niculus cuneatus (16), and ventrad from this the nucleus funiculi cuneati (17, 25). Curving around the funiculus

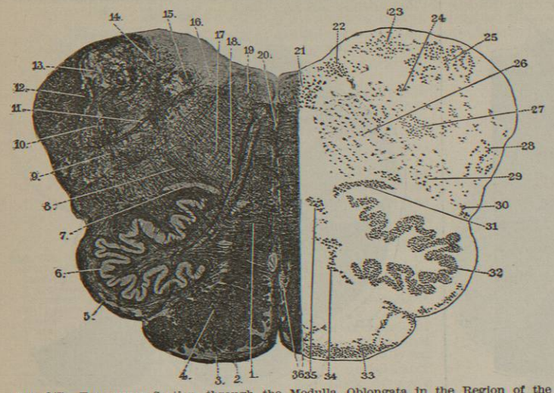

FIG. 947.—Transverse Section through the Medulla Oblongata in the Region of the Nucleus Nervi Hypoglossi and Nucleus Alæ Cinereæ in an Adult Human Being. On the left side the fibres are photographed (Weigert-Wolters' stain); on the right side the cells have been drawn in from Nissl preparations. (After E. Flatau, "Atlas Cerebri Humani," Tab. xi., Fig. A.) 1, Stratum interolivare lemnisci; 2, fibræ arcuatæ superficiales ventrales; 3, nuclei arcuati; 4, pyramis; 5, fibræ arcuatæ superficiales laterales; 6, nucleus olivaris inferior; 7, nucleus olivaris accessorius dorsalis; 8 and 9, fibræ arcuatæ internæ; 10, tractus spinalis nervi trigemini; 11, nervus vagus; 12, corpus restiforme; 13, nucleus funiculi cuneati; 14, remains of the nucleus funiculi gracilis and bundles of the radix descendens nervi vestibuli; 15, tractus solitarius; 16, nucleus alæ cinereæ; 17, formatio reticularis grisea; 18, nervus hypoglossus; 19, nucleus nervi hypoglossi; 20, raphe; 21, nucleus nervi hypoglossi; 22, nucleus nervi vagi; 23, nucleus nervi vestibuli; 24, groups of cells which belong partly to the nucleus funiculi cuneati and partly to the nucleus tractus solitarii; 25, nucleus funiculi cuneati; 26, scattered cells in the formatio reticularis grisea; 27, cells of the substantia gelatinosa; 28, cells of the nucleus lateralis; 29, cells of the nucleus ambiguus; 30, cells of the nucleus lateralis; 31, cells of the nucleus olivaris accessorius dorsalis; 32, cells of the nucleus olivaris inferior; 33, cells of the nuclei arcuati; 34 and 35, cells of the nucleus olivaris accessorius medialis; 36, nuclei arcuati.

cuneatus are a few of the fibræ arcuatæ superficiales dorsales. More ventrally situated is the corpus restiforme (12), here consisting chiefly of the upward continuation of the direct cerebellar tract from the spinal cord. The pale mass of substantia gelatinosa is visible at 13, while lateralward from it are seen in transverse section the descending fibres of the tractus spinalis nervi trigemini (11). Just lateralward from this are more lateral superficial arcuate fibres (10); ventralward from the substantia gelatinosa are situated the nuclei laterales (8, 29). In the zone between the area above described and the radix n. hypoglossi (4, 14) are seen the following structures: the tractus solitarius (18), which represents chiefly descending fibres from the nervus glosso-pharyngeus, the formatio reticularis with many fibræ arcuatæ internæ (9), the nucleus olivaris accessorius dorsalis (7, 30), the nucleus olivaris inferior (5, 31), and the fibræ arcuatæ superficiales laterales (6). In the middle line is seen the raphe extending from the fissura longitudinalis ventralis (1) to the floor of the fourth ventricle (21). From the dorsal surface ventralward between the raphe and the radix n. hypoglossi the following structures are met with: Below the gray matter are seen in transverse section the fibres of the fasciculus longitudinalis medialis. Ventral from this are the transverse sections of the fibres of the stratum interolivare lemnisci which are made up of internal arcuate fibres which have crossed the raphe and turned to run longitudinally. Among these fibres some small cells are present (32). At the most ventral part of the interolivary layer of the lemniscus are seen many transverse fibres; at the level of the olive (2) the large bundle of white fibres on the ventral surface is the pyramis (3). At the periphery of the pyramid a few cells are seen which represent a continuation downward of the nuclei arcuati of the pons.

If a section be taken still higher up the relations become somewhat more complex (see Fig. 947). The fourth ventricle has become much wider, the two halves of the medulla are separated

