A New Function of the Pancreas.

Since the discovery of the close relationship between the pancreas and carbohydrate metabolism a very large amount of work has been done in order to arrive at some definite knowledge as to the way in which this gland acts as a regulator of the normal carbohydrate cycle. Up to the present time these investigations have only led to the introduction into physiological literature of innumerable hypotheses. Of these the most probable ones ascribe to the pancreas a rôle in the mechanism of the deposition of glycogen. Such hypotheses are based on the fact that this glycogen deposition is absent after removal of the pancreas, but this metabolic disturbance may be brought about in various ways—for example, from a loss of the normal glycogen formative power, or from a primary incapacity of the organs to hold glycogen. Even supposing that either of these functions is in abeyance, the explanation of the modus operandi still requires to be given. For example, a glycogen discharge may be brought about by a stimulus arising in cells which are suffering from a sugar hunger due to the existing metabolic disturbance, this excitation affecting the normal storage seat of glycogen.

This explanation is probably, however, negatived by the fact that in birds the combustion of glucose does not suffer after pancreas removal, although the store of glycogen is rapidly lost after the operation.

It seems therefore most likely that after extirpation of the pancreas the main disturbance is due to a primary incapacity of the organs to store (or form) glycogen. It is extremely difficult to know how the pancreas removal brings about this disturbance. In the light of the present-day knowledge of the functions of the sympathetic nervous
system it seems by no means unlikely that the following explanation may be the true one:

After removal of the pancreas the stimulus which leads to the transformation of glycogen remains the normal one, but the regulating inhibitory mechanism is weakened or absent. It is a well-known fact that such inhibitory powers are characteristic of the autonomic or sympathetic, as excitatory or inhibitory nerve supplies in many cases. Thus, after section and degeneration of the nerve fibres, the organ supplied may become over excitable to the normal stimuli (Langendorff, Anderson, Elliott and others). Thus the normal stimuli might after pancreas removal affect hyper-excitible organs, and therefore one might regard the pancreas as necessary for the maintenance of the normal regulating (inhibitory) mechanism.

Loewi (Arch. f. Exp. Path. u. Pharmakol., Bd. lxix. H. 1, p. 83, 1908), in a most interesting paper, has attempted to discover whether the pancreas exercises such an inhibitory control in the case of any other tissue or organ than that concerned in the carbohydrate metabolism. He chose as his test object the dilator pupil, which is under the control of the cervical sympathetic. On stimulation of the cervical sympathetic, contraction of the dilator fibres is brought about. It is known that there are certain inhibiting impulses which pass along to the end-organ from the superior cervical ganglion and which prevent certain stimuli bringing about this effect. Thus, as Meltzer pointed out, adrenalin, on being dropped into the conjunctival sac of man, or dog, or cat, produces no effect on the pupil. If adrenalin, however, be injected into the blood of most animals mydriasis is produced.

If the superior cervical ganglion be removed and then adrenalin be dropped into the conjunctival sac of the cat or dog, dilatation is produced. The explanation is seemingly that the normal inhibiting impulses which pass from the superior cervical ganglion are sufficiently strong to prevent adrenalin from bringing out its stimulating effects on the end-organ, but on removal of the ganglion these effects become evident.

The problem which the author attempts to solve may be put in the form of the following question:

Does the pancreas play any part in the initiation of the normal inhibitory sympathetic stimuli which prevent such an excitant substance as adrenalin from producing its dilator effect upon the pupil? If it were found that, after pancreas removal, but with an intact cervical sympathetic, adrenalin produced its effect on the pupil, one would be justified in concluding that the pancreas did affect the sympathetic control of the dilator pupilæ.

