Comparing the puerperal involution of the uterus of the hedgehog with the same process as it occurs in other mammals, hitherto studied, we may state that in this respect the hedgehog occupies an intermediate position between Rodents and Carnivora. It stands near the former in the way in which the epithelium regresses, near some of the latter in the regression of the layer of connective tissue, although in this respect the analogy is not complete.

The more accurate details of the involutional processes of which a short sketch is given here, will be published elsewhere.

Physics. — "*Magnetic resolution of spectral lines and magnetic force*". By Prof. P. ZEEMAN. (First part).

The intensity of a magnetic field may be defined by the amount of splitting up of a given spectral line emitted by a source placed in the field.

The distance of the outer components of a triplet can be measured with great accuracy. The components of a line resolved by the action of magnetism are of the same width as the original line and the high degree of accuracy obtainable in the measurement of spectrum photographs is generally known.

We may call two magnetic intensities equal, when producing equal amounts of separation of a spectral line, and we may call two differences of magnetic intensities equal, when the changes of the distances of the components are the same. In this way we obtain a scale of magnetic forces, the zero point and the magnitude of the units can still however be chosen arbitrarily. All conditions necessary for the *indirect* comparison of different intensities of a quantity are fulfilled. [1])

In this method of measuring magnetic forces we adopt a natural unit of magnetic force.

In applying the specified method we need not know the functional relation between magnetic force and magnetic separation of the spectral lines. It is sufficient to know that this function is one-valued. The most accurate measurements of the present time [2]) and also theory render it extremely probable that the separation of the spectral lines is proportional to the intensity of the field wherein the source of light is placed. If this simple relation be

1) Comp. RUNGE, Maass und Messen. Encyclopädie der mathematischen Wissensch. Bd. V. I. 1903.

2) See specially: A. FÄRBER, Über das Zeeman-Phänomen. Ann. d. Phys. **9** p. 886. 1902.

the true one, then our scale of magnetic forces is identical with the one commonly used.

We may then deduce from a given separation of a well-defined spectral line the strength of a field in absolute measure, the constant of reduction being once for all determined.

In the measurements of FÄRBER [1]) relating to the lines 4678 Cd and 4680 Zn (produced by a spark between zinc-cadmium electrodes) the constant of reduction could be determined with a probable error of far less then $^1/_{100}$.

This method and all methods used till now for measuring magnetic fields, give the intensity in a point. Or rather the mean value in a small area (often rather extensive) or in a small space is considered to be the intensity in a point of that area or of that space.

The magnetic separation of the spectral lines enables us *to measure simultaneously the magnetic force in all points belonging to a straight line.*

In my experiments vacuum tubes charged with some mercury and excited by a coil were used. The tubes had capillaries of 8 cm. length, the interior diameters varying between $^1/_4$ and $^1/_2$ mm. The shape of the tubes was that given by PASCHEN [2]), also used by RUNGE and PASCHEN in their investigation concerning the radiation of mercury in the magnetic field.

A very moderate heating is required for the passage of the discharge, the light in the capillary is then fairly intense, it becomes very brilliant as soon as the tube is placed in the magnetic field.

It was noticed that for a given vapour density there exists a definite intensity of field for which the luminosity is a maximum. This is easily seen when putting on the current of a DU BOIS half ring electromagnet. Owing to the large inductance (relaxation time 50″) the intensity of the field rises gradually. If the vapour density in the tube is not too high, there is clearly one moment of maximum luminosity.

If with a given field the density of the vapour is well chosen, then only a very moderate heating of the tube is sufficient for keeping it luminous.

When the tube is placed between the conical poles of a DU BOIS electromagnet and in a plane perpendicular to the line joining the poles, there is of course a different field intensity in every point of

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1) FÄRBER. l. c.

2) PASCHEN, Eine Geisslersche Röhre zum Studium des ZEEMAN-effectes. Physik. Zeitschr. p. 478. I. 1900.

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the tube. Analysing the light of the different points of the tube with a spectroscope, we find of course a different magnetic separation for every point.

We can however spectroscopically analyse *simultaneously* the light of all points of the tube.

We have only to focus an image of the tube upon the slit of the spectroscope. This spectroscope must satisfy one condition. This condition is that to every point of the slit there corresponds one point of the spectral image. In the case of a prism spectroscope, of an echelon spectroscope, and of a plane grating spectroscope, this condition is clearly fulfilled, but the concave grating mounted in ROWLAND'S manner forms an exception. The use of the concave grating necessitates in our case the employment of the method proposed by RUNGE and PASCHEN [1]).

My experiments were made in the above manner.

To illustrate this method I shall take the blue line of mercury (4359), which divides into a sextet.