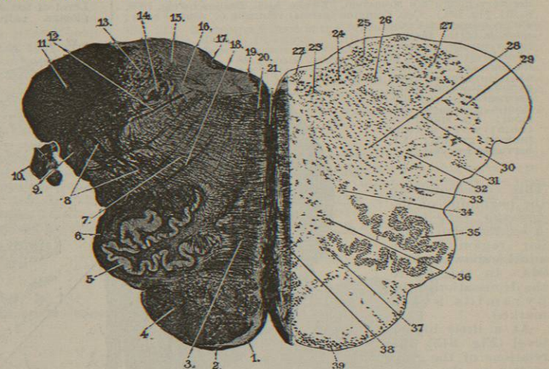

FIG. 948.—Transverse Section through the Medulla Oblongata at the Level of the Nervus Vagus and Nervus Glosso-Pharyngeus in an Adult Human Being. (On the left side, photograph of a fibre preparation; on the right side the cells have been drawn in from Nissl preparations. (After E. Flatau, "Atlas Cerebri Humani," Tab. xi., Fig. 13.) 1, Nuclei arcuati; 2, fibræ arcuati superficiales ventrales; 3, stratum interolivare lemnisci; 4, pyramis; 5, nucleus olivaris inferior; 6, fibræ arcuatæ superficiales laterales; 7, formatio reticularis grisea with fibræ arcuatæ internæ; 8, fibræ cerebello-olivares; 9, tractus spinalis nervi trigemini; 10, extra-medullary bundle of the nervus vagus and nervus glosso-pharyngeus; 11, corpus restiforme; 12, bundle of the nervus glosso-pharyngeus (the radial fibres running medial from this and not lettered represent the motor fibres of the vagus and glosso-pharyngeal nerves); 13, radix descendens nervi vestibuli; 14, tractus solitarius; 15, nucleus nervi vestibuli; 16, nucleus nervi glosso-pharyngei; 17, striæ medullares; 18, radial fibres in the formatio reticularis grisea (at the boundary between the fibræ arcuatæ internæ and the fibræ cerebello-olivares); 19, nucleus funiculus teretis; 20, fasciculus longitudinalis medialis; 21, raphe; 22, nucleus funiculi teretis; 23, cells which lie dorsalward from the fasciculus longitudinalis medialis and belong to the cells of the formatio reticularis grisea; 24, nucleus nervi vagi; 25, nucleus nervi vestibuli medialis; 26, nucleus nervi glosso-pharyngei; 27, cells of the nucleus nervi vestibuli lateralis (Deiters) and of the remains of the dorsal horn of the spinal cord; 28, scattered cells of the formatio reticularis grisea; 29, cells belonging to 27; 30, cells of the substantia gelatinosa; 31, nucleus lateralis; 32, cells of the nucleus ambiguus; 33, nucleus lateralis (?); 34, cells of the nucleus olivaris accessorius dorsalis; 35, 36, 37, cells of the nucleus olivaris inferior; 38, 39, cells of the nuclei arcuati.

from each other by the raphe (20). In the floor of the fourth ventricle, passing from the middle line lateralward, are seen the nucleus n. hypoglossi (19, 21), the nucleus alæ cinereæ (16, 22), the tractus solitarius (15), and the lower portion of the nucleus n. vestibuli (23), near which are a few fibres of the fasciculus cuneatus and some fibres of the radix descendens n. vestibuli (14). Each half of the medulla is divisible by means of the radix n. vagi and the radix n. hypoglossi into three compartments: one lateral between the dorso-lateral edge and the radix n. vagi, one middle between the radix n. vagi and the radix n. hypoglossi, and one medial between the radix n. hypoglossi and the raphe.

In the lateral compartment can be seen the corpus restiforme (12), the nucleus funiculi cuneati (13, 25), the tractus spinalis n. trigemini (10), and the substantia gelatinosa (27).

In the middle compartment there are the fibræ arcuatæ superficiales laterales (5), the nucleus olivaris inferior (6, 32), the nucleus olivaris accessorius dorsalis (7, 31), the fibræ arcuatæ internæ (8, 9), the formatio reticularis grisea (17, 26), the nuclei laterales (28), and the nucleus ambiguus (29) which is regarded as the motor nucleus of origin of the n. vagus and the n. glosso-pharyngeus.

In the medial compartment, passing from the dorsal surface ventralward, is seen the stratum interolivare lemnisci (1), the ventral superficial arcuate fibres (2), the pyramis (4), the nuclei arcuati (3), and the nucleus olivaris accessorius medialis (34, 35).

In the next section (Fig. 948), taken from the upper part of the medulla oblongata, the fourth ventricle is very wide and the corpus restiforme has become very markedly developed. In the floor of the fourth ventricle, passing from the middle line lateralward, are seen the nucleus funiculi teretis (19, 22), the nucleus alæ cinereæ (24), the striæ medullares or striæ acustici (17), the nucleus n. vestibuli medialis (15, 25). The corpus restiforme (11) is seen as a large mass of fibres cut transversely at the lateral dorsal angle of the cross section. Just medial to it are seen the bundles of the radix descendens n. vestibuli (13). In many of these bundles are masses of gray matter (27) which represent chiefly the nuclei of the descending root of the vestibular nerve. The round bundle formed by the tractus solitarius (14) is clearly visible, and close to it the nucleus tractus solitarii (26); at 9 the tractus spinalis n. trigemini is seen crossed by black bundles of fibres, the fibræ cerebello-olivares (8). Medial from the tractus spinalis n. trigemini are situated the cells of the substantia gelatinosa (30). The nucleus lateralis (31) is still visible. The motor nucleus of the n. vagus and of the n. glosso-pharyngeus, or so-called nucleus ambiguus, is visible. At this level (33) the fibræ arcuatæ internæ (7) are numerous, crossing the formatio reticularis grisea and running toward the raphe. The nucleus olivaris inferior (5, 35) is accompanied by the nucleus olivaris accessorius dorsalis (34) and the nucleus olivaris accessorius medialis (37). Dorso-lateral from the olive are the fibræ arcuatæ superficiales laterales. In the middle line is seen the raphe and close to it the fasciculus longitudinalis medialis (20), the stratum interolivare lemnisci (3), and the pyramis (4); running around the pyramid are the fibræ arcuatæ superficiales ventrales (2), and the nuclei arcuati (1, 38, 39).

The section which follows (Fig. 949) is taken at the uppermost part of the medulla oblongata just where it goes over into the pons. Here the fourth ventricle is at its widest, and running transversely across it are seen the striæ medullares (16). Connected lateralward with the

