Anatomy. — *"Caudal connections of the corpus mammillare"*. By Dr. C. T. VAN VALKENBURG. (Communicated by Prof. WINKLER).

Four connections of the corpus mammillare with other parts of the brain are known: part of the fornixfibres unites it with the ammon's horn; the tractus VICQ D'AZYR with the nucleus anterior thalami; the tractus GUDDEN with the nucleus of the same name; the pedunculus corp. mammillaris has a hitherto unknown destination.

This communication regards the two last-mentioned fibre-systems.

With regard to the origin and the extremity of either of these there is no unanimity: whether the tractus GUDDEN originates or ends in the nucl. tegmenti profundus; whether pedunculus corp. mam. commences or finishes in the lateral nucleus of this ganglion, the communications on this point disagree. A rabbit of a series of operated animals had got an exceptional lesion. The pedunculus and tractus GUDDEN were injured, whilst tractus VICQ D'AZYR and the fornix remained unhurt. The animal was killed after half a year; the examination of the brain that had been cut in a continuous series (coloured after PAL's method, alternating with v. GIESON's)brought to light, with regard to the mentioned tractus and nuclei, the following facts. The knife that had entered from the dorsal side, had partly cleft a.o. the diencephalon to the left of the middle line as far as the basis. In this way the pedunculus corp. mammillaris was nearly sectioned, a little distal from the lateral nucleus mammillaris; the distoventral direction of the section made it possible that the tractus GUDDEN was struck on the spot where it separates from the tractus VICQ D'AZYR; only its most medial fibres had remained unhurt. The fasciculus retroflexus (MEYNERT) was entirely destroyed. Further the section had gone through the most lateral part of the fasciculus longitudinalis posterior, the commissura posterior and the splenium corporis callosi. By hemorrhage the most medial ventral nucleus of the thalamus opticus had been severely injured. More distally the wound gradually retracted in a dorsal direction, going along the left edge of the central substantia grisea of the aquaeductus Sylvii through the lamina commissuralis. The right half of thalamus and stem was completely uninjured, so that the secondary degenerations could distinctly be followed.

1. The examination showed that the *pedunculus corporis mammillaris*, after its originally entirely ventral position — medially from the pes pedunculi (pyramid tractus) — turns gradually partly mediodorsal. This part is placed dorsal from the lemniscus medialis arranged in some thick loosely cohesive fascicles. Towards the end of the

diencephalon it becomes constantly more difficult to separate it from the medial lemniscus, and apparently it ends near the cross-plane immediately caudal from the nucleus trochlearis. It was however impossible for me to get from my preparations a strong conviction of this fact. On its way hither, already during its entirely basal position healthy fibres add themselves to the degenerated bundle; these are not met with among the above-mentioned fascicles dorsal from the medial lemniscus. Presumptively they are partly originary from the lemniscus sensu strictiori, joining the pedunc. c. mammillaris (WALLENBERG) in the proximal protuberantial regions, and extending partly towards the ganglion laterale? partly over it towards groups of cells between fornix and tractus VICQ D'AZYR.

In my case I could only follow fibres of the latter sort. The absolute absence of large ganglion-cells, well preserved on the right, proves that in reality the pedunculus c. mam. originates in the lateral nucleus. It is an irrefutable fact that fibres situated laterally extend, during the praepontine course of the ped. c. mam. from the latter in the direction of the substantia nigra ventral from the lemniscus. I intend to give further information about this connection in a subsequent communication.

2. The *tractus Gudden* (mammillo-tegmentalis), consisting of much finer poorly medullated fibres had been primarily destroyed, as was already noted, with the exception of the most medial part. The secondary degeneration could be followed as far as the nucleus Gudden (tegmenti profundus). The cells of this nucleus had moved more closely together than in the healthy right side. At all events it was not possible to discover a loss of cells of any signification. Only a smaller group of cells, more dorsal, situated nearly between the parts of the fasciculus longitudinalis posterior had very considerably diminished in number on the left side. As to the medial nucleus of the mammillare, the left dorsal nucleus of it, with the exception of a small part lying near the median line, had lost its ganglioncells.

It is obvious that we may conclude from this that the tractus Gudden originates in the dorsal nucleus of the medial mammillar ganglion; that this tractus ends in the nucleus tegmenti profundus with the exception of its dorsal smaller part; that the fibres of that tractus are arranged in the same way as they originate from the mentioned dorsal mammillar nucleus, because only the medial cells of those giving origin to the tractus Gudden, were preserved according to the fact that only the medial part of the tractus mammillo-tegmentalis had not been destroyed by the operation.

In my opinion it is probable that the cells lying dorsal from the

nucl. tegm. prof. s.s. give origin to fibres, situated laterally in the fascic. longit. posterior, having a frontal direction, as they had primarily been destroyed near the nucleus oculomotorius.

About 30 years ago VAN GUDDEN had already indicated the dorsomedial nucleus mammillaris as the origin of the tractus called after him, without finding however general agreement (vide e.g. KÖLLIKER: Gewebelehre).

The present standpoint is that of CAJAL according to whom the tractus of VICQ D'AZYR and GUDDEN originate from the same cells, (fascic. mammillaris princeps); one part of the fibres goes in a frontodorsal direction to the nucl. anterior thalami (VICQ D'AZYR) another runs caudally to the nucl. GUDDEN (vide above). From the uninjured state of the medial-ventral nuclei of the corp. mammillare — in agreement with the conservation of the tractus VICQ D'AZYR — it appears that the question is not so schematic as CAJAL represented it in his drawing [1]) in which are represented fibres, originating in the mammillare, dividing each dichotomically, producing in this way ingredient parts for the two mentioned tractus.

In order to control my results obtained in the degenerative way I examined embryos of rabbits of different ages.

