gram) form the essential portion of the instrument, the smaller parallelogram serving merely to carry a balance weight. They are constructed of thin wooden laths, the bearings and pencil holder being of metal. The dimensions, which have been adopted merely for the sake of obtaining a suitable range of movement and magnitude of chart, give a reduction of 7 to 1 and are

Long side of parallelogram	...	3 feet 6 inches	} Between centres
Short side „ „	...	6 inches	
Pointer, from test object to near bearing	...	3 feet	
Pencil, from bearing	...	6 inches	

The pointer, if a simple straight one, would in some positions obscure the fixation point. To obviate this it has been given a double elbow and is capable of turning on its long axis. It is covered with the same black velveteen as the curtain and provided with a test object on each side. The test objects, white and coloured, are on black velveteen covering a clip which slips on the end of the pointer.

The pencil holder is merely a short tube, through which the pencil may be pressed against the chart whenever it is desired to record the position of the test object.

In the board supporting the chart is a small hole corresponding to the position of the centre of the chart. This takes the wire centre of a "dummy" pencil, and serves to hold the instrument in the central position while the curtain is adjusted so that the fixation point and test object coincide.

The whole instrument might conveniently be arranged as a wall fixing and provided with electric illumination.

The chart has been printed to show (on tangent scale) the concentric circles at 5° intervals up to 30° and meridians at 30° intervals. On the curtain the 10° and 25° circles have been marked in black silk, in deference to Priestley Smith's opinion of their diagnostic importance, and to act as a check on the accuracy of the instrument.

A POINT IN FAVOUR OF PROFESSOR ARTHUR THOMSON'S THEORY OF THE PRODUCTION OF GLAUCOMA

BY

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It is a common observation, which I have often confirmed, that an attack of acute glaucoma comes on between midnight and early morning, i.e., after a few hours sound sleep. The history is to the

effect that the patient went to bed as usual without the least premonition of an attack of one of the most painful diseases he or she has ever experienced.

By questioning the patient we can elicit some information as to previous state of health. The history may be absolutely without medical interest. Some prodromata of glaucoma, on the other hand, may have been experienced at times. There may be some worry or constipation, but nothing worth taking serious notice of. On the night in question the patient went to bed as usual, and at some time after midnight severe pain in the head came on, the patient vomited and the eye became red and the eyelids swollen. For a number of years I have tried to find some explanation for the attack coming on at this particular time of night. It is only now when I become acquainted with Professor Arthur Thomson's views about the genesis of glaucoma (*Ophthalmoscope*, Vol. VIII (1910), p. 608), that I can satisfactorily explain the reason of this condition to myself.

Your European readers are doubtless fully familiar with Professor Arthur Thomson's valuable original work on the anatomy of the eye, but I may be excused if I give a brief outline of his theory for the benefit of some of your readers who are not acquainted with his theory.

In short, Professor Arthur Thomson has shown that posterior to the opening of Schlemm's canal there is a projection all round from the inner side of sclera. This projection he calls the scleral spur. In longitudinal section it is almost triangular in shape. To its anterior aspect or apex are attached the fibres of the ligamentum pectinatum. This ligament is elastic. To the posterior aspect or base of the spur are attached fibres of the ciliary muscle. During accommodation the ciliary muscle contracts and in so doing it pulls the scleral spur backwards, thereby pulling the walls of Schlemm's canal apart; whilst at the same time the ligamentum pectinatum is stretched. By widening of Schlemm's canal negative pressure is induced in it. This leads to an in-rush of aqueous in the canal from the iridic angle. Then follows the second part of the phenomenon. The ciliary muscle ceases to act. The pectinate ligament by its inherent elasticity tries to return to its normal condition, thereby positive pressure is brought about in Schlemm's canal. The fluid which rushed into Schlemm's canal during the time the pressure was negative in it is now subjected to positive pressure. It can no longer return to the anterior chamber as the scleral spur by returning to its former position closes the passage to the anterior chamber. The fluid can only pass to the anterior ciliary veins. In fact it is pumped on to the veins. This process is repeated every time the accommodation is brought into play; and fluid from the anterior chamber passes on to Schlemm's canal, thereby maintaining equilibrium of intra-ocular pressure.