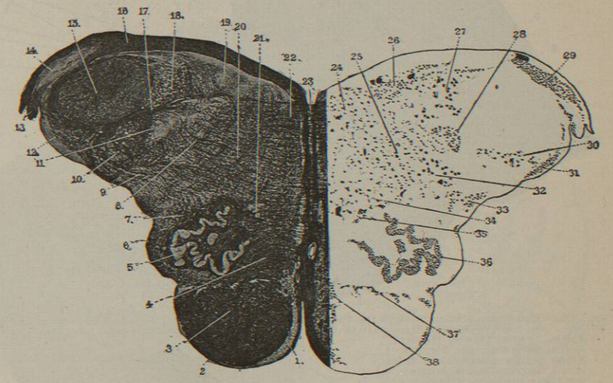

FIG. 949.—Transverse Section through the Proximal Part of the Medulla Oblongata at the Region of Entrance of the Nervus Acusticus in an Adult Human Being. On the left the fibres have been photographed; on the right the cells have been drawn in. (After E. Flatau, "Atlas Cerebri Humani," Tab. xii., Fig. A.) 1, Nuclei arcuati; 2, fibræ arcuatæ superficiales ventrales; 3, pyramis; 4, stratum interolivare lemnisci; 5, nucleus olivaris inferior; 6, fibræ arcuatæ superficiales laterales; 7, fasciculus tegmenti centralis, or centrale Haubenbahn of von Bechterew; 8, fibræ arcuatæ internæ; 9, fibræ cerebello-olivares; 10, tractus spinalis nervi trigemini; 11, substantia gelatinosa; 12, nucleus nervi cochleæ ventralis; 13, nervus cochleæ; 14, nucleus nervi cochleæ dorsalis (tuberculum acusticum); 15, corpus restiforme; 16, striæ medullares (very markedly developed); 17, radix nervi glosso-pharyngei; 18, radix descendens nervi vestibuli; 19, nucleus nervi vestibuli medialis; 20, formatio reticularis grisea; 21, stratum interolivare lemnisci; 22, fasciculus longitudinalis medialis; 23, raphe; 24, cells dorsal from the fasciculus longitudinalis medialis connected with the nucleus reticularis tegmenti; 25, scattered cells of the tegmentum (von Bechterew's nucleus reticularis tegmenti); 26, nucleus nervi vestibuli medialis; 27, nucleus nervi vestibuli lateralis (Deiters); 28, cells of the substantia gelatinosa; 29, cells of the tuberculum acusticum; 30, tongue-like collection of cells; 31, ventro-medial continuation of the nucleus nervi cochleæ ventralis; 32, nucleus nervi facialis; 33, nucleus lateralis; 34, large multipolar cells (connected with the scattered cells of the formatio reticularis grisea); 35, nucleus olivaris accessorius dorsalis; 36, cells of nucleus olivaris inferior; 37, scattered cells at the dorsal periphery of the pyramid (beginning nuclei pontis); 38, cells of the nuclei arcuati.

nucleus n. cochleæ dorsalis or tuberculum acusticum (14) is the n. cochleæ. In the floor of the fourth ventricle, passing from the middle line lateralward, can be seen some cells of the nucleus reticularis tegmenti (24) and the nucleus n. vestibuli medialis (19, 26). The corpus restiforme (15) is separated from the periphery by the dorsal cochlear nucleus (14, 29); medial from it the radix descendens n. vestibuli is present in the form of numerous discrete bundles in among which are situated the large multipolar ganglion cells of Deiters' nucleus (nucleus n. vestibuli lateralis) (27). Ventral from the corpus restiforme and the radix descendens n. vestibuli are seen the root fibres of the n. glosso-pharyngeus (17). A portion of the nucleus n. cochleæ ventralis is visible (12, 31). Ventralward from the root fibres of the glosso-pharyngeal nerve are seen the fibres of the tractus spinalis n. trigemini (10), and medial from them the cells of the substantia gelatinosa (11, 28). The formatio reticularis (20) is well developed. It is crossed as in the sections below by many fibræ arcuatæ internæ (8); the fibræ cerebello-olivares are still visible (9). The section passes through the upper part of the nucleus olivaris inferior (5) and a portion of the nucleus olivaris accessorius dorsalis (21, 35). The fibræ

arcuatæ superficiales laterales are still present (6), and dorso-lateral from the olive are seen some of the fibres of the fasciculus tegmenti centralis or centrale Haubenbahn

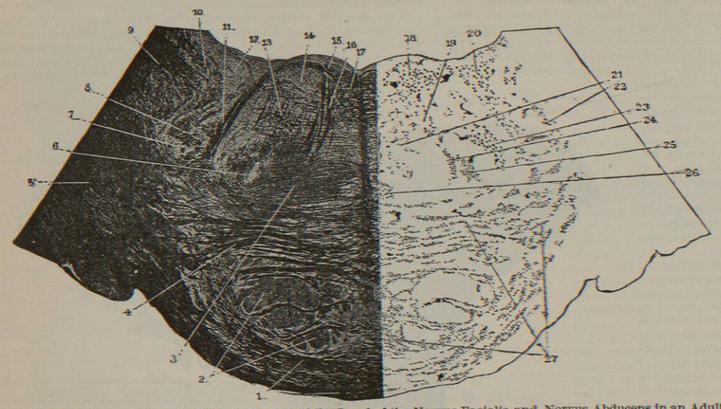

FIG. 950.—Transverse Section through the Pons at the Level of the Nervus Facialis and Nervus Abducens in an Adult Man. On the left side the fibres have been photographed; on the right the cells have been drawn in. (After E. Flatau, "Atlas Cerebri Humani," Berlin, 1899, Tab. xii., Fig. B.) 1, Fibræ pontis superficiales; 2, fasciculi longitudinales pontis; 3, lemniscus medialis; 4, fibræ pontis profundæ; 5, brachium pontis; 6, nucleus olivaris superior; 7, substantia gelatinosa (beginning sensory nucleus of the trigeminus); 8, tractus spinalis nervi trigemini; 9, corpus restiforme (ascending to cerebellum); 10, radix descendens nervi vestibuli; 11, radix nervi facialis pars secunda; 12, nucleus nervi vestibuli medialis; 13, formatio reticularis grisea with ascending fibres from the nucleus nervi facialis and fibres from the nucleus olivaris superior to the nucleus nervi abducentis; 14, nucleus nervi abducentis; 15, genu internum nervi facialis; 16, nervus abducens; 17, fasciculus longitudinalis medialis; 18, nucleus nervi abducentis; 19, cells of formatio reticularis grisea; 20, nucleus nervi vestibuli lateralis Deiters; 21, nucleus reticularis tegmenti von Bechterew; 22, cells of the substantia gelatinosa; 23, cells of the proximal part of the nucleus nervi facialis or of the distal motor nucleus of the nervus trigeminus; 24 and 25, cells of the nucleus olivaris superior; 26, continuation of the nuclei pontis in the tegmentum; 27, nuclei pontis.

of von Bechterew (7). A good many fibres run longitudinally in the raphe (28). The fasciculus longitudinalis medialis (22) is larger than in the sections below. The stratum interolivare lemnisci (4) is highly developed just before going over into the lemniscus medialis of the pons. The pyramis (3) is large, is surrounded by the fibræ arcuatæ superficiales ventrales, and has close to it the nuclei arcuati (1, 38).

