PHYSIOLOGY.

UNDER THE CHARGE OF

T. H. MILROY, M.D., F.R.S.E.,

PROFESSOR OF PHYSIOLOGY, QUEEN'S COLLEGE, BELFAST.

Pancreatic Secretion in Man.

The work of the Pawlow school on the mechanism of pancreatic secretion has attracted the attention not only of physiologists, but also of clinicians, and perhaps no part of the investigations has appealed more to both than the close relationship which was shown to exist between the amount and character of the ferments in the pancreatic juice and the foodstuffs which called forth the secretion. It was but natural that doubt would be cast upon the results which appeared to agree so closely with those which we would expect to obtain were the ferments of the juice called forth only by the foodstuffs upon which these enzymes normally acted, that is to say, the fat-splitting ferment by fats, the diastatic by starches, and the proteolytic by proteids. Among the opponents of the Pawlow doctrines may be mentioned Popielski (Centralbl. f. Physiol., Leipzig u. Wien, Bd. xvii. S. 65). He was unable to detect any such close relationship as the experimental results of Wassilief, Walter, and Lintwarew seemed to have conclusively proved. But even were these experiments of the Russian school proved to be correct, they would only hold for the pancreatic secretion of the dog, while in the case of man the relationship between ferments and foodstuffs might be absolutely different. Rather less than a year ago, Glaessner (Ztschr. f. physiol. Chem., Strassburg, Bd. xl. S. 465) obtained from a fistula pancreatic juice which may be regarded as normal; but the most careful quantitative analysis of human pancreatic juice was that given by Schumm (Ztschr. f. physiol. Chem., Strassburg, Bd. xxxvi. S. 292), although in this case the fluid was obtained from a pancreatic cyst. These investigators, however, referred mainly to the chemical composition of the juice. Ellinger and Cohn (Ztschr. f. physiol. Chem., Strassburg, Bd. xlv. S. 28) were enabled, through the courtesy of some of their clinical colleagues, to examine the juice obtained from a pancreatic cyst; and as the secretion was large in amount, and appeared to be normal when compared with the analyses of Glaessner and Schumm,
their results may be accepted as holding good for the human pancreatic secretion. The chemical analyses of the juice need hardly be referred to, except in so far as they refer to the ferments. In the first place, an active proteolytic ferment was never found preformed in the juice; but the addition of an enterokinase solution, obtained in the usual way from the mucous membrane of the jejunum, converted the inactive into the active ferment. The juice was, however, not so active as that obtained by Glaessner. It was also found to contain, in fairly large quantity, active diastatic and fat-splitting ferments.

The effect of different diets upon the activity of the secretion was also investigated. On a mixed diet, the juice which was secreted was found to be richest in all the ferments. On a diet of fat, the juice was moderately rich in fat-splitting and diastatic ferments, and poor in proteolytic. On a purely flesh diet, the juice was richer in proteolytic ferment than on a fat diet, but poorer in diastatic and in fat-splitting ferments. On a diet of starchy foods, the juice was poorest in all the ferments. One, unfortunately, cannot feel entire confidence in these results, as the effect of the mixed diet was studied earliest in the series and starches last. One must remember that in all probability in the interval the character of the juice had changed.

The Influence of Copious Water Drinking.

This has been made the subject of many investigations, but the results obtained have been at variance with one another. The larger proportion of those who have studied the subject hold that there is at least a slight increase in the excretion of nitrogen; but even among those there is a good deal of doubt expressed as to whether this is due simply to better washing out of the tissues, or to an increased metabolic activity in addition. Thus Salkowski states that unless water be taken in enormous quantity, the increase in the excretion of nitrogen is almost negligible. Rubner, however, and a fair number of others, have noticed a very marked increase in nitrogenous metabolism after the ingestion of fairly large quantities of water.

Seegen, Fränkel, and some others have been able to detect no increase in nitrogen excretion even when fairly large quantities of water have been taken. Hawk (Univ. Penn. Med. Bull., Phila., 1905, March) carried out a careful investigation on this subject. He studied the influence of copious water drinking in man, estimating not only the nitrogen, but also the $\text{SO}_3$ and the $\text{P}_2\text{O}_5$. His analytical methods were those which are usually employed in exact investigations, and the food and faeces were analysed as well as the urine. His conclusions may be shortly summarised. Copious water drinking produces an increase in the excretion of nitrogen, sulphur, and phosphorus, the increase in the nitrogen being due, primarily, to the washing out from the tissues of the urea previously formed, but not yet removed, by the normal processes, and, secondarily, to a stimulation of proteid metabolism.

The increase in the excretion of phosphorus is due to increased cellular activity, especially affecting the katabolism of nucleins, lecithins, and other phosphorus-containing bodies. The $\text{SO}_3$ excretion, although
somewhat irregular, ran a more or less parallel course with the nitrogen, that is to say, the most marked rise taking place on the first day, and gradually falling on the second. The course of the $P_2O_5$ excretion was distinctly different from the nitrogen and sulphur, the maximum excretion always taking place on the second day, and the amount remaining above normal to the close of the experiment.

Thus the influence of the copious ingestion of water upon phosphorus-holding tissues is different from its effect upon nitrogen- and sulphur-containing bodies. There seems to be no doubt that there is an increased excretion such as Hawk refers to, and in all probability both factors are concerned in this increase, a better removal of preformed urea and sulphates, and an increased katabolism, especially of phosphorus-holding tissues. The results obtained are what one would naturally expect to be produced under the influence of an agent which removes effete products.

**ACCOMMODATION AND INTRA-OCULAR PRESSURE.**

The question as to whether accommodation is independent of intra-ocular pressure has been discussed both by ophthalmologists and physiologists. Heine (*Arch. f. Ophth.*, Leipzig, 1905, Bd. lx. S. 448) shows, by an interesting experiment, that accommodation can take place without the intra-ocular pressure being affected. He obtained from Dr. Otto Meyer a child's eyeball which had been freshly removed for a tumour at the corneo-sclerotic junction. The eyeball was placed between two ring electrodes, one at the corneo-sclerotic junction, and one at the entrance of the optic nerve, care being taken to avoid pressure. Accommodation at once occurred on stimulation with the weakest faradic current. A tiny wound was then made with a Graefe knife at the equator, and a small drop of vitreous exuded. During accommodation not the least change took place in the drop of vitreous. The refraction before and after stimulation was estimated. Thus, even under conditions when contraction of the ciliary muscle can produce no compression of the vitreous, accommodation can take place to its normal extent. Beer (*Wien. med. Wehnschr.*, 1898, S. 42) carried out practically the same experiment on the monkey's eye, with the same result.

Opening the vitreous chamber produces no relaxation of the suspensory ligament. The lens in the resting eye is rendered independent of the intra-ocular pressure by the firmness of the sclerotic, just as a thick or firm rubber ball maintains its form without collapsing, even after a piece has been removed. It is a point of great importance that the height of the intra-ocular pressure is without significance as regards the tension of the zonule and the attached choroid.