Now it is quite plain that accommodation acts only during waking hours and it stops during sleep, and hence changes—brought about by the constantly altering conditions of accommodation—are no longer in action during sleep. How is it then that in normal conditions the equilibrium of intra-ocular pressure is maintained? It is possible either that the secretion of aqueous should be enormously diminished or stop altogether or that the work of excretion be carried on through some other channels. So far the physiologists have not proved that the process of secretion ceases during sleep nor have they demonstrated that it is diminished; on the other hand, we have reasons to believe that aqueous is secreted during sleep. The reasons I allude to are first, when a patient is under the effects of an anaesthetic and an incision is made in the cornea, the aqueous flows out, but if some time be allowed to pass the anterior chamber is filled in again. Let it be made clear that normal sleep is not similar in every respect to narcosis produced by an anaesthetic and that the emptying of the anterior chamber induces negative pressure in it and that thereby conditions favourable to the secretion of aqueous are produced which are far from being similar to the conditions in normal sleep. The second reason is that it has been proved that urine is secreted during sleep, and Mr. Treacher Collins has shown that histologically there is a certain amount of resemblance between the ciliary body and glomeruli of the kidneys; and hence it is quite possible that aqueous humour which is secreted by the ciliary body continues to be secreted during sleep. Now, under these circumstances, as the aqueous which is secreted can no longer pass on through Schlemm's canal during sleep, there must be some other passages through which it finds its way out under normal conditions. We know that there are two routes at least through which the aqueous can find an exit. These are through the crypts of the iris and the posterior route through lymphatic channels of Cloquet's canal.

In normal eyes, or in eyes not predisposed to acute glaucoma, this arrangement works smoothly, but in those eyes that are predisposed to acute glaucoma from one cause or another the comparatively scanty filtration is not adequate till morning hours when the patient wakes and the pumping mechanism can come into play again. As soon as the patient goes to bed the pumping mechanism ceases, aqueous collects in the posterior chamber; perhaps part of it forces its way into the anterior chamber and manages to pass through the crypts and thence to the veins. This inadequate arrangement allows a few hours after sleep to elapse before the effects of increased pressure in the posterior chamber begin to be felt. The increased pressure gives rise to venous engorgement which in turn makes the ciliary body and iris turgid. The iris and lens are pushed forwards and a vicious circle is established.

It may be worth while to mention here that during sleep the pupil contracts, hence this factor can be easily said to have no effect on the condition.

A DIRECT RECORD SCOTOMETER FOR INVESTIGATING THE CENTRAL FIELD OF VISION*

BY

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DURING recent years increasing attention has been given to the investigation of the state of the central fields of vision. Observations made by such investigations are of value to the physician and to the ophthalmic surgeon. The physician is interested in the appearances of scotomata as indications of lesions of the optic nerves in organic diseases and in the various phenomena that may be elicited in functional disorders. The ophthalmic surgeon is interested in these observations also, and more particularly in the state of the blind spots in suspected early onset of chronic glaucoma. There is general agreement on the value of the field of investigation opened by the work of Bjerrum, but most will equally agree that these investigations are laborious in the extreme, and that not a little of their value is lost since the results tend to be vitiated by the occurrence of fatigue on the part of the patient owing to the lengthy process of the investigation.

The instrument illustrated is a simple and convenient arrangement for making and recording Bjerrum's test and mapping out central scotomata. I have had it in use for over two years, and find it a great labour-saving contrivance. Besides that, the speed with which the observations can be made ensures an accuracy of measurement which I do not think can be beaten. A permanent record of the observation is made at the same time as this is taken without any calculation on the part of the surgeon; and withal the patient sees and knows nothing of what is happening and is not distracted by a number of manipulations or changes of position by surgeon or instrument.

My first experience of Bjerrum's test was made in the fashion recommended by the author of the test: with a black sheet hung against a wall. I soon felt the need of getting behind the screen so as to be able to see the patient's eyes without interruption. I thereupon used a blackened disc of three-ply wood fitted to the ordinary perimeter stand, with the degrees, circles, and radii graven upon its surface. The object used was gummed on to the point of a lead

*Instrument demonstrated before the Section of Ophthalmology, Roy. Soc. Med., on January 14, 1921.