Physiology. — *"Regarding Automatic Movements of the Isolated Iris"* [1]). By JASPER TEN CATE. (Communicated by Prof. G. VAN RIJNBERK).

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After SERTOLI's description of automatic rhythmic movements of the M. retractor penis (1882), numerous other organs with nonstriated muscle-cells have been investigated with regard to this phenomenon. It has been proved that the stomach, the guts, the ureters, the uterus, the arteries, the spleen, the bladder, the gall-bladder, and the oesophagus, in cold- as well as in warm-blooded animals, exhibit rhythmic contractions when surviving outside the body under favourable circumstances. In his researches MAGNUS has demonstrated that, as regards the gut, this faculty resides in the local nervous apparatus of AUERBACH's plexus. Since all the organs mentioned also possess local nervous plexus, it seems likely that also in the case of these organs the rhythmic contractions are attributable to an automatic function of those local nervous apparatus. Besides our knowledge of these facts justifies the assumption that other organs, provided with smooth muscle-cells, local nervous plexus and ganglia, are also capable of performing automatic rhythmic contractions. This induced me to experiment on the iris. This organ with an abundance of smooth muscles, also possesses a well-developed apparatus of ganglia, as has been made out by the uniform results of the most recent histological inquiries (LAUBER 1908, SCHOCK 1910, POLLACK 1913). There was good reason to suppose, therefore, that also the isolated iris should be capable of executing automatic rhythmic movements. However, the muscles of the iris being very feeble we had to cast about for a technique which, with least friction, should permit a registration of the result as much enlarged as possible.

With this view I made the following contrivance: A blade of straw was fixed to a glass bar for a lever. The fulcrum was constituted by a thin slightly twisted silk thread attached to the two prongs of a glass fork. The iris pulled at the end of the glass lever. The magnification of the displacement of the free end of the straw

[1]) After experiments made in the Physiological Laboratory of the Amsterdam University.

was $\times$ 16. Registration took place by arranging the contrivance before the slit of a camera with vertically moving plate, in the pencil of light emitted by a projection lantern.

I experimented chiefly on the cat's iris. The eye was rapidly enucleated and preserved in Tyrode-solution of 37—38° C. Glucose soon appeared to have an unfavourable action, so that tyrode was used without glucose. When oxygen was administered the isolated iris shortened considerably, but the spontaneous movements were much feebler than without the perfusion of O^2. In the latter case the iris relaxed and spontaneous contractions soon followed. They were stronger but of shorter duration than when oxygen had been supplied. I found the optimal temperature to be 37°—38° C. All these conditions being fulfilled, it was not difficult to establish two sorts of movements in the iris-preparation. First: movements that were comparatively strong, very slow and apparently analogous to those known in the literature as "tonus-oscillations". Secondly: movements that were much weaker and more frequent, bearing a distinct resemblance to what are generally termed: "spontaneous rhythmic movements" of isolated organs. They were not exactly regular, as is the case with other organs: their rhythm, as far as we could ascertain, varied in normal relations, in Tyrode, from 16 to 29 contractions per minute. Nevertheless our findings have established the capacity of the isolated iris of executing spontaneous, automatic, rhythmic contractions.

Furthermore, I have dealt with a few pharmacological problems viz. that pilocarpin and cholin reinforce these movements as well as the tonus-oscillations, whereas adrenalin weakens them and atropin inhibits and ultimately abolishes them. Under the influence of pilocarpin the rhythm is accelerated up to 25—38 contractions per minute. In the presence of adrenalin the frequency falls to 4—18.