little care their pressure may be graduated so as not to injure the intima; but time is occupied in exposing the vessel, and the clamps may be accidentally displaced by the operator during subsequent manipulations.

3. Where neither constriction nor clamps are applicable, haemorrhage can certainly be controlled when the aneurysm is opened by the introduction of the left index finger into the sac, and making direct pressure on the wound in the vessel, which can usually be felt distinctly. Even if the vessel has been completely divided and the ends lie some distance apart, they may both be controlled as a rule by introducing the index and middle fingers, and splaying them until each compresses one end. By dissection the vessel can then be exposed, isolated, and secured. It is probably better for the operator to control the bleeding himself than to entrust it to an assistant, even though he is handicapped in the subsequent dissection by having only one hand free.

Technique.

1. At the risk of uttering a surgical platitude it is necessary to emphasize the need for strict asepsis in operative procedures on aneurysms, particularly if conservative measures are to be adopted. If infection occurs where an artery has been sutured, it will almost certainly lead to disaster in the form of secondary haemorrhage, and in the presence of existing infection suturing should not be attempted. The same rule generally holds in dealing with venous injuries, though here it is not so binding; in one obviously septic case the femoral vein was sutured successfully.

Possibly we shall learn in time that greater liberties may be taken in vascular surgery, but at present one does not feel justified in advocating them.

2. As it is impossible to determine by clinical examination what type of wound is present in the artery, all preparations necessary for effecting a plastic procedure should be made before commencing an operation for aneurysm of any of the larger important vessels. The surgeon must be prepared to ligate or suture, according as the operative findings dictate.

3. When the sac has been evacuated, careful and thorough examination should be made to determine the exact nature and extent of the vascular injury. Incomplete recognition of the conditions present may lead the surgeon to waste time in carrying out measures which further investigation proves to be unsuitable.

4. In regard to suturing I have closely followed Carrel's technique, with the details of which most surgeons are familiar. The needles employed are small, round-bodied, either straight or curved, and of the finest pattern. The suture material is fine silk, No. 0 or No. 1, which is sterilized in liquid paraffin at a temperature of 105° C. Carrel advocates the use of vaseline, but I have found liquid paraffin renders the needles and sutures easier to handle, and the results appear to be as good. The sutures are threaded in the needles before sterilization, and all are prepared together. The consensus of opinion now favours silk in preference to catgut, but if vascular suture is attempted in the presence of infection catgut should be employed.

Before suturing, all blood and clot should be carefully washed off the vessel and its surroundings, the edges of the wound should be carefully trimmed with fine sharp scissors if necessary, and the parts should be lightly lubricated with sterile liquid paraffin. Extreme gentleness must be employed in manipulating the wound in the vessel, and the greatest care exercised to avoid injury to the intima, which will probably be followed by thrombosis. Forceps with serrated points must not be used; those with fine spherical ends, as suggested by (I think) Bernheim, are the best, but ordinary forceps may be adapted by stretching some fine rubber tissue over their points.

5. Tension may cause serious difficulty in attempting end-to-end anastomosis in those cases where a portion of the artery has been resected, or where complete division with retraction of the ends has occurred. The artery does not retain its normal extensibility, especially when the aneurysm is of large size and has tracked along the course of the vessel. This appears to be due to "fixation" of its walls by the fibrous lining of the sac, and it may render anastomosis impracticable in an otherwise suitable case.

6. When restorative endo-aneurysmorrhaphy has been performed, the line of sutures may be strengthened by infolding the sac walls over it by a few stitches. After end-to-end anastomosis the junction may be wrapped snugly in a strip of deep fascia taken from the thigh or other convenient neighbourhood.

7. Removal of the sac is not necessary unless special indications exist. (It was performed in one case in my series where the nerves of the brachial plexus were incorporated in it.) In recent cases the walls readily fall together, even without suture, and attempts to dissect them out sacrifice many of the advantages of intrasaccular operation.

8. Drainage may be advantageously employed for twenty-four hours in the case of large aneurysms.

9. When the track of the missile suggests the possibility of direct injury to a nerve, and pressure palsy exists in a degree compatible with this, the nerve should be examined as soon as the aneurysm has been dealt with. If the nerve lies in close relationship to the aneurysm, it may easily be found by incising the sac wall over it from its interior aspect; when the nerve lies some distance away it should be sought for extrasaccularly, or even through an independent incision. The appropriate treatment of the nerve should then be effected.

