and that is the reason why it takes place immediately. The inhibition of the MO fraction does not alter the diffusion phenomenon.

The intimate mechanism of action of merthiolate is now being investigated and also the action of other hyaluronidase inhibitors (heparin and sodium salicylate) on the various enzyme fractions. The results of such experiments will be reported *in extenso* in a further paper.

M. CAMPANI

Institute of General Pathology of the University of Modena, July 18, 1949.

*Zusammenfassung*

Merthiolat zeigt eine hemmende Wirkung auf die Hyaluronidase des Hodens. Dennoch ist es mittels verschiedener Konzentrationen jenes Stoffes möglich, eine selektive Hemmung der Mukooligosaccharase-Fraktion (MO) bei fast vollständiger Schonung der depolymerisierenden Fraktion (MP) zu erzielen.

## Noradrenaline and Adrenaline in the Suprarenals of the Guinea-Pig

HOLTZ and SCHÜMANN[1] have given evidence to show that extracts of suprarenals of cattle in addition to adrenaline probably contain noradrenaline. This finding has been confirmed by EULER and HAMBERG[2] and by GOLDENBERG *et al.*[3]. L-noradrenaline has subsequently been isolated in pure form from suprarenals of cattle (BERGSTRÖM, EULER, and HAMBERG[4] and from standard samples of epinephrine (TULLAR[5]).

The present experiments have shown that guinea-pigs suprarenals also contain noradrenaline as estimated with the colorimetrical method of EULER and HAMBERG[6] which permits quantitative estimation of both noradrenaline and adrenaline in a mixture.

The animals were killed by a blow on the neck and the suprarenals immediately prepared and extracted with 10 p.c. trichloracetic acid which was removed from the filtrate with ether. The following figures were obtained:–

| No. | *l*-Adrenaline µg per g | *l*-noradrenaline µg per g | per cent *l*-noradrenaline |
|---|---|---|---|
| (1) single pair | 276 | 52 | 15·9 % |
| (2) single pair | 272 | 122 | 31·0 % |
| (3) 5 pairs | 223 | 70·5 | 24·0 % |

The relative amount of noradrenaline compares well with the figures obtained by EULER and HAMBERG on 7 extracts of fresh suprarenals from cattle, 18·0–27·4 p.c., with an average of 23·6 p.c.

[1] P. HOLTZ and H. J. SCHÜMANN, Naturwiss. *35*, 159 (1948).
[2] U. S. v. EULER and U. HAMBERG, Nature *163*, 642 (1949).
[3] M. GOLDENBERG, M. FABER, E. J. ALSTON, and E. C. CHARGAFF, Science *109*, 534 (1934).
[4] S. BERGSTRÖM, U. S. v. EULER, and U. HAMBERG, Acta chem. Scand., *3*, 305 (1949).
[5] B. F. TULLAR, Science *109*, 536 (1949).
[6] U. S. v. EULER and U. HAMBERG, Acta physiol. Scand., in the Press (1949).

L-Noradrenaline, which has previously been recognized as a neuroergone in adrenergic nerves[1] thus also occupies the position as a true hormone.

U. S. v. EULER, U. HAMBERG, and A. PURKHOLD

Department of Physiology, Faculty of Medicine, Karolinska Institutet, Stockholm, August 3, 1949.

*Zusammenfassung*

In Nebennierenextrakten von Meerschweinchen wurde folgendes gefunden: sie enthalten *l*-Noradrenalin, das 15,9–31 % der gesamten Katecholverbindungen ausmacht.

[1] U. S. v. EULER, Acta physiol. Scand. *16*, 63 (1948).

## Measurement of the Pressure in Schlemm's Canal and in the Anterior Chamber of the Human Eye

It has been discussed if the pressure in Schlemm's canal is higher or lower than the intraocular pressure[1]. The mechanism of the outflow depends on that question, but it has never before been possible to measure this pressure.