In sections through the pons we have to distinguish between the pars dorsalis pontis and the pars basilaris pontis. The pars basilaris pontis includes the large fasciculi longitudinales of the pons, the large bundles of transverse fibres of the pons, and the great gray masses known as the nuclei pontis. The pars dorsalis pontis includes the upward continuation of the medulla oblongata with the exception of the pyramids. It contains the nuclei of the nerves connected with the pons, the fasciculus longitudinalis medialis, the medial and lateral lemnisci, the corpus trapezoideum, the formatio reticularis and the superior olivary complex. In Fig. 950 some of the principal structures of the lower part of the pons are shown.

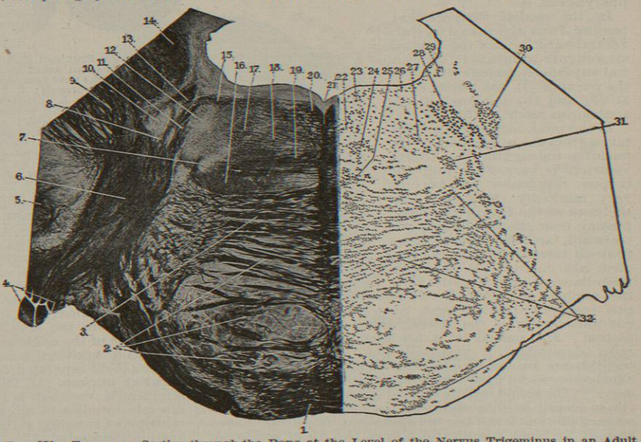

FIG. 951.—Transverse Section through the Pons at the Level of the Nervus Trigeminus in an Adult Human Being. On the left side the fibres have been photographed; on the right side the cell bodies have been drawn in. (After E. Flatau, "Atlas Cerebri Humani," Tab. xiii., Fig. A.) 1, Fibræ superficiales pontis; 2, fasciculi longitudinales pontis; 3, fibræ pontis profundæ; 4, radix nervi trigemini; 5, brachium pontis; 6, radix nervi trigemini; 7, nucleus olivaris superior; 8, radix nervi trigemini pars sensorius; 9, corpus restiforme; 10, nucleus sensorius nervi trigemini; 11, radix motorius nervi trigemini; 12, nucleus motorius princeps nervi trigemini; 13, radix descendens mesencephalica nervi trigemini; 14, brachium conjunctivum; 15, crossed fibres of nervus trigeminus; 16, lemniscus medialis; 17, formatio reticularis tegmenti; 18, fibræ arcuatæ internæ tegmenti; 19, fibræ arcuatæ internæ ventrales (compact bundle); 20, fasciculus longitudinalis medialis; 21, raphe; 22, cells of the middle line; 23, cells at the dorso-lateral part of the fasciculus longitudinalis medialis (connecting with the cells of the middle line); 24 and 25, nucleus centralis tegmenti, a large aggregation of cells in the tegmentum at the ventral part of the middle line related to the nuclei pontis); 26, cells of the stratum griseum centrale; 27, scattered large cells of the tegmentum (nucleus magnocellularis diffusus of von Kölliker); 28, nucleus motorius princeps nervi trigemini; 29, cells of the locus cœruleus; 30 nucleus sensorius nervi trigemini; 31, cells of the nucleus olivaris superior; 32, nuclei pontis.

The section is taken at the level of the nuclei of origin of the n. facialis and the n. abducens. In the pars dorsalis pontis the raphe is seen in the middle line. The nucleus n. abducentis is situated close to the floor of the fourth ventricle (14, 18). Running ventralward from the medial side of the nucleus are seen the root fibres of the n. abducens (16); the nucleus n. facialis is present (23); the pars prima of the radix n. facialis exists as a number of scattered fibres radiating dorsalward and medialward (13). The genu internum n. facialis (15) is indicated just medial to the nucleus n. abducentis, the pars secunda of the radix n. facialis passing obliquely ventralward and lateralward at 11. A portion of the nucleus n. vestibuli is shown near the floor of the fourth ventricle (12, 20), and lateral from it still some fibres of the radix descendens n. vestibuli (10). At this level the corpus restiforme (9) turns dorsalward to enter the cerebellum. The mass of fibres of the brachium pontis (5) are shown in their relation to the transverse fibres of the pons. Near the raphe, in the formatio reticularis, is a mass of cells, the so-called nucleus reticularis tegmenti of von Bechterew (21). The cells of the substantia gelatinosa (22) are seen chiefly medial to the fibres of the tractus spinalis n. trigemini (8). Running transversely across the pons at the most ventral part of the pars dorsalis pontis are seen the fibres of the corpus trapezoideum, and in between these fibres run lengthwise the fibres of the lemniscus medialis (3). In the lateral part of the corpus trapezoideum is seen the nucleus olivaris superior (6, 24, 25). In the pars basilaris pontis are the fasciculi longitudinales (2), the fibræ pontis profundæ (4) and the fibræ pontis superficiales. In among these transverse and longitudinal bundles are situated the nuclei pontis (27). Some of the cells of this nucleus extend into the tegmental region (26).

