$$\int \lambda_1^{\nu_1} \lambda_2^{\nu_2} \ldots \lambda_n^{\nu_n} d\lambda_2\, d\lambda_3 \ldots d\lambda_n = \frac{\nu_1!\,\nu_2! \ldots \nu_n!}{(\nu_1+\nu_2+\ldots+\nu_n+n-1)!} =$$

$$= \frac{\nu_1!\,\nu_2! \ldots \nu_n!}{(\nu+n-1)!},$$

hence

$$p^{(\nu)} = \frac{\nu!\,(n-1)!}{(\nu+n-1)!} M \sum_{\nu_1,\nu_2 \ldots \nu_n=1}^{n} a_1^{\nu_1} a_2^{\nu_2} \ldots a_n^{\nu_n} \quad \ldots \quad (3)$$

with

$$\nu_1 + \nu_2 + \ldots + \nu_n = \nu.$$

The sum to the right could evidently be arrived at out of $(a_1 + a_2 + \ldots + a_n)^\nu$ by developing it according to the polynomial theorem and by suppressing all the polynomial coefficients. The factor

$$\frac{\nu!\,(n-1)!}{(\nu+n-1)!}$$

is nothing else but the reciprocal of the number of terms. By introducing in 1) the obtained value of $p^{(\nu)}$, we find, when the distance of the vertex a_i of the simplex from the space E or A is indicated by y_i,

$$M_\nu = \frac{\nu!\,(n-1)!}{(\nu+n-1)!} M \sum y_1^{\nu_1} y_2^{\nu_2} \ldots y_n^{\nu_n},$$

$$(\nu_1 + \nu_2 + \ldots + \nu_n = \nu).$$

For $\nu = 2$ I have deduced (l. c.) the sum in 3) to a sum of $(n+1)$ respectively n squares, in other words I have substituted for the simplex a system of $(n+1)$ resp. n single material points, which is equivalent to it with respect to all questions connected with the moments of inertia. For $\nu > 2$ a similar reduction seems to be less easily effectible.

Stuttgart, March 1905.

Physiology. — "*On the branchings of the nerve-cells in repose and after fatigue.*" By Dr. S. J. DE LANGE. (Communicated by Prof. C. WINKLER.)

In the laboratory of MATTHIAS DUVAL some experiments have been made by MANOUÉLIAN in order to ascertain whether it is possible to demonstrate modifications in the dendrites of the ganglion-cells in cases of sleep through fatigue. His results have been published in the "Comptes Rendus de la Société de Biologie, 28 Févr. 1898" and subsequently.

The animals he made use of for his experiments were mice, and he proceeded in the following manner: For the space of an hour

together a mouse was driven to and fro in a cage, without granting it any rest; after that the exhausted animal fell asleep or at any rate remained perfectly quiet. The control-animal was kept in perfect repose. Both animals were then killed, and small pieces of the brain were immediately fixed after the method of GOLGI. He obtained manifest results already when only feebly magnifying: the collaterals of the dendrites have vanished, instead of these the dendrites have globular tumefactions, retracted branchings which seem to have loosened themselves from the neighbouring end-arborisations.

MANOUÉLIAN writes:

"On pense, en présence de ces images, à celle d'une sangsue vue comparativement dans l'état d'élongation et dans l'état de rétraction en boule."

Previous to these experiments, RABL-RÜCKHARDT had published a theory on the amoeboid motion in the cells of the central nervesystem, a theory not founded however on microscopical data. (Neurolog. Centralblatt 1890, p. 199). The investigations of WIEDERSHEIM who experimented on a living Crustacea, Leptodora hyalina, and those of PERGENS and others on the retina of Leuciscus rutilus, seemed to confirm the conjectures of RABL-RÜCKHARD.

WIEDERSHEIM has been able to follow the motion of the processes of the nerve-cells with the microscope and arrives equally at the conclusion: "dasz die centrale Nervensubstanz nicht in starre Formen gebannt, sondern dasz sie activer Bewegungen fähig ist."

