which point the nodal curve passes, just as with a torsal line of the second kind; and indeed the plane λ through d contains besides d only twelve generatrices of Ω^{20}, intersecting each other mutually in $\frac{1}{2} . 12 . 11 = 66$, and d in 12 points counting double, which amounts together to $66 + 24 = 90$ points of the nodal curve; so one is missing, but is the point of intersection in a closer sense of the two generatrices coinciding in d, and according to the above this cannot lie on l. In passing we learn from this consideration that *the nodal curve of* Ω^{20} *touches each plane through* l *and either a torsal line of the second kind or a double edge in twelve points lying either on that torsal line or on that double edge.*

That a double edge, however, does not bear itself altogether as a torsal line follows from a repetition of the above given consideration with the three planes λ_1, λ, λ_2; for now in λ_1 as well as in λ_2 two *real* generatrices of Ω^{20} will lie. Nevertheless the nodal curve has here with Ω^4 not only a contact by two points, but even one by three points, so that the plane of osculation of the nodal curve coincides with the tangential plane of Ω^4, and the nodal curve touches one of the two branches of the section of Ω^4 lying in the tangential plane.

Indeed, it is clear that besides the $368 + 80 + 58 = 506$ points of intersection already found no others are possible than the 6 points on the double edges, which occupy us here; for each point of intersection not lying on l must be the point of contact of a generatrix of Ω^{20} with a conic of Ω^4, so a pinchpoint of a torsal line of the second kind, or of a double edge; as there are 6 of the latter sort in evidence and $524 - 506 = 18$ points missing, each of those six points must be counted three times.

Physiology. — "*The posterior longitudinal fascicle, and the manege movement.*" By Dr. L. J. J. MUSKENS. (Communicated by Prof. C. WINKLER).

(Communicated in the meeting of October 26, 1912).

In a series of experiments in cats by means of different needles a lesion was caused in the cerebro-spinal axis, between the posterior commissure and the vestibular nuclei, avoiding the *N*-vestibularis, of which the lesion invariably causes such vehement rolling movements to the side of lesion, that the observation of the manege-movements is impossible. The microscopical control of the lesion and its results was performed after the method of MARCHI.

In three cases both posterior longitudinal fascicles were cut. Without exception the posterior longitudinal bundles were found degenerated, as well above as below the lesion, but not always equally heavily. Especially to the oral side the number of strongly stained fibres rapidly diminishes, reminding of GEE and TOOTH's observation [1]), which particularly strikes one in 114, where within the domain of the oculomotor nuclei the lesion was performed. As well the ascending as the descending degeneration involves in these cases the whole area of the longitudinal bundle.

The physiological result is naturally different, according to the additional lesion of the cerebral stem. The spontaneous locomotion is always seriously interfered with. Forced movement, in the form of manege-movement, is as a rule absent and the stature of these animals answers to the description of the attitude after exstirpation of both labyrinths. Only in case 90 as an exception manege-movement to the right was observed, which in this case should be attributed to the fact, that a bloodextravasation had happened at the cross-section of the left longitudinal bundle, which had caused during some days an asymmetrical irritation. This is inferred from the results after unilateral section of the longitudinal bundles.

In a second series of experiments a unilateral lesion of the longitudinal bundle was applied, with little or no lesion of the DEITERS Complex. In these three cases regularly an ascendent degeneration of the lateral part, especially of the severed longitudinal bundle was observed. Downward equally degeneration in the middle part of the cross section of the bundle was found, whereas also on the other side in the same field some degeneration was noted. Equally regularly in these cases *manege-movement to the side of the non-sectioned longitudinal posterior bundle* was observed during life; solely on 111 also the allied symptom of conjugated deviation of head and eyes was noted.

In a third group a unilateral lesion of the DEITERS Complex was caused. In this series of animals the results were neither anatomically, nor physiologically so easy to understand as in the two first groups. Regarding the degenerated fibres in the posterior bundle, they are in all cases far less numerous, compared with direct lesion of the bundle; also here it holds good more than for group 2, that degeneration, limited on one side only, is a rare occurrence; but in all cases very decided predominance of the degeneration on one side was found. Of these (7) animals in one (158) a total longitudinal lesion was performed *at the left side of the left longitudinal fascicle,*

[1]) Brain 1898.