A section through the pons at the level of the root of the n. trigeminus is illustrated in Fig. 951. Here the pars dorsalis pontis or tegmentum is more sharply differentiated from the pars basilaris pontis than in the previous section. The fourth ventricle is narrowing as the aqueduct of Sylvius is approached. The raphe (21) separates the two halves of the section from each other. Just lateral from the raphe on each side are seen the fibres of the fasciculus longitudinalis medialis. In the floor of the fourth ventricle are seen the cells of the stratum griseum centrale (26). At the lateral angle is a group of pigmented cells of the so-called locus cœruleus (29); the fibres of the corpus restiforme (9) are still visible at this level, and a cross section of the fibres of the superior cerebellar peduncle or brachium conjunctivum (14) is met with. The junction of the n. trigeminus with the pons is shown at 4, the radix n. trigemini at 6. Lateral from it is seen the brachium pontis (5). The sensory portion of the root of the n. trigeminus (8) is distinguishable from the motor portion (11). The sensory nucleus of termination of the n. trigeminus (10) is situated more lateralward than the nucleus motorius princeps n. trigemini (12). The crossed fibres of the trigeminal root are indicated at 15, while the radix descendens mesencephalica n. trigemini is shown at 13. The fibræ arcuatæ internæ (18) are present in the tegmentum of the pons, but are not so much curved as

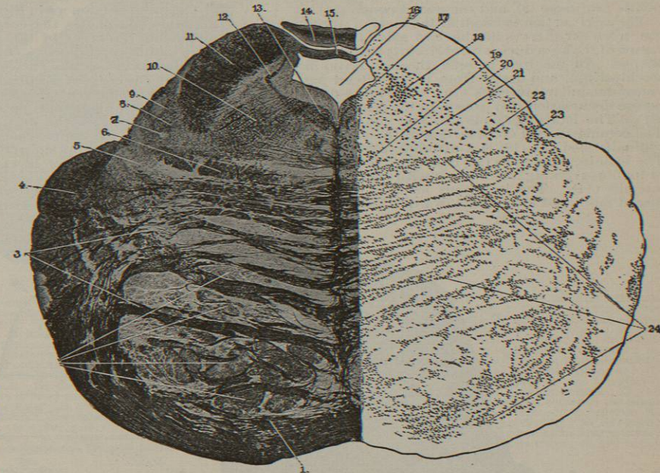

FIG. 952.—Transverse Section through the Pons in the Region of the Velum Medullare Anterius in an Adult Human Being. On the left side the fibres have been photographed; on the right side the cell bodies have been drawn in. (After E. Flatau, "Atlas Cerebri Humani," Tab. xiii., Fig. B.) 1, Fibræ pontis superficiales; 2, fasciculi longitudinales pontis; 3, fibræ pontis profundæ; 4, latero-dorsal compact pedunculer part of pons; 5, latero-dorsal part of nuclei pontis; 6, lemniscus medialis; 7, nucleus lemnisci lateralis; 8, lemniscus lateralis; 9, continuation of nuclei pontis into lateral portion of tegmentum; 10, formatio reticularis tegmenti; 11, brachium conjunctivum; 12, radix descendens mesencephalica nervi trigemini; 13, fasciculus longitudinalis medialis; 14, lingula; 15, velum medullare anterius; 16, transition from the fossa rhomboidea to the aqueductus cerebri Sylvii; 17, aggregation of cells dorsal from the fasciculus longitudinalis medialis, continuous with the cells of the middle line; 18, cell bodies of the locus cœruleus; 19, continuation of the nuclei pontis into the tegmentum; 20, cells at the ventro-lateral periphery of the brachium conjunctivum; 21, scattered cells in the tegmentum (nucleus reticularis tegmenti of von Bechterew); 22, nucleus lemnisci lateralis; 23, continuation of nuclei pontis into the lateral part of the tegmentum; 24, nuclei pontis.

those which were seen in the medulla oblongata. They are more compact in the ventral part of the tegmentum (19). The lemniscus medialis (16) is more laterally placed than in sections lower down. Just dorso-lateral from it is seen the nucleus olivaris superior (7, 31); the nucleus centralis tegmenti (24, 25) at this level makes a large mass of cells near the raphe on each side. In the pars basilaris pontis are seen the fasciculi longitudinales (2), fibræ pontis superficiales (1), the fibræ pontis profundæ (3), and the nuclei pontis (32).

A section taken at a higher level (Fig. 952) shows the beginning of the aqueductus cerebri (16), the roof of which is formed by the velum medullare anterius (15). Above this a cross section of the lingula (14) is illustrated. In the lateral portion of the pars dorsalis pontis the large mass of fibres of the brachium conjunctivum (11) is seen. Lateral from the aqueductus cerebri are to be found the fibres of the radix descendens n. trigemini. In the floor of the aqueduct, close to the raphe on each side, is the fasciculus longitudinalis medialis (13); it is separated from the aqueduct by a mass of cells (17). The cells of the locus

cœruleus (18) are situated just ventral from the radix descendens n. trigemini. The formatio reticularis tegmenti (10) contains scattered cells of the nucleus reticularis tegmenti (21). Ventro-lateral from the brachium conjunctivum are seen the fibres of the lemniscus lateralis, and among them the cells of the nucleus lemnisci lateralis (22). The lemniscus medialis (6) forms a broad, flat ribbon in the floor of the pars dorsalis pontis. In the pars dorsalis pontis are met with again the fasciculi longitudinales (2), the fibræ pontis superficiales (1), the fibræ pontis profundæ (3), and the nuclei pontis (24).

The next section is taken at the level of decussation of the trochlear nerves of the two sides (Fig. 953). The lumen of the aqueductus cerebri (20) is small and diamond-shaped. In the roof is seen the decussatio nervorum trochlearium, and dorsal from it the lateral part of the velum medullare anterius (16). The radix n. trochlearis before decussation (15) is seen in the central gray matter (21). The locus cœruleus (22) here contains large cells. The comma-shaped cross section of the fasciculus longitudinalis medialis (18) is a striking feature at this level. The lemniscus lateralis (10) is situated lateralward, many of its fibres coming into relation with the nucleus lemnisci lateralis (11). The lemniscus medialis (7) becomes displaced more and more lateralward. The brachium conjunctivum (9, 12) is undergoing decussation (8) at this level; its fibres run through the formatio reticularis tegmenti (17, 25). At the junction of the pars dorsalis with the pars basilaris pontis, near the middle line, is seen the tractus mamillo-peduncularis (Edinger), and lateral from it the bundle from the lemniscus medialis to the basis pedunculi. Close to the middle line, at about this level, are seen cells of the corpus interpedunculare (28). In the pars basilaris pontis the same structures are to be met with as at lower levels.

