a protein, provisionally called substance C by Miss VAN HERWERDEN. Not until the enzym has been able for a long time to influence these substances, does it form primary albumose from them. At the same time, however, the enzym also appeared at neutral reaction to form from coagulated albumen primary albumose, though in a small quantity. So there is every reason to consider curdling of milk as a proof of the first stage of proteolysis.

Taking this into consideration, it is not so wonderful, as it has been regarded, that all kinds of proteolytic enzymes possess the power of curdling milk, though in natural circumstances they never come in contact with caseine. For then the peculiarity is not to be sought for in the enzyme, but in the caseine, the splitting of which already can be observed in a stage of the digestion, in which with other proteins alteration is still quite imperceptible.

Physics. — "*The intensities of the components of spectral lines divided by magnetism*". By Prof. P. ZEEMAN.

If a spectral line is resolved into a triplet by the application of a magnetic field, the two outer components and the middle line will generally differ in intensity. According to the elementary theory of LORENTZ of the phenomenon of magnetic resolution there exists a simple relation between these intensities.

Let I_1 and I_3 be the intensities of the outer components and I_2 that of the middle line then we may expect that

$$I_1 = I_3 = \tfrac{1}{2} I_2 \quad , \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad (1)$$

It has been often asserted, that generally this relation is not fulfilled, and that triplets frequently have in contradiction with (1) a weak middle line and strong outer components.

Really some cases [1]) can be cited, in which the intensities differ from what may be inferred from equation (1). In numerous cases however this contradiction is only apparent, no attention having been paid to a circumstance presently to be mentioned and not yet examined in connexion with our present subject.

In - the very important investigation by RUNGE and PASCHEN [2]) a calcspar prism was placed before the tube placed in the magnetic field. By means of a quartz lens the two images given by the calc-

[1]) The lines exhibiting the partial polarization observed by EGOROFF and GEORGIEWSKY (C.R. **124**, **125** 1897) are meant here.

[2]) C. RUNGE u. F. PASCHEN Abh. der Berl. Akad. Anhang. 1902.

spar are projected in the plane of the slit of the spectroscope. The two images could be examined separately.

"Bei richtiger Stellung des Kalkspaths bestand das eine Bild aus Licht, dessen elektrische Schwingungen in der Lichtquelle parallel den Kraftlinien vor sich gehen, das andere Bild aus Licht, dessen elektrische Schwingungen in der Lichtquelle auf den Kraftlinien senkrecht stehen. Dass die Ebene der Schwingungen nach dem Durchsetzen des Kalkspaths durch die Quarzlinse gedreht wird, thut nichts zur Sache".

Bij means of this arrangement the components with vertical vibrations are undoubtedly separated from those with horizontal ones. The main object of RUNGE and PASCHEN's investigation being the connexion between series and magnetic separation there is no objection to be made. The case is changed however as soon as the relative intensities of the components in the emitted light are under investigation, for these under certain circumstances could be essentially altered. If vertical and horizontal vibrations are reflected differently by the grating, the rotation of the direction of vibration in the beams passing through the quartz lens of course will be apparent in the observed intensity.

Polarizing effects of gratings are well known and generally the direction of vibrations relatively to the grooves must be of importance.

I had not anticipated that this circumstance would give rise to such striking effects as were observed by me in some experiments with a large ROWLAND grating. I have only made some observations with the yellow mercury lines, observing in the spectrum of the first order. The incident rays made an angle of about 19° with the normal to the grating, and in this latter direction observations were made or photographs taken. A vacuum tube charged with some mercury [1]) was placed in the magnetic field and by means of a glass lens an image was projected on the slit of the spectroscope. The light emitted at right angles to the horizontal magnetic lines of force was investigated.

In figure 1. a reproduction is given of the triplet in which the line 5769.4 is resolved. The distribution of intensities is in absolute contradiction with equation (1).

Observations with a calcspar and a sodium flame, the light of which was incident on the grating at about the same angle as above specified, the direction of observation being normal to the grating, showed at once that the light reflected from the grating

[1]) F. PASCHEN, Physik. Zeitschr. Jahrg. 1 p. 478. 1900.

was strongly polarized. The vertical vibrations were strongly preponderating.

The influence of a rotation of the plane of polarisation of the yellow mercury light on the distribution of intensities in the triplet was then examined. The plane of polarization was rotated by means of quartz plates with faces perpendicular to the axis placed in front of the slit. I had at my disposal two small plates of 2.15 resp 4.17 mm. thick. According to GUMLICH [1]) the rotation for mercury light of wavelength 5769 in a quartz plate 1 mm. thick, is at $t = 20°$ 22°.718 and hence the rotation in my plates amounted to

$$22.72 \times 2.15 = 48°.90 \text{ en } 22.72 \times 4.17 = 94°.7.$$

The change in the distribution of light is at once apparent. In figure 3 the outer components are hardly visible. The negative reproduced corresponds to the case in which the plate rotating the plane of polarization 94°.7 is in front of the slit.

Figure 2 corresponds to the case in which the incident vibrations are inclined at about 45° to the slit. It may be remarked that in this case the real distribution of intensities between the components, as existing in the emitted light, is observed.