in such a way, that all fibres from the left DEITERS Complex towards the posterior bundles and the raphe, had been cut leaving the left longitudinal bundle practically intact. Solely in this animal both longitudinal fascicles were upward degenerated, on the right side more heavily than on the left side. In three animals the lesion struck the DEITERS nucleus (118, 113 and 99). In these cases in the contra lateral longitudinal bundle a limited degeneration was found. In three animals (95, 93 and 111) the most proximal-dorsal cell group of the vestibulary-complex (BECHTEREW's Nucleus) was struck; in this series a very limited degeneration on the side of the lesion in the lateral part of the bundle, rather mixing with the fibres of the fasc. DEITERS ascendens (WINKLER [1]), could be followed up. All these ascendent degenerated (more medially in the areal of the longitudinal bundle after lesion of DEITERS nucleus, more laterally after lesion of BECHTEREW's nucleus) fibres can be followed up to the oculomotor nuclei, where as in all cases, some strands of fibres could be traced up to the nucleus of the posterior commissure. The descending degeneration after lesion of the DEITERS complex is usually not very extensive, but present on both sides, regularly stronger on the side, where there is more marked *ascending* degeneration. [2]) These fibres occupy, lower down, more and more a ventral situation and can be traced down to the cervical medulla and lower down. For reason of comparison one of PROBST's experiments [3]) has been added to the table.

The degeneration found in these cases seems to prove, that solely for the distal nuclei of the vestibulary complex (especially the triangular part) FUSE's dictum holds good, that the structural connection between the DEITERS-complex and the longitudinal bundle is a crossed one. Here the results, obtained by GUDDEN's method, are reinforced by those of MARCHI's method. On the other hand with the latter method it appears hardly subject to doubt, that the connection between BECHTEREW's nucleus and the longitudinal bundle is mainly a homo-lateral one, these fibres mixing with the fasc. DEITERS ascendens.

Regarding the phenomena observed during life, it is surprising that, equally regularly as in group 2 manege-movement was observed to the non-sectioned side, equally regularly also in these animals

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[1]) Central Course of the nervus octavus. Verhandelingen der Koninklijke Akademie van Wetenschappen. Tweede sectie 1907.

[2]) This detail seems to be able to support RAMON Y CAYAL's and MONAKOWS contention, that the fibres from the DEITERS-complex to the posterior longitudinal fascicles all split up in an ascending and descending branch.

[3]) Jahrbücher f. Psychiatrie 1901. P. 7 of the separate paper.

manege-movement was noted to the side where the P. L. B. shows the least degeneration (the lesion being on the same or on the other side). Some reserve I have to make here for the homo-lateral degeneration in the longitudinal bundle after lesion of BECHTEREW's nucleus. For in 95, being the animal, that produced the most classical circus-movements to the left, a very local lesion was found in the middle part of the ingoing fascicles of the N. vestibularis. It can a priori not be excluded, that such a direct and local lesion of the nerve may cause manege-movement to the other side, in the same way as *usually* any lesion of the vestibulary nerve causes vehement and long lasting rolling movements to side of the lesion [1]). Such an interpretation seems however very improbable indeed. As to 111, the lesion was here accompanied by an haemorrhage and rather extensive. The physiological analysis of the DEITERS-complex can go, I think, a little further, in that a lesion of the caudal part of the complex, e.g. on the right side, as well as a lesion of the proximo-dorsal part (BECHTEREW's nucleus) of the left side resulted in an ascendent degeneration in the P. L. B., of the left side, and also produced equally circusmovements to the right. This circus movement to the right side being elicited from an anatomical entity on either side, we are led to believe, that a double sided connexion of either horizontal semicircular canal with DEITERS nucleus and a proper extension of EWALDS experiments might clear up this point.

From these results I think it must be admitted, that the physiological function of the P. L. B., or at least one of its functions, is intimately related to the coordinated locomotion in the horizontal plane of eyes, head, trunk and extremities. A similar suggestion of such a relation is often found in literature, but about the precise form and direction resulting from such coordination none of these researches give information (EDINGER) [2]).

In a fourth group of experiments (in 6 animals) a lesion was applied in the region of the corpora quadrigemina anteriora, of the commissura posterior and of the red nuclei. In four cases descending degeneration from that region into the posterior longitudiual bundle, exclusively on the side of lesion, was found. This degeneration, sometimes amounting to no more than a few fibres, is lost sight of high in the medulla oblongata, especially in the region of the abducens-nuclei. In 2 of these cases accurately the origin can be followed in the series and it appears that the nucleus of the posterior commissure is involved

[1]) Compare: Studies on the forced movements. Journal of Physiology. XXXI. Ne. 3 and 4. 1904.