The next section (see Fig. 954) passes through the midbrain and shows the corpora quadrigemina and the pedunculi cerebri. In the middle line is situated the aqueductus cerebri (24). On each side of the aqueduct dorsalward the section passes through the superior colliculus of the corpora quadrigemina. The amount of the stratum griseum centrale (25, 26) is large in this region. In the superior colliculus passing from the dorsal surface inward can be seen the stratum zonale (20) or superficial white layer, the cappa cinerea (17) or superficial gray layer, the stratum opticum (16) or external grayish-white layer, the middle gray layer (15), the stratum lemnisci (14), the deep white layer (19), and the commissure between the two superior colliculi (21). The cerebral peduncle is divisible into two parts, the tegmentum and

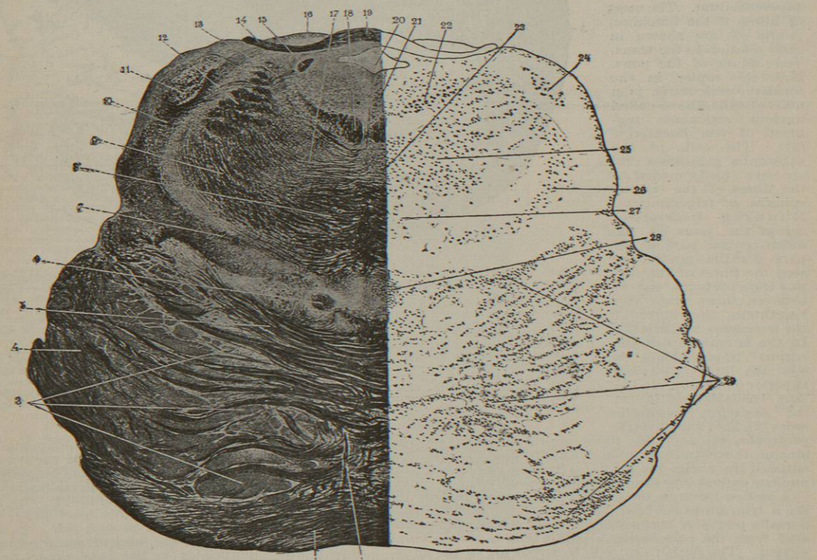

FIG. 953.—Transverse Section in the Region of the Proximal Portion of the Pons and of the Decussation of the Trochlear Nerves (Close Behind the Inferior Colliculi of the Corpora Quadrigemina) in an Adult Human Being. On the left side a photograph of the fibres is represented; on the right side the cell bodies have been drawn in from Nissl preparations. (After E. Flatau, "Atlas Cerebri Humani," Tab. xiv., Berlin, 1899.) 1, Blood-vessel; 2, fibræ pontis superficiales; 3, fasciculi longitudinales pontis; 4, lateral portion of basis pedunculi; 5, fibræ pontis profundæ; 6, tractus mamillo-peduncularis (Edinger) and lateral from it the bundle from the medial lemniscus to the pons (or to the basis pedunculi); 7, lemniscus medialis; 8, decussatio brachii conjunctivi; 9, brachium conjunctivum; 10, lemniscus lateralis; 11, bundles of the lateral lemniscus cut transversely (in the nucleus lemnisci lateralis); 12, brachium conjunctivum; 13, radial transverse bundles of the lemniscus lateralis passing across the radix descendens nervi trigemini; 14, nervus trochlearis after the decussation; 15, nervus trochlearis before the decussation; 16, lateral part of the velum medullare anterius going over into the substance of the tegmentum; 17, formatio reticularis tegmenti; 18, fasciculus longitudinalis medialis; 19, decussatio nervorum trochlearium; 20, aqueductus cerebri Sylvii; 21, cell bodies of the stratum griseum centrale; 22, cells of the locus cœruleus (the dorso-lateral cell bodies belong probably to the radix descendens nervi trigemini); 23, cell bodies of the middle line; 24, nucleus lemnisci lateralis; 25, cell bodies of the formatio reticularis; 26, gray intermediary layer of the formatio reticularis (dorso-medial from the lemniscus); 27, scattered cells in the neighborhood of the decussatio brachii conjunctivi; 28, cells of the corpus interpedunculare (substantia perforata posterior); 29, nuclei pontis.

the basis pedunculi. Between the two is the substantia nigra (3, 39). In the tegmentum, below the stratum griseum centrale, are seen some deep arcuate fibres (18) which represent the continuation of the fibres of the deep white matter of the superior colliculus. The large nucleus ruber (13) is seen at this level in cross section.