TREATMENT OF ARTERIO-VENOUS ANEURYSM.

Many cases of aneurysmal varix cause little or no inconvenience to the patient, and may not require operative treatment. On the other hand, varicose aneurysms present the same needs for treatment as do simple aneurysms.

Aneurysmal varix may be treated either by (1) dividing the connexion between the artery and vein and suturing the opening in each, having first applied constriction to the limb or secured both vessels above and below in clamps; or (2) by ligation of the artery above and below the anastomotic opening, and ligation of any intervening branch.

Varicose aneurysm should be dealt with, where possible, by the intrasaccular route. When the sac has been opened and cleared the wounds in the vessels should be carefully examined and dealt with on their merits. In the case of important vessels ligation of both artery and vein together should be avoided if possible; and when the continuity of one appears to depend on the sacrifice of the other the vein should be preserved rather than the artery, except in the case of the internal carotid and internal jugular vessels, where the former is the more important.

THE PHYSIOLOGICAL WORK OF IVAN PETROVICH PAVLOV.

ABSTRACT OF A LECTURE GIVEN AT UNIVERSITY COLLEGE, LONDON.

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ABOUT the beginning of the present year the physiological world received with the greatest regret a report of the death of Professor Pavlov of Petrograd. A few months later a corresponding degree of pleasure was experienced when it was found that Ivan Petrovich Pavlov was still alive and well, and that confusion had been made with a surgeon of the same name.

The frequent spelling of the name as Pawlow, while correct in German, is not so in English. It should be given up, and the spelling here used adopted, as it gives, as nearly as possible, the Russian pronunciation.

There are two large and important regions of physiological work which have been practically created by Pavlov. Although they may appear somewhat widely apart, it will be seen presently how the later work naturally arose from the earlier.

This earlier work was devoted to the function of the digestive glands and the way in which their activity is excited and co-ordinated. Especially it was shown how the process in one part prepares the next following part of the alimentary canal for due treatment of the food when it arrives. The way in which the various glands are set into action and the control of the passage of the food from one section to the next were thoroughly investigated.

One of the most important means used in these researches was the method of making fistulae in various situations. Although salivary and pancreatic fistulae had been made in the seventeenth century by René de Graaf, of Delft, the development given to the method by Pavlov made it, to all intents and purposes, a new one. This development was made possible by the introduction into the physiological laboratory of the methods of aseptic surgery. A complete series of sterilizing and operating rooms, together with a hospital for the animals recovering from operations, was established for the first time in connexion with experiments on animals. These arrangements were introduced into England in the new Physiological Institute of University College, London.

In the space here available to me it is impossible to refer to more than a small part of the results obtained. Commencing with the mouth and the secretion of saliva, the effect of the sight and smell of food and other substances in causing "psychical" secretion of saliva of an appropriate kind was investigated. Thus, meat caused the appearance of a small quantity of a viscid secretion, sand or sugar a copious watery secretion. At the same time, provided that the food was received with "appetite," there was a "psychical" secretion of gastric juice. Many experiments on the process of digestion in the stomach were rendered possible by the design of a new form of sample stomach distinct from the main one, so that no food passed into the cavity in which it was desired to observe the secretion. In this new operation, the nervous supply of the sample stomach was preserved intact, obviously a matter of great importance, but absent from the mode of operation used by Heidenhain. Amongst other facts brought out were the inefficacy of the mere mechanical contact of food, or any other substance, with the mucous membrane of the stomach. It was noticed, also, that secretion of gastric juice may be brought about by the action of some chemical substance present in the food or produced by digestion. Pavlov rejected the hypothesis of any direct chemical effect on the glands in favour of that of stimulation of special sensory nerves, on the ground that these substances had no effect when injected into the circulation. But the possibility had not occurred to him that some new chemical substance might be formed in the mucous membrane, carried in the blood current to the glands and set them into activity independently of nervous influence.

It will be obvious that the method of fistulae enabled many other questions to be answered, such as that of the nerves innervating the various glands and the composition of the products of digestion at the different levels of the alimentary canal.

Reference must next be made to the pancreatic secretion produced by the presence of acid in the duodenum. Thus the acid chyme from the stomach causes the inflow of pancreatic juice. The influence of the vagus nerve on the pancreatic secretory process was also made out. The succus entericus appears to be formed in response to the presence of pancreatic juice in a neighbouring section of the small intestine. The discovery of enterokinase, which activates the trypsinogen of the pancreatic juice, belongs also to this series of researches.