[2]) Vorlesungen. 1912, P. 110.

in the region of the direct lesion or of the local malacy. My supposition that this nucleus must be regarded as the origin of this commissuro-medullary bundle, gains in probability by the findings in 2 cases (106 and 108), where this bundle was not degenerated. In 106 the lesion involves exclusively the superficial layers of the anterior corpus quadrigeminum, but leaves the nucleus of the commissure intact. In 108 an extensive sagittal lesion in that region was found. Here from the surroundings of the red nucleus a strand of degenerated fibres can be followed in the homolateral posterior bundle, which however does not disappear at the level of the n. abducens, but can be traced far lower down, as far as in the dorsal spinal cord. Problably we deal here with the homolateral tecto-spinal bundle of PROBST.

As to the forced movements, it is remarkable, that all these four animals with the degeneration of the commissuro-medullary bundle performed circus-movements for a short period to the side of the lesion, whereas the animal with lesion in the corpus qudrigeminum anterius solely, and that with lesion of the nuc. ruber exclusively did not do so.

In relation with these cases we have to mention two animals with extensive lesion of the *cerebral hemisphere*. Whereas in 127 solely an extensive exstirpation of the anterior pole was performed, leaving the thalamus opticus intact, in 186 the whole hemisphere was exstirpated and also the thalamus wounded. Only in this latter animal on the operated side some degenerated fibres were found, of which the course is exactly that of our commissuro-medullary bundle. This latter animal showed decidedly circus-movements *to the operated side* during some days.

From these results we conclude, in agreement with current anatomical notions, that the posterior longitudinal bundle contains fascicles of different source and end-station. At any rate in the medial portion of the P. L. B.-formation 3 bundles must be distinguished, two *ascendent* and a *descendent* one dealing with the coordinated locomotion in the horizontal plane. Innermost within the medial portion of the P. L. B. we find the descending commissuro-medullary bundle; next comes the crossed ascendent DEITERS P. L. B.-bundle, then comes the homolateral BECHTEREW-P. L. B. bundle, containing fewer fibres than the crossed one. The latter bundle lies entirely within WINKLER's Fasc. DEITERS ascendens. In a next paper the physiological analysis of the rest of the P. L. B. formation will be dealt with. There are many preparations in my collection, which tend to prove (as far as MARCHI-work is entitled to do so), that, as is suggested by the authors, the vestibulary-P. L. B. fibres, as well the crossed as the homolateral ones, in the

P. L. B. formation bifurcate, one limb ascending to the oculomotor nuclei and the nuc. of the posterior commissure, the other passing down to the cord.

The descending bundle has its origin exclusively, so it appears, in the nuc. commissurae posterioris (VAN GEHUCHTEN, PROBST) and can be traced as far as the homolateral abducens nucleus. The oral and distal final stations of both coordinating bundles are therefore found in the same level, a detail with seems particularly inviting to study here the physiology of the bundle as a common final path (SHERRINGTON). For the study of the mechanism of the circus and rolling-movements undoubtedly labyrinth- and neck-reflexes described by MAGNUS and Dr. KLEYN [1]) as well as BARANYI's experiments [2]) have to be considered.

As to the function it can be hardly considered accidental, that in my experiments the animals with ascending degeneration in the P. L. B., on one side (e.g. on the right side) performed circus-movement to the other side, to the left; whereas the animals with a (from the Nuc. comm. post) descending degeneration e.g. on the right side, did their manege-movements to the diseased side. PROBST's law [3]) that "a hemisection of the brainstem anterior to the red nuc. caused manege-movements to the diseased side; a hemisection caudal to the red nucleus to the healthy side", seems therefore, well founded, but with this important restriction, that the nuc. commissurae posterioris and not the red nuc. is the origin of the commissuro-medullary bundle, and that not hemisection, but a simple lesion of one longitudinal bundle will suffice, to cause the circusmovements.

By comparison with a number of other series and subtraction of the phenomena during life, it can be proved, that lesion of the great descending tracts (pyramidal, rubro-spinal, tecto-bulbar, vestibulospinal, and ponto-spinal tracts), of the most important ascending systems (GOWERS's and FLECHSIG's tract) the lemniscus and cerebello-rubral tracts have nothing to do with this function. I am not in a condition to deny nor to affirm CLARKE and HORSLEY's supposition [4]), that the ponto-cerebellar connections should have to do with the "mouvement de manege" but I do think as long as there is no proof forthcoming, regarding a centre for equilibration in the temporal lobes, that after these experiments there is no need to fall back upon any such conjecture.