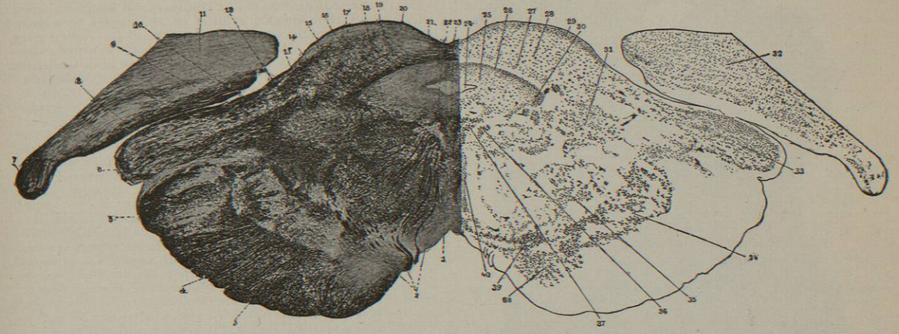

FIG. 954.—Transverse Section through the Superior Colliculi of the Corpora Quadrigemina and the Pedunculi Cerebri in an Adult Human Being. On the left side the fibres have been photographed; on the right the cells have been drawn in. (After E. Flatau, "Atlas Cerebri Humani," Berlin, 1899, Tab. xv.) 1, Ventral tegmental decussation of Forel; 2, radix nervi oculomotorii; 3, substantia nigra Soemmeringi; 4, basis pedunculi; 5, longitudinal bundles in the lateral part of the substantia nigra; 6, lemniscus medialis; 7, tractus opticus entering the corpus geniculatum laterale; 8, corpus geniculatum mediale; 9, formatio reticularis tegmenti; 10, brachium quadrigeminum superius; 11, thalamus; 12, lemniscus lateralis; 13, nucleus ruber (proximal part); 14, part of lemniscus medialis; 15, middle gray layer; 16, stratum opticum (external grayish-white layer); 17, cappa cinerea (superficial gray layer of superior colliculus); 18, deep arcuate fibres; 19, deep white layer of superior colliculus; 20, stratum zonale (superficial white layer of superior colliculus); 21, commissure of superior colliculi; 22, fasciculus longitudinalis medialis; 23, dorsal tegmental decussation of Meynert; 24, aqueductus cerebri Sylvii; 25, cell bodies in stratum griseum centrale; 26, aggregation of cells in peripheral part of stratum griseum centrale; 27, cell bodies of internal grayish-white layer; 28, cell bodies of middle gray layer with scattered large multipolar cells; 29, cell bodies of the cappa cinerea; 30, cell bodies of the radix descendens nervi trigemini; 31, aggregation of cell bodies in latero-dorsal part of tegmentum; 32, cells of distal part of thalamus (pulvinar); 33, cell bodies of corpus geniculatum mediale; 34, cell bodies of substantia nigra; 35, cell bodies of proximal part of nucleus ruber; 36, nucleus nervi oculomotorii extending ventralward into the region of the fasciculus longitudinalis medialis; 37, nucleus nervus oculomotorii; 38, most proximal remnant of nuclei pontis; 39, cell bodies of substantia nigra; 40, cell bodies of the middle line.

The formatio reticularis (9) is very highly developed. Lateral from the nucleus ruber are seen the fibres of the lemniscus lateralis, and still more lateralward those of the brachium quadrigeminum superius (10). The corpus geniculatum mediale is shown at 8 and 33, while the pulvinar of the thalamus is seen at 11 and 32. Entering the corpus geniculatum laterale and the pulvinar is the tractus opticus (7). The fibres of the lemniscus medialis (6) are seen between the nucleus ruber and the substantia nigra. Near the middle line the fasciculus longitudinalis medialis (22) is met with in cross section. Just dorsal to it is the nucleus n. oculomotorii (36, 37). The root fibres of this nerve (2) are shown passing ventralward to the interpeduncular space. The ventral tegmental decussation of Forel is visible at 1.

The basis pedunculi consists of a compact mass of fibres that is sometimes known as the pes pedunculi cerebri. Through it run the fibres of the pyramidal tract, those of the frontal cerebro-cortico-pontal path, and those of the temporal cerebro-cortico-pontal path.

One of the most satisfactory methods of studying the structure of the medulla, pons, and midbrain is by wax reconstruction from serial sections. The model constructed by Miss Florence Sabin from specimens prepared by Dr. John Hewetson is of especial value inasmuch as it gives ideas in three dimensions of the form relations of this part of the medulla.* The model and its parts are depicted in Plate A and Figs. 955–962. The model as a whole is well shown in Plate A and Fig. 955. In Plate A the model is viewed from the lateral surface and its relations to the spinal cord and cerebellum and the third ventricle are illustrated. In Fig. 955 it is viewed from the dorsal surface and the fourth ventricle is seen to be an important guide. A large central fibre mass containing the medial, lateral, and superior lemnisci has formed the basis of the model. This central fibre mass is divided into two parts by a cross bar of fibres, the corpus trapezoideum. The distal part consists of a thin sheet of fibres extending the whole length of the medulla and reaching almost from the dorsal to the ventral surface (Fig. 958); Miss Sabin calls it the medulla sheet. The proximal part is divisible into three subdivisions, the ventral division (lemniscus medialis), a dorsal division (fasciculus longitudinalis medialis), and a middle portion (formatio reticularis). The medulla sheet corresponds dorsalward to the upward continuation of the ground bundles of the spinal cord, ventralward to the stratum interolivare lemnisci.

The ventral fibres of the proximal subdivision of the central fibre mass are divisible into: (1) a horizontal pontal sheet and (2) a vertical midbrain sheet. The lateral portion of the pontal sheet contains the bulk of its fibres. It is the lemniscus medialis on its way to the diencephalon. By gradual rotation the horizontal pontal sheet becomes the obliquely vertical midbrain sheet (Fig. 959). In the centre of the midbrain sheet runs the lemniscus medialis. Ventral to it is a part of the capsule of the nucleus ruber, while dorsal to it are the fibres of the lemniscus superior or Obereschleife of the Germans.

The dorsal portion of the proximal subdivision of the central fibre mass is the fasciculus longitudinalis medialis and is obviously the continuation of the dorsal part of the medulla sheet (Figs. 957 and 960). It follows the course of the floor of the ventricle. The bundles of the two sides form a trough at the beginning of the midbrain (Fig. 956). In the sides of the trough are shallow depressions, three on the right side and two on the left. They correspond in position to the nuclei of the oculo-

*Sabin, Florence R.: "A Model of the Medulla Oblongata, Pons, and Midbrain of a New-Born Babe." Contributions to the Science of Medicine, dedicated by his pupils to William Henry Welch on the Twenty-fifth Anniversary of his Doctorate. The Johns Hopkins Press, Baltimore, 1900, pp. 925–1045.

motor and trochlear nerves (Fig. 960). The space cerebralward from these depressions left in the wall corresponds to the region of exit of the main mass of fibres

