

*Citation:*

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This formula gives for  $r_0$  the value :

$$r_0 = \frac{\frac{4}{9} a_1^2}{\frac{2}{3} b_2} = \frac{2 a_1^2}{3 b_2}.$$

From the obtained values  $R_0 = \frac{a_1^2}{2 b_2}$  and  $r_0 = \frac{2 a_1^2}{3 b_2}$  we get

$$R_0 : r_0 = 3 : 4.$$

Delft, Sept. 1904.

**Physiology.** — “*Degenerations in the central nervous system after removal of the flocculus cerebelli*”. By Dr. L. J. J. MUSKENS.  
(Communicated by Prof. C. WINKLER).

(Communicated in the meeting of September 24, 1904).

In 6 rabbits the flocculus of the right side was extirpated. This organ lies, as is well known, in these animals in a separate bony hole, so that we here have the possibility to remove a part of the cerebellum without disturbing the nervous structures of the neighbourhood in their conditions of nutrition as well as of pressure. The animals were killed after 8 days to 5 weeks and complete series stained after Marchi, were prepared.

The degenerations of fibres after this lesion in 4 of the 6 cases were found exclusively directed upward i. e. to the superior crus cerebelli and to the pons.

In one case there was a fine degeneration all over the restiform body; in this case however it could not be made out with certainty whether we had to deal with really descending degeneration, because firstly all through the cord fine, black spots were found, and secondly the black spots were of so little dimensions, that there is much doubt about the genuineness of such a fine degeneration. In this animal the staining was insufficient, irregular and not limited to degenerated nerve-fibres, for an unknown reason, so that we do not think much value can be attached to this single case, in which downward degeneration was found.

In another wellstained case in the restiform body a number of degenerate fibres on the operated side was found; also in the longitudinal posterior fascicle and in the field of the tecto-spinal bundle,

equally on the operated side. In the superior cervical region also a small field with the base lying towards the margin, the point towards the restiform body was found full of degenerate fibres. Lower down than the upper cervical segments, these degenerate fibres do not reach. In this case not only the flocculus and the floccular peduncle, but also the vestibular nucleus was severed, so that also this experiment cannot be recognized as a clear experiment.

Although allowance must be made for an eventual different result after extirpation of other parts of the cerebellum of the rabbit, so we think, that these experiments show clearly the absence of descending degeneration after a sharply localised lesion of the floccular cortex. The discussion in the literature between MARCHI, FERRIER and TURNER, THOMAS, BIEDL and RISIEN RUSSELL regards the question, how much of the found degenerations must be ascribed to lesion of the neighbourhood, because, as THOMAS justly remarks, exactly in this region of the cerebro-spinal axis it is characteristic, that also without direct lesion by the severing instrument yet by haemorrhage or an alteration of pressure, extensive degenerations can be caused. As in these experiments certainly no such lesion of the neighbourhood can have arrived and in the completely successful cases the cord was found free of degeneration, we may be sure, that from the ganglioncells of this part axis-cylinders with centrifugal course to the medulla are not found, so that for this part of the cerebellum at least, the original data of MARCHI are not confirmed. Thus these observations as also those of PROBST can be regarded to agree with the English observers, after whom only 'after lesion of the nucleus-DEITERS descending degeneration of the anterior and lateral tracts is found. In judging this result it is important to observe, that also in another point than by its own bony capsule the rabbit must be regarded as an abnormal form.

The flocculus of the rabbit contains viz. except its part of the cerebellar cortical gray matter and its af- and ef-ferent fibres also a nucleus of large multipolar ganglioncells, such as are found in the nucleus dentatus. The study of the development of kindred animals (squirrel) leave not the least doubt, that indeed a part of the dentate nucleus is dislocated in the flocculus. It appears that it is not always in connection with the principal nucleus.

Now I do not think that for the elucidation of the question, whether there exist descending cerebellar tracts, this circumstance must be regarded an undesirable complication, but rather we may reckon this a useful detail, in so far as it allows to exclude at the same time,

that such efferent fibres descending in the cord, should spring from (this part at least of) the dentate nucleus.