I communicate here only what a specimen of 11 cm. length and another of $2^1/_2$ cm. show. The brains of both embryos were, after enclosure in paraffine coloured with cresylviolet by Dr. DROOGLEEVER FORTUYN (frontal series).

Embryo 11 *cm.* Here principally all the relations so as they exist in the fullgrown animal can distinctly be found. With greater distinctness however the separate connections of the tractus GUDDEN and VICQ D'AZYR with the mammilare can be observed. Dorsoproximal from the latter the two systems are united. The most median part of the apparently common stem radiates first downward as soon as the dorsal nucleus of the medial mammillare-ganglion appears. An examination of the series in a caudal direction shows that these fibres are the continuation of the tractus GUDDEN, which, where the lateral (VICQ D'AZYR-) fibres run ventrally, appears as a distinct tractus, passing the fascic. retroflexus at its medial side.

The dorsal nucleus of the medial mammillare has here the same somewhat dish-shaped form as in the full-grown animal and lies on the proximal half. The tractus VICQ D'AZYR first sends its lateral, more distally the other fibres into the ventral part of the medial

[1]) Text. del. sist. nervioso Tomo II, segunda parte, Fig. 636, pag. 746.

ganglion, in which they run for a short distance sagittally backward, (just as the fascic. retroflexus does in the gangl. interpedunculare).

By the way I mention the very distinct radiation of fornix fibres, in this stage of development, dorsal from the corp. mammillare to the opposite side of the hypothalamus.

Embryo $2^1/_2$ *cm.* A fasciculus VICQ D'AZYR is still missing. The corpus mammillare has only a very slight ventral curvation, in which the ventral nucleus of the medial ganglion will be formed, its dorsal nucleus however is very well recognisable. The tractus GUDDEN is likewise perfectly distinct, passing on the typical point the fasc. retroflexus. As in the other embryo the lateral nucleus and the ped. c. mammill. are extant. Judging from such young stages one should however not easily reckon this nucleus among the mammillary elements, as it is situated too lateral. The peduncle originates in it strongly sagittally (in the same way as in the full-grown animal) and is therefore rather difficult to recognize.

The fact that only the tractus GUDDEN is extant whereas the tractus VICQ D'AZYR is missing, is a striking proof of the comparative independence of these two bundles. The existence of the dorsal nucleus is in agreement with this fact. Evidently GUDDEN's tractus is *older* and its alliance with VICQ D'AZYR is especially of a secondary, topographical nature. It is possible that the lateral nucleus with pedunculus corporis mammillaris, the dorsal nucleus of the medial ganglion with tractus GUDDEN, are of an older date than the ventral nucleus of the medial ganglion with which part of fornix and the tractus VICQ D'AZYR are connected A system of fibres perhaps homologous with the pedunculus c. mam, with a very similar originary nucleus is already known to comparative anatomists, in many fishes (teleostei) [according to a communication of Dr. ARIENS KAPPERS]; this is not the case (hitherto) with the tractus mammillotegmentalis.

According to the majority of authors it is an undeniable fact, that in submammalia nothing is found either of a corpus mammillare sensu strictiori or of a tractus VICQ D'AZYR. This excludes likewise the possibility of the existence of fornixfibres that might unite the ammon's formation with the medial ganglion of the mammillare. They radiate all towards the hypothalamus, in correspondence with the majority of the fornix-ingredients in rabbits, which run towards the crossed hypothalamus (and tegmentum. ?)

Mathematics. — *"On two linear congruences of quartic twisted curves of the first species"*. By Prof. JAN DE VRIES.

In a communication in the *Proceedings* of this Academy (Vol. XIV, p. 255) I have considered the congruence generated by the curve of intersection of two quadrics each of which belongs to a given pencil. This congruence is of the *first order* and of the *first class*.

In the following pages will be treated properties of two other congruences of quartic twisted curves also of the *first order* but of the *second* and *third* class.

1. We consider a pencil (φ^2) of quadrics φ^2 passing through the conics α^2, β^2, and a pencil (φ^3) of cubic surfaces φ^3 the base curve of which breaks up into α^2 and a twisted curve γ^7. By the intersection of each surface φ^2 and each surface φ^3 a congruence Γ of quartic twisted curves ϱ^4 of the first species is generated. Through an arbitrarily chosen point passes *one* surface of both pencils and therefore *one* ϱ^4; so Γ is linear or of the *first order*.

Through any point C of γ^7 passes *one* surface γ^3 of (φ^2) containing ∞^1 curves ϱ^4 passing through C; therefore γ^7 may be called a *singular curve, C a singular point of the second order*.

Also β^2 is *singular*; through any of its points B passes *one* surface β^3 containing all the curves ϱ^4 cutting B^2 in B; so B is a *singular point of the third order*.

Finally α^2 is *singular* too. For a φ^2 and a φ^3 touching each other in a point A of α^2 have a ϱ^4 passing through A in common. By making to correspond to each surface φ^2 the surface φ^3 touching it in A, the pencils, brought thereby in projective correspondence, generate a surface α^5 with α^2 as nodal curve and A as triple point, containing ∞^1 curves ϱ^4 cutting α^2 in A; so A and α^2 are *singular of order five*.

2. On an arbitrary straight line l the two pencils determine two involutions I^2, I^3; as these involutions admit two common couples, l is bisecant of two ϱ^4 and therefore Γ a congruence of the *second class*.

Any generator s of one of the φ^2 is cut by (φ^3) in an involution I^2 and therefore a *singular bisecant*. All these lines s form the congruence (2, 4) of the lines cutting α^2 and β^2 in two different points.

The planes α, β bearing α^2, β^2 form together a surface φ^2 intersected by any φ^3 in the combination of a line α with a cubic curve