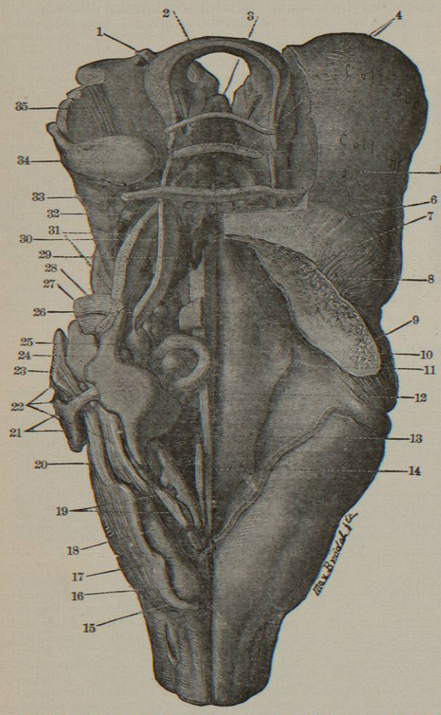

FIG. 955.—View of the Model from the Dorsal Surface. The right side of the view shows the surface form, the left the structures of the model. The position of these structures can be related to the dorsal funiculi of the spinal cord, the fourth ventricle, and the inferior and superior colliculi. 1, Fasciculus retroflexus (Meynerti); 2, stratum album profundum; 3, nucleus n. oculomotorii; 4, commissuræ nuclei colliculi inferioris; 5, nucleus n. trochlearis; 6, substantia ferruginæ; 7, ventriculus quartus; 8, brachium conjunctivum; 9, corpus restiforme; 10, radix n. facialis (genu internum); 11, nucleus n. abducentis; 12, fasciculus longitudinalis medialis; 13, nucleus olivaris inferior; 14, nucleus n. hypoglossi; 15, fasciculus gracilis; 16, nucleus funiculi gracilis; 17, fasciculus cuneatus; 18, nuclei funiculi cuneati; 19, tractus solitarius et nucleus alæ cinereæ; 20, corpus restiforme; 21, nucleus n. cochleæ dorsalis; 22, nucleus et radix n. vestibuli; 23, corpus restiforme; 24, nucleus n. vestibuli lateralis; 25, nucleus n. trigemini (sens.); 26, nucleus motorius princeps n. trigemini; 27, radix n. trigemini (sens.); 28, radix n. trigemini (mot.); 29, locus coeruleus; 30, radix descendens n. trigemini; 31, brachium conjunctivum; 32, *a*; 33, radix n. trochlearis; 34, nucleus colliculi inferioris; 35, lemniscus medialis.

Nucleus et radix n. vestibuli: The ascending root is marked by the most proximal of the three lines on the figure; the descending by the most distal line, while the nucleus n. vestibuli medialis is indicated by the middle of the three lines. The nucleus n. vestibuli superior is continuous with the medial nucleus and lies opposite the ascending root. The nucleus n. vestibuli lateralis consists of two parts, one between the corpus restiforme and the ascending root, the other in the notch between the medial and superior nuclei.

Nucleus n. cochleæ dorsalis: The more proximal of the two lines points to the striæ acusticæ. (After Sabin, F. R.)

of the root of the oculomotor nerve (Fig. 960). Proximal from this space is a long groove which opens out into the proximal capsule of the nucleus ruber. The groove contains the nucleus of Darkschewitsch and marks the junction of three different masses of fibres: (1) the fasciculus longitudinalis medialis; (2) the commissura posterior, and (3) the capsule of the nucleus ruber. The sides of the trough formed by the fasciculi longitudinales mediales of the sides are related in the model to a large hollow shell which occupies the centre of the dorsal part of the midbrain. It represents the stratum album profundum. The relations of the fasciculus longitudinalis medialis to the nuclei of the motor cerebral nerves is striking. It is in intimate relation with the nuclei of the n. hypoglossus, n. abducens, n. trochlearis, and, n. oculomotorius.

The middle portion of the proximal subdivision of the central fibre mass corresponds to a part of the formatio reticularis alba. The relations of the nuclei of the cerebral nerves to the central fibre mass are interesting. In Fig. 957 of the model can be seen the trough which contains the ventral column of gray matter of the spinal cord, opening out on to the medulla sheet. From this point two separate groups of nuclei belonging to the cerebral nerves can be traced; a median motor group, and a lateral group containing both motor and sensory nuclei. The median motor group includes the nucleus n. hypoglossi, the nucleus n. abducentis, the nucleus n. trochlearis, and the nucleus n. oculomotorii. The lateral group, lying near the formatio reticularis, can be subdivided into a ventral motor group and a dorsal sensory group. The motor group includes the nucleus n. accessorius of the motor nuclei of the n. glosso-pharyngeus, n. vagi, n. facialis, and n. trigeminus. The sensory group includes the nuclei of termination of the sensory portions of the n. glosso-pharyngeus, n. vagus, n. intermedius, and n. trigeminus, together with all the nuclei of the cochlear and vestibular nerves.

The corpus restiforme and brachium conjunctivum are well illustrated in the model. The corpus restiforme is made up at this stage chiefly of the direct cerebellar tract from the lateral funiculus from the spinal cord and the dorsal external arcuate fibres from the dorsal funiculi. The fibræ olivo-cerebellares are non-medullated at this stage. The relation of the corpus restiforme to the spinal cord, as well as its position with reference to the cerebellum and to the other cerebellar peduncles, is shown in Plate A.

The brachium conjunctivum or superior cerebellar peduncle is illustrated in Plate A, and Figs. 955, 956, and 960. The part of it which forms the commissure between the superior nuclei of the vestibular nerve is well shown (Fig. 960).

A number of facts concerning the cerebral nerves and their nuclei are made apparent in the model. The nuclei of the median group all lie near the middle line just ventral to the central canal and are closely related to the fasciculus longitudinalis medialis (Fig. 957). The nuclei of the n. hypoglossus and n. abducens are very near the dorsal surface, while the nuclei of the n. trochlearis and n. oculomotorius are farther ventral inasmuch as they lie on the midbrain curve. The nerve fibres from all the nuclei of the groups except those of the root of the n. trochlearis pass ventralward to the surface near the middle line. The root of the n. trochlearis takes an anomalous course since it passes dorsalward, decussates in the velum, and leaves the brain on the dorsal surface of the isthmus of the rhombencephalon. The motor nuclei of the lateral group lie in the formatio reticularis at a considerable distance from the middle line and at a level ventral from the central canal. The root fibres from these nuclei, with the exception of those of the n. trigeminus, do not follow a direct course toward the surface of the central nervous system. The root fibres of all four nerves take their exit at the lateral sulcus.

The sensory nuclei of the entire region belong to the lateral group, and their root fibres enter without exception on the lateral surface (Plate A and Fig. 956). From