[1]) Archiv. f. d. gesammte physologie, 1912. Bd. 145. S. 455.
[2]) Neurologischer Centrallblatt. 1912.
[3]) Loc. cit. p. 41.
[4]) Brain 1905

TABLE OF EXPERIMENTS.

Group	LESION	Number of cat	*Ascending degeneration of P. L. B. (orally of the lesion)*		Circus movement	Duration	*Descending degeneration of P. L. B. (distally to the lesion)*	
			Left	Right			Left	Right
I	**Both P. L. B. sectioned:**							
	Lesion high, in region of corp. quad. post.	114	Total	Total	0		Total, lower down (in medulla) ventro-med.	Total, lower down (in medulla) ventro-med.
	„ low, in the vestibulary region	92	Total (+ F. Deiters asc.)	Medial especially (+ F. Deit. asc.)	0		Total lower down ventro-medial	Total, lower down ventro-median
	„ „ „ „ „ „ (with an haemorrhage on the left P. L. B.)	90	Tot. (med. part esp.)	Total and strong (+F. Deit. asc.).	To Right	9 days	Total, lower down ventral	Strong and complete, lower: ventral
II	**One P. L. B. sectioned:**							
	Pons-region Right	139	0	Strong, esp. lat. part	„ Left	10 „	Little	Ventro-median part (to lumbar region)
	„ Left	91	Total (latero-dorsal part esp.)	Some fibres	„ Right	8 „	Total, lower down ventro-median	A few fibres
	„ Left	119	Lateral	Some fibres	„ Right	2 „	Tot., median part esp.	Moderate
	Hemisection of midbrain	IX Probst [1])	0	Degeneration	„ Left	20 „	0	Degeneration
III	**One-sided lesion of vestibulary nuclei**							
	Left vestibulary nuclei cut off from raphe (with exstirpation of left frontal hemisphere)	158	Diffuse and little (partially descend.)	Lateral part	„ Left	11 „	Lateral part (strong)	Medial part, rather diffuse
	Right nucleus Deiters (pars triangularis)	118	Moderate (med. part, higher esp. lateral)	Lateral part	„ Right	1 day	Medio-ventral (till dorsal region)	Lateral (+F. Deit asc.)
	Right nucleus Deiters (pars triangularis)	113	Strong (idem)	Fasc. Deit. asc.	„ Right	8 days	„	„
	Left nucleus Deiters (pars triangularis?)	99	0	Few fibres	„ Left	11 „	0	Few fibres (med.), to dors. part of medulla
	Right nucleus Bechterew (+N.? vestib. ?)	95	0	Few fibres (+ Fasc. Deit. asc.).	„ Left	5 „	0	Latero-ventral, to cervical region
	Right nucleus Bechterew	93	0	Idem	„ Left	6 „	0	Little, lateral, to low in medulla spinalis
	Left nucleus Bechterew	111	Total	0	„ Right	2 „	Latero-ventral	Few fibres
IV	**Lesion of upper quadrigeminal region with exclusively descending degeneration in the P. L. B.**							
	Nuc. commissurae post. Right	107			„ Right	8 „		Medio-dors. (not lower than striae acust.)
	Superficial lesion Corp. quad. ant. Right	106			0			Few fibres
	Lesion of lateral part of red nucleus Right	108			To Left (?)	2 „		Fasc. interstitialo-spinalis
	Nuc. commiss. post. Right	109			„ Right	1 day		Few fibres
	„ „ „ Right	98			„ Right	1 „		Very little
	Lesion of region of red nucleus Left	61			„ Left	3 days	Well degenerated (to medulla oblongata; there more ventral)	Little (medial), to medulla; there more ventral)
V	**Lesions of cerebral hemisphere.**							
	Ablation of frontal region Right	127			0		0	0
	„ „ „ „ Right	Cat I (Probst)			0		0	0
	Ablation of tot. hemisph. (with thalamus-lesion) Left	186			To Left	5 „	Some fibres to exit of N. Trigeminus	

[1]) Jahrbücher f. Psychiatrie 1901. P. 72 (of separate paper).