The discovery of the aqueous veins by ASCHER[2] and independently by GOLDMANN[3] has opened the possibility of bloodless measurement of the pressure in Schlemm's canal. If an aqueous vein is blocked by compression so near to the limbus corneæ, that it has not yet joined any veins, the pressure above the block will be the same as in Schlemm's canal. Since there are some twenty connections between the canal and the episcleral veins this compression of a single one will not significantly increase the physiological pressure in Schlemm's canal. Determinations according to this principle have been made by means of a small pressure chamber connected to a manometer[4] and fitted with a transparent rubber membrane and built-in lighting. The aqueous vein was blocked by a small pelotte, the pressure chamber applied above the block and the pressure adjusted until the collapse of the blocked vessel. The whole measurement was made under a magnification of 30.

By compression of the jugular veins by means of a pneumatic cuff the pressure in the episcleral veins can be raised. When it is high enough the flow of aqueous humour first stops and then turns in retrograde direction. This can best be seen where an ordinary vein empties into the aqueous vein. Just at the moment of balance when the flow has stopped the boundary pulsates. At this moment the pressure is the same in the aqueous and episcleral veins, in Schlemm's canal and in the anterior chamber of the eye and can be measured with the pressure chamber.

Thus, this is a new bloodless method of measuring the intraocular pressure (I.O.P.). However, the stasis does not leave the I.O.P. unaffected and the method does not directly yield values of the physiological I.O.P. In order to obtain such values the following procedure was adopted. First of all a tonometry was performed with a Sklar-Schiötz tonometer yielding a value of $P_1$ mm Hg. Then the cuff is inflated and the venous pressure at which aqueous flow ceases is determined ($P_2$). Immediately after this and without change in the degree of stasis a new tonometry is performed ($P_3$). The physio-

[1] S. DUKE-ELDER, Brit. J. Ophthal. *25*, 287 (1926).
[2] K. W. ASCHER, Amer. J. Ophthal. *25*, 31, 1174, 1301 (1942).
[3] H. GOLDMANN, Ophthalmologica *111*, 146 (1946); 112, 344 (1946).
[4] E. SEIDEL, GRAEFE'S Arch. 112, 252 (1923).

logical I.O.P. must be very near $P_1 + (P_2 - P_3)$. The difficulty of the method lies in the determination of $P_2$. In many eyes it is not easy to see clearly the moment when the flow has stopped.

20 young healthy students with distinct aqueous veins in together 24 eyes served as subjects. The intraocular pressure was first measured with Sklar-Schiötz tonometer and then the pressure in the episcleral veins and in Schlemm's canal was determined. The average of 3 measurements with the pressure chamber was taken. Every person was examined in lying position twice on different days. On 7 of these persons the intraocular pressure was measured too. The results are summarized in the Table.

Measurements of pressure in mm Hg

| Signs:— n = number of eyes m = arithmetic mean e = standard error s = standard deviation | n | m ± e | s |
|---|---|---|---|
| The episcleral veins . | 24 | 14·31 ± 0·21 | 1·02 |
| Schlemm's canal . . | 24 | 16·20 ± 0·25 | 1·24 |
| $P_1$ . . . . . | 24 | 16·5 ± 0·57 | 2·80 |
| $P_2 - P_3$ . . . . . | 7 | 5·7 | |
| I.O.P. $(P_1 + P_2 - P_3)$ | 7 | 22·2 | |

The measurements are being continued. The results and a complete discussion will be published in the Acta Ophthalmologica.

