A CONTRIBUTION is here made to the problem of the double innervation of striated muscle. The investigation was undertaken by means of the gold chloride technique. The investigators have been able to satisfy themselves that, quite apart from their vascular supply, the striated muscle fibres of the hen and goat have a rich supply of peculiar nerve endings, derived from mixed nerves and plexuses of non-medullated nucleated sympathetic nerves, and distinct from the end-plates derived from myelinated somatic motor nerves. These two types of nerve terminations ("en grappes" and "en plaques") do not exist in the same muscle fibres, but each supplies separate groups. There is little evidence incompatible with the theory that striped musculatures are divided into alternate groups of muscle fibres which are served respectively by branches from the somatic and sympathetic nervous systems, the former subserving 'contractile' and the latter 'plastic' tonus.

LEWIS YEALLAND.


It is now generally accepted that voluntary muscle has a double nerve supply of medullated fibres from the anterior horns and non-medullated fibres from the sympathetic ganglia, but there is no conclusive evidence that the sympathetic nervous system has any influence on muscle tone. Royle claims to have lessened the disability produced by hypertonus in antagonistic groups of muscles by dividing the sympathetic trunk and gray rami communicantes, and in association with Hunter performed experiments which seemed to show that it is possible to influence the degree of decerebrate rigidity by division of the sympathetic system. These experiments have been repeated by Kanavel and his co-workers with negative results. In six cats the right cervical sympathetic chain, including the stellate ganglion, was removed, and in another six animals the right abdominal sympathetic trunk from the second to the fourth lumbar ganglion. The abdominal trunks on both sides were removed in four cats, and in two the right stellate ganglion alone. The animals were
studied at frequent intervals from two weeks to sixty-five days after operation, and no effect on normal muscle tone could be observed. Further, the removal of the sympathetic supply to a limb had no effect on the onset, maintenance, or any of the characteristics of decerebrate rigidity, even though long intervals were allowed to elapse between the removal of the sympathetic supply and the decerebration. Clinical experiments were likewise negative, for kymographic tracings of tendon reflexes, faradic stimulation, active and passive movements and tremors before and after removal of the sympathetic nerve supply showed no change in cases of paralysis agitans, postencephalitic Parkinson's disease or lateral sclerosis. One patient with cerebral hemiplegia appeared to improve after operation, although graphic records showed no indication of this. The writers conclude by stating that the sympathetic nervous system may have some function dealing with metabolism so that under certain conditions the contractility of a muscle may be changed by the removal of sympathetic impulses. Such a function would probably be chemical in nature.

R. M. S.


The operation of 'periarterial sympathectomy' consists in the stripping off of the adventitia for a length of 10 or 12 cm., high up on one of the arterial trunks of the limbs. It has been thought that vasoconstrictor fibres run along the vessels all the way from the aorta to the capillaries, and that these are interrupted by the operation. Wiedhopf reviews the facts and gives a useful summary of the experimental work that has been done in regard to the course of the nervi vasorum.

If the cervical sympathetic trunk and its stellate ganglion be removed, there results immediately a maximal dilatation of all the vessels of the corresponding upper limb, and a raising of the skin temperature by 4 or 5 degrees. But 'periarterial sympathectomy' produces at first a localized vasoconstriction; if several narrow circles of adventitia are cut away at short intervals along a vessel a moniliform appearance results; only after several hours do dilatation and hyperemia begin. A division of vasoconstrictors running along the vessel should, however, bring about dilatation immediately. Moreover, the result in the peripheral distribution should follow, no matter at what point along the artery the operation is performed, and not only when it is performed high up; in fact, if, as will be shown, sympathetic branches from mixed spinal nerve trunks also join the artery in its course, then the nearer the periphery the more effective should be the operation. Also, a simple division should suffice, instead of the stripping of 8 to 10 cm., as insisted on in Leriche's technique.

Wiedhopf's earlier experiments on animals provided strong evidence against the presence of long vasoconstrictor fibres in the arterial sheath. He measured the volume of the hind limb of a dog and found that it was not
altered by ‘periarterial sympathectomy,’ and that the vasoconstriction which results from irritation of the abdominal wall occurred as usual after the operation. But if the sciatic and femoral nerves were divided, the arterial coat being intact, there resulted at once an increase of volume from vasodilatation, and the vasoconstriction with abdominal irritation no longer occurred. He concluded that all the vasoconstrictors ran in the mixed nerve trunks and were distributed thence to the vessels and that none coursed along the arteries. Similar experiments were performed on human subjects, the three nerve trunks to the hand being interrupted by means of novocaine at situations where the nerves were far enough away from the vessels to ensure that the novocaine could not affect any nerves present in the vessel sheaths; an immediate increase in volume (from vasodilatation) resulted. His findings are supported by those of Langley, of Schilf and of Friedreich. Langley found that irritation of the lumbar sympathetic in the cat caused vasoconstriction in the hind limb, but if the sciatic and femoral nerves were divided the stimulation was without effect. Schilf stimulated electrically the adventitia of the artery and observed an increase in volume of the limb, but if the femoral nerve was divided stimulation of the adventitia produced no result; he concluded that the dilatation obtained was a reflex effect, and that the reflex are passed along the femoral nerve. Friedreich observed that vessel reflexes were still present in man after ‘periarterial sympathectomy,’ could always be made to disappear by anaesthetization of the nerves, and were not present in an arm in which the nerve trunks had been divided.