Vertical and horizontal vibrations now being equally present in each of the components, and hence the circumstances as to vibrations being the same for the three components, the polarization by the grating is eliminated.

The distribution of light in figure 2 is certainly not in contradiction with equation (1) and eye observation seems to confirm it numerically also. Of course a photographic reproduction is not sufficient for a comparison of intensities and a numerical test must be reserved for a future paper.

For an estimation of the real ratio of intensities of the components of a divided spectral line henceforth care must be taken that for the region of the spectrum under review the vibrations in the incident light are inclined at an angle of 45° C. to the slit.

If in the case of a complicated division of a spectral line some components are weak, it will sometimes be possible to strengthen these components by placing a quartz plate of suitable thickness in front of the slit. This will be feasible in all cases in which the incident vibrations are not those most favoured by the grating.

Of course also with other spectroscopes this device does apply

[1]) GUMLICH. Wied. Ann. Bd. 64 p. 333. 1898.

e. g. in the case of a MICHELSON echelon spectroscope, if the incident light has been previously analyzed by means of an auxiliary spectroscope. Reflection and refraction in the glass prisms of course weakens to different amounts vertical and horizontal vibrations.

Cases in which relation (1) fails are to be observed in some spectra with many lines (e. g. iron). Among adjacent magnetic triplets some are to be detected in which the distribution of intensity in one resembles figure 1, in the other figure 2. Without further analysis one may conclude that for the one or for the other relation (1) fails.

EXPLANATION OF THE PLATE.

The figures are thirtyfold enlargements of negatives concerning the mercury line 5769, 4.

In all cases the image of the source was projected on the slit with a glass lens.

Fig. 1. No quartz plate in front of slit.

Fig. 2. Quartz plate, rotating plane of polarization 45° in front of slit. The distribution of light corresponds to that in source.

Fig. 3. Quartz plate, rotating plane of polarization 90° in front of slit. Though the time of exposition was thrice that used with the other figures, there appear only traces of the outer components in the original negatives.

Chemistry. — *"On lupeol."* By Prof. P. VAN ROMBURGH.

In the Comptes rendus of June 24, 1907, JUNGFLEISCH and LEROUX state that lupeol cinnamate occurs in the gutta percha of *Palaquium Treubii* BRCK.

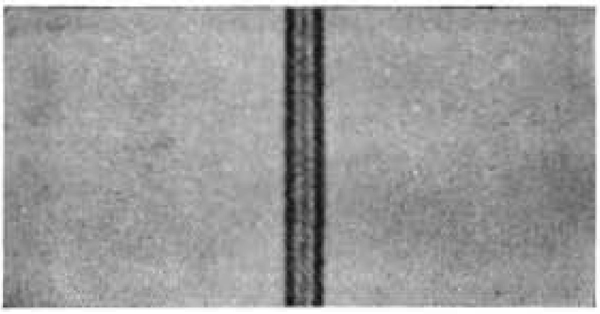
I have demonstrated previously that cinnamic acid may be obtained from this species of gutta, whereas lupeol cinnamate proved to be a constituent of different commercial varieties of gutta percha [1]).

JUNGFLEISCH and LEROUX have now studied the lupeol obtained by them and state that this substance on heating suddenly on the "bloc Maquenne" melts at 190°—192°, then immediately solidifies and melts again at 212°. They explain this phenomenon by assuming that lupeol loses water and is converted into a hydrocarbon, melting at 212°, to which they give the name of lupeylene. At 130° lupeol would lose water slowly, very rapidly so at 150°—160° and suddenly at 190°.

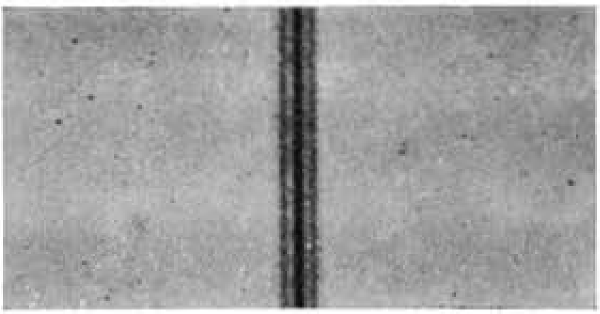
1) B.B. 37 (1904) 3442.

2) Diss. Utrecht 1906.

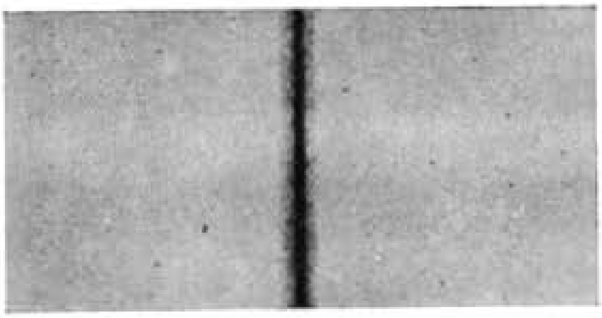
P. ZEEMAN. The intensities of the components of spectral lines divided by magnetism.



1. No quartz plate in front of slit.



2. Quartz plate, rotating plane of polarization 45° in front of slit.
   Intensities as in source.



3. Quartz plate, rotating plane of polarization 90° in front of slit.