Passing to the second great new departure, we may note that as a method it had its origin in the psychical secretion of saliva. It is stated by Pavlov that he had been struck by the change of attitude assumed by the physiologist when he passes from the investigation of the lower nerve centres to that of the higher ones. He regards these latter from the point of view of the psychologist. Although the psychological mode of discussion is, of course, legitimate and valuable, it is clear that a physiological method would throw much light on these obscure processes. What is needed is some way in which we can trace the relation between external phenomena and the reactions of organisms to them, without introducing the complication of consciousness. This is afforded by Pavlov's method of "conditioned reflexes."

It is a matter of some difficulty to give an intelligible account of this method in a small space. A lecture was given by Pavlov himself at the International Congress of Physiologists at Groningen in 1913. A translation of this lecture by Dr. Lovatt Evans was published in this JOURNAL on October 18th, 1913. The kind of phenomena to be considered may be illustrated by one of the simplest

of the experiments. When food is presented to a dog with a salivary fistula, a reflex secretion is produced, as we have seen. If a certain bell is rung simultaneously with the presentation of food for a number of times, it is found that the sound of the bell alone is sufficient to excite the secretion, although originally it had no such effect. A new connexion with a system of neurones has been established. But this connexion is easily broken or its effect annulled by inhibition, contrary to the almost mechanical certainty of the lower reflex centres. One of the most characteristic marks of the processes in the highest centres is just this ascendancy of the inhibitory phenomena, and the investigation of the numerous ways in which it is manifested forms a large part of the work hitherto done.

In the initial formation of the conditioned reflex, the slightest extraneous interruption spoils the result for the time. It is further necessary to have a large number of accurate means of exciting the various sense organs. A special laboratory has been erected at Petrograd in order to ensure the adequate fulfilment of the conditions required. We may confidently expect a great number of valuable additions to our knowledge of the cerebral functions from this new laboratory.

The importance of the sense organs and their central connexions is obvious. Pavlov calls the complete mechanisms associated with sensation "analysers," and one of the branches of the research has been the determination of the power of discrimination of these organs in the dog. It is found to be of a very high order, especially in the sense of hearing.

A remarkable fact is that a painful stimulus, such as an electric shock, can be made into a sign for a conditioned reflex. When this takes place, the painful quality of the stimulus is in abeyance through inhibition. Moreover, an inhibitory stimulus can itself be made a sign for a conditioned reflex.

Especially interesting are the cases into which the time element enters. A flash of light, say, is followed regularly by presentation of food at an interval of ten seconds. Then, afterwards, the flash of light alone is succeeded by secretion of saliva, but not until ten seconds has passed from the time of the flash of light. The interval is filled up by an internal inhibition of the secretory centres. This is shown by the fact that an extraneous, indifferent stimulus, not associated with salivary secretion, arriving during this interval evokes an immediate secretion by inhibiting the inhibition already present.

Much of the work is somewhat inaccessible, being published in Russian; but it is to be hoped that before long an account of it in English may be published. Enough has been said in this article to indicate how much research of a fundamental nature has already been done and the wide field awaiting further investigation.

Certain early work of Pavlov's should not be omitted. The nervous supply of the heart was worked out in considerable detail, and the mechanism of the opening of the shell in bivalve molluscs was shown to be of much interest. In the latter, the first direct proof was given that inhibition of the tonic contraction of smooth muscle does not take place in nerve ganglia, but in the substance of the muscle itself.

The charm of Pavlov's character is apparent to all who have had the pleasure of meeting him. The devotion of his students to "Ivan Petrovich" is especially significant and delightful to witness. I would especially mention his generosity to the workers, students, or others who have joined in his researches. They will be the first to acknowledge how the initiation and success of a piece of work was due to his ideas. Yet it is striking to notice how rarely his name appears even as joint author of a paper.

THE forthcoming appearance of a new quarterly periodical, the *American Journal of Syphilis*, is announced. It will be devoted to the study of syphilis in all its phases. The publishers are the C. V. Mosby Company of St. Louis, and the first number will be issued on January 15th, 1917.

THE total number of cases treated in the Pasteur Institute of Tunis in 1915 was 443; from these must be deducted 23, in 15 of which the dog was proved not to be suffering from rabies, and 8 in which treatment was given up by the patient. Five deaths, attributed to severity of infection or late arrival at the institute, occurred under treatment. The total number of cases so far treated there is 5,711, with 18 deaths.