Loewi found that for the first 24 hours after the removal of the pancreas, just as is the case after the ganglion removal, adrenalin on being dropped into the eye produces no effect. After this period,
however, and at latest within 65 hours, all the animals operated on showed well-marked mydriasis as a result of the adrenalin. As a rule a few drops of a 1 per cent. solution produce well-marked dilatation of the pupil within 20 to 60 minutes, and this may last for 6 hours. The light reaction of the poisoned eye is slow. The effect on the pupil is not so marked as after removal of the superior cervical ganglion, nor is the normal form of the pupil in the former case quite lost, as it usually is in the latter. The dilated pupil becomes contracted when physostigmin is introduced, as Loewi found also to occur in the dilatation brought about by adrenalin after removal of the superior cervical ganglion. Subcutaneous injection of adrenalin after removal of the pancreas does not produce mydriasis, although this occurs when the ganglion is removed. It seems scarcely likely, however, that there is any inherent qualitative difference between the two cases, but simply a quantitative difference, because there is no evidence that pancreas removal facilitates the adrenalin effect from other causes; for example, from increased facilitation of entrance of the drug into the eye or from diminished tone of the oculo-motor nerve.

Loewi endeavoured to show that the effects mentioned above as occurring after pancreas removal were brought about by the withdrawal of the internal secreting mechanism of this gland, and not from other complications which might arise as a result of the operation. Thus neither does withdrawal of the pancreatic juice, nor such injury of neighbouring nerve structures as might be brought about by the operation, produce the same effect as entire removal of the gland. The function of the pancreas therefore appears in this case to control the excitability of sympathetic nerve elements, so far at least as certain stimuli are concerned.

The occurrence of diabetes and mydriasis do not appear to be expressions of the withdrawal of the same function, for the glycosuria and adrenalin effect do not occur in all cases together, one or other making its appearance first after pancreas removal.

Loewi investigated the adrenalin pupil effect in the case of patients suffering from various diseases and found that in the great majority of cases no dilatation was produced. In a fairly large proportion of cases of diabetes, and in one case of Basedow's disease, adrenalin produced dilatation of the pupil. Loewi concludes that a positive adrenalin effect is characteristic probably of a disturbance of the pancreas, or of a similar disease producing increased excitability of the sympathetic (Basedow's disease). If such a pupil reaction occurs in diabetes, it points to this being in all probability the pancreatic form, although its absence does not negative its pancreatic origin.
Localisation of Action of Poisons.

It is extremely important in many cases to be able to determine the part attacked by a particular poison. It has been generally supposed that if the seat of action of one substance be known, any body which is able to antagonise this action must act upon the same part. This, according to Magnus (Pflüger's Arch., Bd. cxxiii. p. 99, 1908), is by no means proved. Thus, one poison may act as an antagonist of two others, each of which acts upon a different part.

It is also interesting to note that the dose by means of which one body may antagonise another is frequently very much smaller than that required to bring about the characteristic action of the former in the normal condition. That is to say, a stimulant poison may antagonise a paralysing one in a dose much smaller than will produce in the unpoisoned condition the normal excitant effect.

Also in the case of a drug which antagonises the stimulant effect produced by another poison, there may be no trace of a paralysis.

The author therefore concludes that this method of employing antagonistic poisons cannot be made use of for the localisation of the point of attack.

PUBLIC HEALTH NOTES.

By W. ROBERTSON, M.D., D.P.H., M.O.H. for Leith.

Medical Inspection of School Children.

The long-promised Education Act for Scotland has now emerged from the committee stage. At no distant date the Act will be on the Statute-Book, when it will behove education authorities to make up their minds as to their future plans of action.

There are those who do not believe in the suggestion that school children should be medically examined, their chief ground of objection being the relief of parental responsibility. There is much to be said for the objection, but medical inspection demands more than perfunctory criticism. It is not enough to put it on one side by declaring it to be grandmotherly. It may be so, but the time has come when someone must assume the part of the grandparent. From time to time systematic examinations of school children in different centres have proved the existence of abnormal physical conditions among the scholars. Many of these abnormalities were unsuspected by parent or scholar. Not a few were neglected by the former. Further, many of the discovered defects were such as could not have been "diagnosed" by the