The distribution of the magnetic force in a plane perpendicular to the axis of a DU BOIS electromagnet with a distance of 4 mm. between the poles is mapped out in a spindle-shaped magnetogram, of which a part is reproduced in Fig. 1. This figure is from a negative enlarged 9 times. We may extinguish by means of a Nicol the light of the inner components. At both sides two narrow lines remain. Fig. 2 is a *natural* size reproduction of a magnetogram taken under the specified conditions. The duplication of the outer components is lost in the reproduction. The extension of the field, mapped out by this magnetogram, may be better understood if I observe that 1 mm. in the focal plane of the spectroscope corresponds to 1.80 mm. in the plane between the poles or 1 mm. in the latter plane to 0,556 mm. of the negative. Hence in Fig. 1 5 mm. corresponds to 1 mm. between the poles. The complete magnetogram gives the magnetic force in a line, 30 mm. in length. Using a lens of shorter focus we can represent, of course, a greater part of the field. In the middle of the field the magnetic force is about 24,000 C. G. S. A *comparison* of field strengths can be made with a decidedly higher degree of accuracy than that which is given above for an absolute measurement.

The method set forth above will be applied, of course, only in difficult cases. As long as our spectroscopes of great resolving power are rather cumbersome, no practical application of the method is possible.

In many cases there will be great advantage in selecting a spectral line which is tripled in the field.

[1]) KAYSER, Handbuch Bd. I, p. 482.

P. ZEEMAN. "Magnetic resolution of spectral lines and magnetic force.'

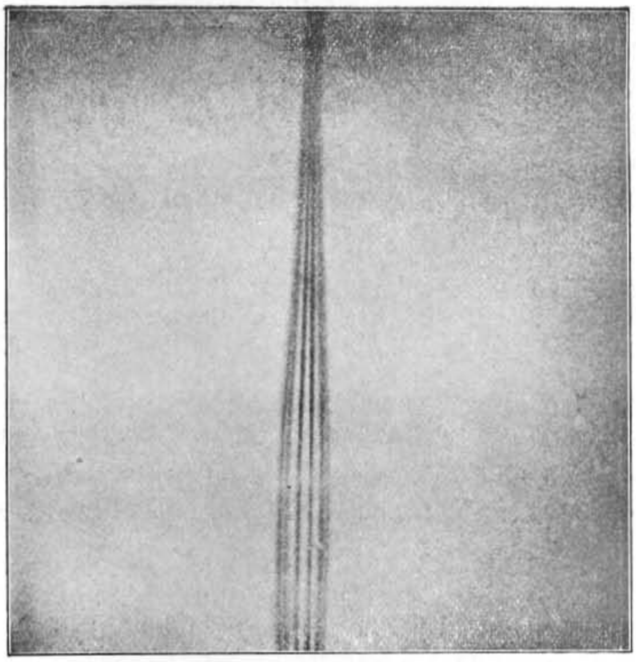

Fig. 1.

Fig. 2.

The magnetisation of the spectral lines enables us to determine the maximum value of the force with phenomena varying rapidly with the time, and with non-uniform fields.

In some cases it is of great importance to follow the behaviour of a spectral phenomenon with different strengths of field. The above described method might then be called *the method of the non-uniform field.*

In a future communication I hope to study in this manner the *asymmetry* of the separation of spectral lines in weak magnetic fields, predicted from theory by VOIGT. On a former occasion I have communicated some experiments giving rather convincing evidence of the existence of this asymmetry [1]).

In the mean time, I think that the developments lately given by LORENTZ [2]) make it desirable to corroborate the reasons for accepting the existence of this extremely small asymmetry.

Mathematics. — "*Some properties of pencils of algebraic curves*". By Prof. JAN DE VRIES.

§ 1. Let A be one of the n^2 basepoints of a pencil (c^n) of curves c^n of order n, B one of the remaining basepoints. If we make to correspond to each c^n the right line c^1 touching c^n in A, then we get as product of the projective pencils (c^n) and (c^1), a curve T_1 of order $(n+1)$ forming the locus of the tangential points of A, i. e. of the points which are determined by each c^n on its tangent c^1. This *tangential curve* has in A a threefold point where it is touched by the inflectional tangents of three c^n having in A an inflection; it has been considered for the first time by EMIL WEYR (Sitz. Ber. Akad. in Wien, LXI, 82).

I shall now consider more in general the locus T_m of the m^{th} tangential points of A. The order of this curve is to be represented by $\tau(m)$, whilst $\alpha(m)$ and $\beta(m)$ are to indicate the number of branches which T_m has in A and B.

Prof. P. H. SCHOUTE has drawn my attention to a paper inserted by him in the Comptes Rendus de l'Académie des sciences, tome CI, 736, where the corresponding curve is treated for a cubic pencil. I found that the numbers obtained there for $n = 3$ appear from the results to be deduced here.

1) ZEEMAN. These Proceedings, December 1899.

2) LORENTZ. These Proceedings, December 1905.