Regarding the ascending degeneration in the different operated animals the most complete accordance is found. Two bundles are found in all successful cases, very clearly and in exactly the same place of the cross-sections and both find in the same region of the cerebrum their end, viz. in the regio subthalamica. In the first place the superior cerebellar peduncle being the most voluminous bundle, where we find fibres of heavy caliber. This degeneration shows especially gross fibres, compared with the fine degenerations, found elsewhere in the rabbit. The degeneration is found especially in the middle third part of the superior cerebellar peduncle, whereas the medial and lateral thirds are nearly entirely free from degenerate fibres. Arrived about at the posterior quadrigeminal body, the degenerate fibres curve downward in a nearly rightangle, as this is represented by the authors, building the wellknown peduncular decussation. Only a few sections separate the commencement and the finish of the decussation in the sections. In the substantia reticularis the direction is again purely longitudinal to the long axis of the cerebral stem, where as in the region of the red nucleus it becomes clear, that especially the ventral part of the red nucleus comes in contact with the crossed peduncle. This crossed connection is, as far as the flocculus is concerned complete. Here it may be recalled, that Probst has shown, that after extirpation of more dorsally situated cerebellar parts of the cat also non-crossed fibres run to the subthamic region.

Besides this most important upward degenerating bundle, there is another tract up to now only described as far as I am aware by PROBST, which is constituted of finer fibres than the first bundle, takes its course by the substantia reticularis, of the contra-lateral side, and joins the first tract about its arrival in the red nucleus. Both together run frontalwards, and end in the ventral part of the nucleus ventralis thalami. The sections leave no doubt, that no fibres from the flocculus arrive in the thalamic region uncrossed, but all decussate either in the decussation of the superior peduncle or as far as the second bundle is concerned in the pontine region, right near its emergence from the flocculus. Also THOMAS has designed this degeneration, but he thinks, that here we have to deal with descending collaterals of the frontal cerebellar peduncle, which leave the principal bundle after the decussation of this peduncle. PROBST on the other hand thinks, that these fibres arise from the dentate nucleus, pass directly through the region of the vestibular nuclei, to the substantia

reticularis of the crossed side and ascending frontalwards are found in the same region up to their junction with the superior crus cerebelli.

My own sections suggest very strongly indeed, that these centrifugal (from the cerebellum, or rather from the nucleus dentatus) fibres, take their course by the superficial layers of the middle cerebellar peduncle and then can be followed right through the pyramidal bundles or partly winding around them to the reticular substance.

In different series it becomes clear that proceeding in the series of sections from below upwards there, where are found the first degenerate fibres in the reticular substance, also the first degenerate fibres appear in the middle peduncle. While by THOMAS no sound reasons are given for his conception about the significance of this bundle, it pleads against the opinion of PROBST that in the region of the vestibular nuclei, no degenerate fibres are found.

Finely the sections show, compared with the sections gained by other experiments, that the ventral thalamic bundle originates for the greater part from the ventral portions of the cerebellum, especially of the flocculus. Sections of cats-brain after similar operations leave no doubt, that after lesion of more dorsal cerebellar portions, there exists a very marked contrast between the very pronounced degeneration of the crus cerebelli ad corpora quadrigemina and the very slight degeneration of the ventral thalamic bundle, whereas as well in the cat as in the rabbit after exclusive lesion of the flocculus, both bundles are affected about equally.

**Physics.** — “*The validity of the law of corresponding states for mixtures of methyl chloride and carbon dioxide,*” by Prof. H. KAMERLINGH ONNES and Dr. C. ZAKRZEWSKI. Communication N<sup>o</sup>. 92 from the Physical Laboratory at Leiden by Prof. Dr. H. KAMERLINGH ONNES (continued).

(Communicated in the meeting of June 25, 1904).

§ 1. *Introduction.* In n<sup>o</sup>. IX of the “Contributions to the knowledge of VAN DER WAALS’  $\psi$ -surface” we have expressed the hope of giving an experimental contribution to the investigation of the co-existing mixtures of methyl chloride and carbon dioxide at low temperatures in connection with the test of the law of corresponding states for mixtures, which for many years has formed a subject of experimentation at Leiden. Of the extensive territory of reduced states, which