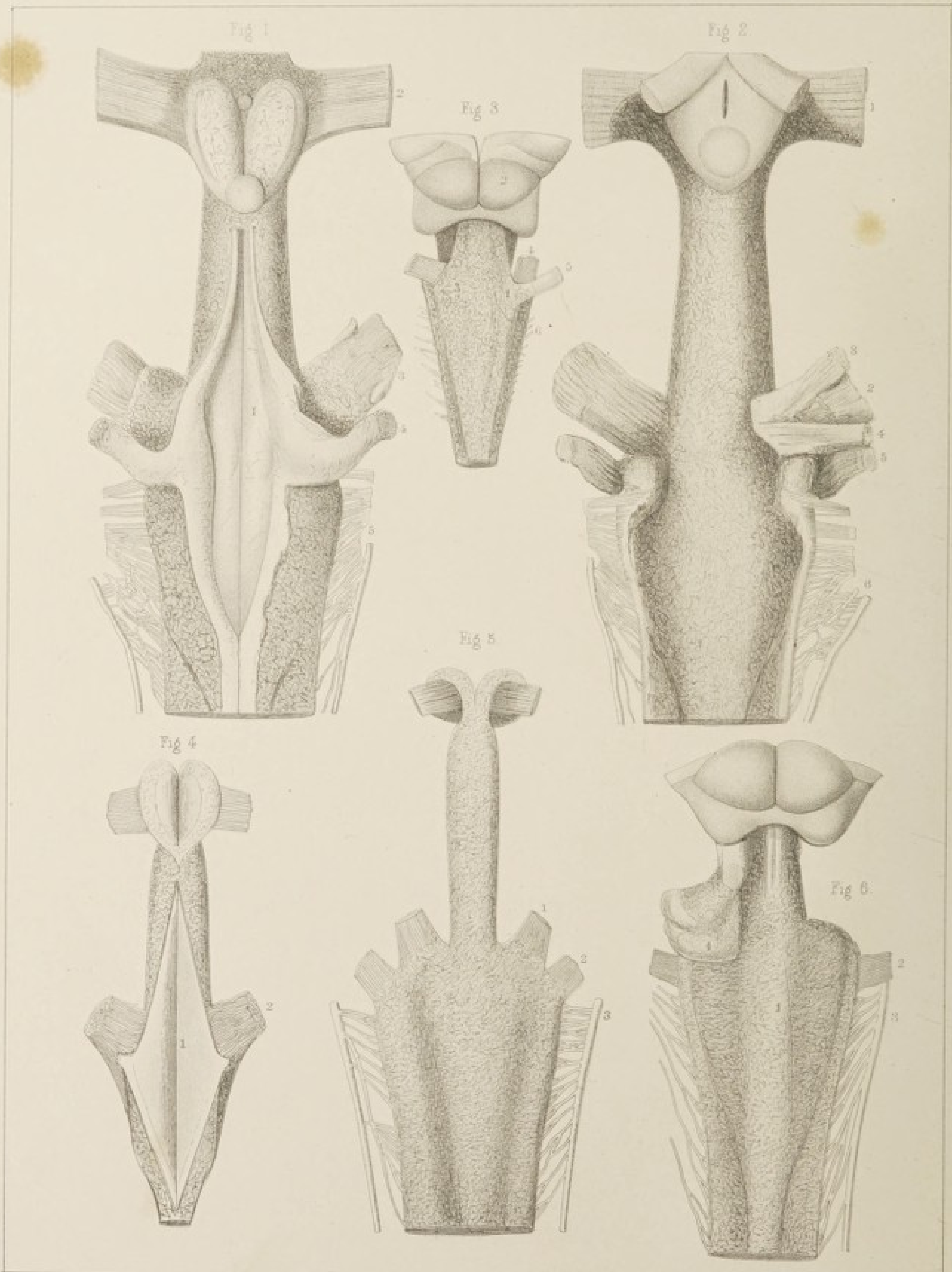

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PLATE XXII.

FIGURE I.

In the preparation of the oblong medulla of the horse, *equus caballus*, from which the two first figures of the preceding plate were taken, the involuntary tract only is preserved, that the distinct connection of one-half of the larger portion of the fifth nerve with it might be seen. In this preparation the sensitive tract also has been preserved for showing at the same time the origin of the other half of the larger portion of the fifth nerve from it. This is the posterior or upper view.

1. Sensitive tract, giving origin to half of the larger portion of the fifth nerve and the auditory.

2. Fibres passing from the ring of the involuntary tract through the narrow end of the striated body to their appropriate convolutions.

3. Larger portion of the fifth nerve arising from the sensitive and involuntary tracts.

4. Auditory nerve arising from the sensitive tract.

5. Glosso-pharyngeal nerve and par vagum arising from the involuntary tract.

FIGURE II.

The anterior or basal view of the same preparation from which the preceding figure was taken. Besides the larger portion of the fifth nerve, the smaller portion usually considered as belonging to muscular motion has been left, with the hard portion of the seventh nerve, the roots of both of which are in contiguity.

1. Fibres of the involuntary tract passing from the ring through the narrow end of the striated body to their appropriate convolutions.

2. Larger portion of the fifth nerve showing part of its origin on the left side from the involuntary tract.

3. Smaller or muscular portion of the fifth nerve.

4. Hard portion of the seventh nerve.

5. Auditory nerve.

6. Glosso-pharyngeal nerve and par vagum arising from the involuntary tract.

FIGURE III.

Anterior view of the oblong medulla of the sheep, *ovis aries.*

1. Sensitive tract.
2. Quadrigeminal bodies.
3. Involuntary tract.
4. Larger portion of the fifth nerve.
5. Auditory nerve.
6. Origins of the glosso-pharyngeal nerve and par vagum.

FIGURE IV.

Posterior or upper view of the sensitive and involuntary tracts, and the larger portion of the fifth nerve arising from both in the ox, *bos taurus.*

1. Sensitive tract.
2. Larger portion of the fifth nerve arising from the sensitive and involuntary tracts.

FIGURE V.

Anterior or basal view of the involuntary tract in the ox, *bos taurus.*

1. Half of the larger portion of the fifth nerve originating from the involuntary tract.

2. Glosso-pharyngeal nerve and par vagum.

3. Accessary nerve.

FIGURE VI.

Posterior or upper view of the involuntary tract in the ox, *bos taurus*, and the origin of the glosso-pharyngeal nerve and par vagum from it.

1. Involuntary tract.
2. Origins of the glosso-pharyngeal nerve and par vagum.
3. Accessary nerve.
4. Auditory nerve.

THE END.

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