In the course of these experiments, having specially in view the posterior longitudinal bundle and the DEITERS-complex, it appeared, that — at least for this system — in relation to the disturbances observed during life one has to distinguish three different modes of traumatical lesion. 1. Total destruction of a cell-complex or bundle through the instrument used, with renders the structure irrecognizable, the tissue being totally or partly replaced by a moderate bloodextravasation. After this lesion invariably a total degeneration of all fibres arising from or passing this region occurs, if care be taken, that the specimen does not stay too long in MÜLLERS fluid. 2. Malacy of a region which causes in a selective way some systems of fibres to degenerate, whereas other systems apparently continue to be nourished and probably also continue their function [1]). In view of KOHNSTAMM's and MONAKOW's findings it appears, as if the great, the middle-sized and the small cells of the DEITERS-complex suffered unequally in their nourishment, if this structure happens to be involved in such a malacy. 3. If an extensive haemorrhage occurs and exerts compression, irritative symptoms appear of the same order [2]) but more vehement, than those which are caused by the dissolution of the medullary sheath and the moderate irritation, caused by this process.

In judging about the physiological consequences, it must be kept in view, that every lesion after 1. and 3. is always found surrounded by a zone of malacy, and finally, that in a case with voluminous haemorrhage in the brainstem the general brain-compression may mask completely the forced movements.

It is quite natural, that in different experiments the vestibulary P. L. B.-complex was repeatedly wounded on more than one locality. Regarding the physiological effect it appeared, that a lesion of the N. vestibularis itself predominates above a lesion of its nucleus, and the latter again dominates above a lesion of the posterior longitudinal bundle.

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[1]) So I found in 102, that the left longitudinal bundle passed such a malacy in the upper pontine region. The descending commissuro-medullary bundle was degenerated and the animal had shown the physiological consequence of this degeneration; the ascending vestibulary-P. L. B. fibres were not degenerated.

[2]) It is interesting to note, regarding the nucleus of the posteror commissure, that after E. SACHS' experiments (Brain 1909, p. 180) direct electrical stimulation of this region causes conjugated deviation to the opposite side; which evidently corresponds to the effect, described in this paper, of the stimulation exerted on the nucleus of the posterior commissure by the degeneration of a number of ascending fibres, running in the P. L. B. and ultimately arriving in this nucleus. The circus movement in many of my experiments was accompanied by conjugated deviation to the same side; both phenomena evidently being narrowly related.

Geology. — *"On the formation of primary parallel-structure in lujaurites."* By Dr. H. A. BROUWER. (Communicated by Prof. G. A. F. MOLENGRAAFF).

(Communicated in the meeting of October 26, 1912).

In an important memoir of the late Professor N. V. USSING [1]) we find a detailed discussion on the question of the origin of schistose structure in lujaurites. It is explained as a consequence of fluctuation, in contradiction to RAMSAY'S [2]) view, who admits a slow cooling and undisturbed crystallization of the magma for the rocks of the peninsula of Kola.

In my description of the Transvaal nepheline-syenites [3]) the name lujaurite was extended to rocks without parallel-structure, characterized by the occurrence of fine-needle-shaped crystals of aegirine in abundance. The parallel-structure where it occurs was explained as a consequence of a crystallization influenced by one-sided pressure, which view will be now more explicitly explained.

Geological connection with accompanying rocks.

In the peninsula of Kola no remains of the roof of the intruded batholite have been preserved and thus it is not certain whether the lujaurites are the first products of consolidation in the marginal zone of the igneous mass. In the Pilandsbergen (Transvaal) the schistose varieties are often still surrounded by a border of nepheline-syenitic or syenitic rocks, whilst in the Greenland intrusions which have been very carefully examined, the lujaurites form the lowermost rocks of a stratified batholite which has been denuded. The last mentioned rocks are covered by a very coarse-grained foyaitic rock (naujaite) the crystals of which are sometimes a few decimeters large; it is characterized by sodalite poikilitically surrounded by all other minerals. Pegmatitic segregations are found chiefly in a horizontal position, whilst in the rock itself a more or less horizontal stratification in thick layers is indicated. Towards the upper portion the naujaite gradually passes into a sodalite-foyaite, whilst downwards it is connected with the underlying lujaurites by a breccia-ted zone of transition. This breccia-zone is formed by strata of lujau-

[1]) N. V. USSING, Geology of the country around Julianehaab, Greenland. Meddelelser om Gronland, vol. XXXVIII, and Muséum de Min. et de Géol. de l'Université de Copenhague, Communications Géologiques N°. 2, 1911.

[2]) W. RAMSAY, Das Nephelinsyenitgebiet auf der Halbinsel Kola, I and II. Fennia 11 and 15, N°. 2. Helsingfors 1894 and 1899.

[3]) H. A. BROUWER, Oorsprong en samenstelling der Transvaalsche nephelien-syenieten. 's Gravenhage, MOUTON & Co., 1910.