ERIK LINNÉR

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*Zusammenfassung*

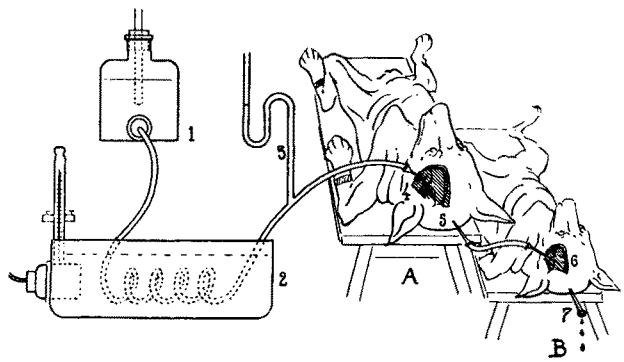
An menschlichen Augen werden die Kammerwasservenen blockiert. Der Druck oberhalb der Blockierungsstelle wird genau so hoch wie im Schlemmschen Kanal und wird mit Hilfe eines kleinen Druckgefäßes gemessen. Durch Stauung der Halsvenen wird der Druck in den episkleralen Venen erhöht, bis die Strömung in der Kammerwasservene aufhört. Im Moment, in dem das Gleichgewicht erreicht wird, herrscht in den episkleralen Venen, im Schlemmschen Kanal und in der Vorderkammer ein übereinstimmender Druck.

## PRO LABORATORIO

### Technique pour l'étude des influences directes du liquide céphalo-rachidien sur les centres nerveux supérieurs

En dehors du rôle protecteur exercé par le liquide céphalo-rachidien vis-à-vis d'influences mécaniques pouvant agir sur les centres nerveux supérieurs, l'attention a été attirée sur la possibilité d'une action directe des éléments constituants de ce liquide sur le système nerveux central. A ce point de vue, différentes possibilités peuvent être envisagées: le liquide céphalo-rachidien peut notamment présenter des modifications dans sa composition à la suite de changements dans le fonctionnement de la barrière hémato-encéphalique et peut, d'autre part, contenir des concentrations variables d'hormones comme conséquence d'une activité plus ou moins considérable de l'hypophyse, et en particulier de l'hypophyse postérieure.

Nous avons mis au point une technique (voir schéma) qui nous permet d'examiner les influences exercées sur les fonctions de l'organisme par des modifications de la composition du liquide céphalo-rachidien, telles qu'elles peuvent se produire dans différentes circonstances. Deux chiens sont anesthésiés; l'un d'eux, que nous appellerons chien *A*, pèse deux à trois fois plus lourd que le second que nous désignerons sous le nom de chien *B*. Chez le chien *A*, une aiguille (*4*) est introduite dans un ventricule latéral du cerveau par un petit orifice de trépanation, tandis qu'une seconde aiguille est introduite dans la région cisternale (*5*); cette dernière aiguille est reliée à une autre aiguille (*6*), enfoncée, par un orifice de trépanation, dans un ventricule cérébral latéral du chien *B* dont le contenu ventriculaire peut s'échapper ensuite par une aiguille sous-occipitale placée dans la région cisternale (*7*). Au moyen de cette technique, le contenu des ventricules cérébraux du chien *A* est transfusé dans les ventricules du chien *B* et peut y exercer ses effets sur les centres nerveux supérieurs de cet animal; il s'écoule ensuite par




l'aiguille sous-occipitale placée chez ce chien. La production de liquide céphalo-rachidien étant très lente, nous avons, dans le but d'assurer un passage continu et régulier du contenu ventriculaire du chien *A* dans les ventricules du chien *B*, relié l'aiguille latérale du chien *A* à un flacon rempli d'un liquide céphalo-rachidien artificiel (*1*), préalablement chauffé à la température de l'animal. Un débit très lent de ce liquide réduit la dilution du liquide céphalo-rachidien du chien *A* au minimum.

Cette technique permet d'examiner si, dans différentes conditions expérimentales, le liquide céphalo-rachidien subit des modifications de sa composition, capables d'influencer directement les centres nerveux supérieurs. Nous communiquerons ultérieurement les résultats qu'elle nous aura permis d'enregistrer.

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Laboratoire de pathologie et de thérapeutique générales de l'Université de Gand, Belgique, le 25 juillet 1949.

*Summary*

In order to study the influences of variations of the composition of the cerebrospinal fluid on the central nervous system, a technique can be used which allows the passage of cerebrospinal fluid from one dog to the cerebral ventricles of a second one, the last one being used to record the reactions due to changes occasionally produced in the cerebrospinal fluid of the first one.