J. DEMOOR injected dogs with lethal dozes of morphia, and studied a small piece of the cortex cerebri, which he extirpated before the death of the animal. He too, and likewise STEFANOWSKA, after injecting mice with ether, found similar changes as observed by MANOUÉLIAN: the branchings having become smaller and shaped like a string of beads.

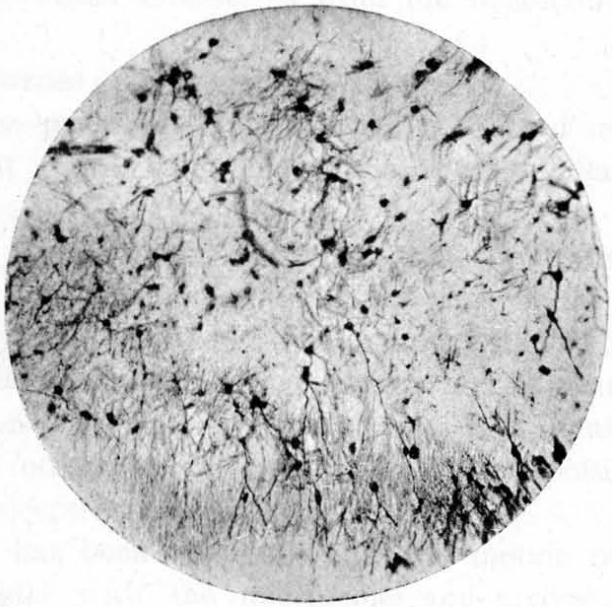
Two american authors however, FRANK and WEIL, did not obtain these results on animals under narcosis.

In order to obtain some certitude whether any differences might in reality be observed, I tried a few experiments in the laboratory of Professor WINKLER.

Firstly I did repeat the experiments of STEFANOWSKA and DEMOOR, albeit the methods employed were not in every respect the same as theirs.

The mice were brought under narcosis by means of chloroform instead of ether: immediately after death they were decapitated, the head was caught into a liquid, prepared after the method of GOLGI

S. J. DE LANGE. **"On the branchings of the nerve-cells in repose and after fatigue."**



Nerve-cells of the cornu Ammonis from a mouse, exhausted by incessantly running in a turning cage for four hours together.

modified by Cox, whilst the brain was prepared directly in the liquid. For the control another mouse, not having been put under narcosis, was treated in the same manner. No differences whatever were to be observed in the microscopical preparations, obtained by means of the freezing-microtome.

Neither did I observe any differences in the case of mice, injected in the manner used by DEMOOR with repeated doses of morphia until death ensued.

Thinking these results might have been impaired by the fact that the animals were decapitated only after death, I next tried with the utmost accuracy a repetition of the experiments of MANOUÉLIAN.

A mouse was put into a turning cage, being therefore constrained to run incessantly, whilst the cage was kept in continual motion by means of a small motor driven by water. The motion was continued for four hours together, the animal experimented upon being therefore perfectly exhausted. Meanwhile the control animal had been kept in darkness, enveloped in wadding. The four hours having elapsed, both animals were very quickly decapitated, the heads being caught into the fixation-liquid, and the brain being further prepared in it.

After ten weeks the preparations were impregnated with celloidine and section-series in frontal direction were made of both brains. In this way it became possible to obtain a comparable material.

For further control another pair of mice was sacrificed, for the purpose of demonstrating by means of the method of NISSL the presence of the well-known modifications in the easily tinctured parts of the protoplasma of the nerve-cells.

For whilst under normal conditions the elective tincturing part of the protoplasma of the ganglion-cells is divided into small granula, in case of fatigue these granula tend to dissolving more and more, the tincturing of the cellular body thus becoming homogeneous.

These modifications are clearly to be observed in the ganglion-cells of the exhausted animal experimented upon: the fatigue therefore must have been exquisite.

The preparations, made after the method of GOLGI modified by Cox, offer however beautiful arborisations as well in the case of the non-fatigued animal, as in that of the exhausted one used for the experiment, the annexed photographical reproduction of the exhausted animal presenting no trace of retracted branchings, or of globular tumefactions, neither of being shaped like a string of beads.

I have therefore not succeeded in demonstrating after this method modifications in the branching system of the nerve-cells of the cortex cerebi, caused by intense fatigue.