Kramer, Todd and Potts showed anatomically that nerves were distributed to the vessels from the spinal nerve trunks. Bräucker showed that the aorta and the vertebral and subclavian arteries were supplied segmentally, and he brought forward arguments that the vessels of the arm were similarly supplied.

The theory of efferent fibres in the vessel sheaths being thus discredited, Brüning suggested that there were afferent sensory fibres in the same position and that the effects of the operation were the result of the interruption of a vasoconstrictor reflex arc. Wiedhopf attacks this hypothesis vigorously.

Dennig injected ‘chlorbarium’ into the arteries of dogs under light narcosis with ether, producing each time a very definite pain reaction; but if the sciatic and femoral nerves were cut no pain reaction resulted from the injection, and he concluded that all the sensory fibres ran in the mixed nerves and none along the vessels. Wiedhopf has repeated these experiments and obtained the same results. Flick and Dumpert also made experiments with ‘chlorbarium;’ the vessels and their sheath were cut across, and, with the exception of the artery, which was immediately joined up again by sutures, tied off above and below the division; any nerves running along the vessels must consequently have been divided; ‘chlorbarium’ was then injected into the joined artery below the point of section, and the pain reaction resulted as strongly as before.

Wiedhopf and Friedreich have found that painful stimuli applied to a normal hand do not cause vasoconstriction in the other hand if the latter has
been previously rendered anaesthetic by novocaine injection of the nerve trunks. They have also found that a cold stimulus to one hand normally causes a stasis in the capillaries of the nail-fold in the other hand; but if the nerve trunks to the hand receiving the stimulus are anaesthetized (the arteries being undisturbed), no stasis is produced in the other hand.

Neither the observations on animals nor those on man provide any basis for the assumption that nerves course along the vessels, and the effects of the operation of 'periarterial sympathectomy' must be explained in some other way. Lehman attributed them to mere operative trauma; Läwen considered the hyperæmia as a reflex phenomenon set up by the reparative processes going on in the neighbourhood of the portion of artery operated on, and therefore only lasting as long as the processes of repair were active; such a reflex could only act through the segmentally distributed nerves. Some such purely general hypothesis must be accepted in view of the experimental evidence brought forward.

J. P. MARTIN.

Arch. of Neurol. and Psychiat., 1925, xiii, 754.

BEING impressed with the theory of a cerebral heat centre the author produced destructive lesions in the brain of the dog in the hope of reproducing experimentally the syndrome encountered clinically. The early experiments were concerned with lesions of the basal ganglia, but later the pons, medulla oblongata and pituitary gland were also investigated. The method employed consisted in implanting in the brain small glass tubes containing radium emanations, but as the action of the radium appeared too slow the electric current was used in later experiments. In only six of a series of thirty experiments did the temperature exceed that normally observed in the dog, and by means of such lesions a condition simulating so-called 'medullary œdema' could not be obtained. Kornblum concludes that the hyperthermia of 'medullary œdema' is not dependent on a lesion in any definite area of the brain, but is rather the result of a disturbance of widely distributed reflex arcs essential to the maintenance of body temperature. The use of the term heat or temperature centre as indicating a definite spot in the brain whose sole function is the regulation of temperature is misleading, and the term should therefore be dropped.

R. M. S.

—E. SACHS and M. E. MACDONALD. Arch. of Neurol. and Psychiat., 1925, xiii, 335.

The authors carried out an experimental study of blood sugar values in the dog following removal of the hypophysis and lesions of the hypothalamic region. The results of the experiments may be summarized as follows:

Complete removal of the pituitary, if the hypothalamus is not injured, does not lead to the death of the animal. Deaths that occurred were always associated with hypothalamic injury. These experiments confirm the work of others that polyuria is apparently due to hypothalamic injury.
The blood sugar average in fasting animals is slightly lower after pituitary or hypothalamic operation, but this may be within normal limits of variation. Transient glycosuria for from one to two days occurred after hypothalamic puncture in a few cases, and during this time the blood sugar was higher than normal. Because of the transience of this symptom it is probably of little importance.

The height of the blood sugar curve following operation, in all cases except those of anterior lobe removal, was reached at the end of one hour, in contrast to the curve in normal animals in which the height occurs at the end of one half-hour. The blood sugar curve in the cases of anterior lobe removal was of the normal type.

Sachs and Macdonald were unable to produce a permanent glycosuria experimentally, although it has been observed in cases of pituitary disease. Some, but not all, of these were cases of hyperfunction of the anterior lobe, which cannot be produced experimentally.

R. M. S.


The author attempted to trace the exact distribution of each cerebral artery by injecting an opaque substance which would show by means of the Röntgen ray, but from the first it was found impossible to confine the mercury to any one arterial distribution. Stereoscopic studies showed several well-defined anastomotic trunks which could be traced by means of the stereoscope as directly connecting the anterior, middle, and posterior cerebral arteries. There was evidence of definite end arteries on the cortex, and it was interesting to note that no anastomosis seemed to exist between the larger vessels supplying the subcortical ganglia. Of some surgical value was the discovery of a relatively avascular zone extending from the frontal lobe to the parietal area about 2.5 cm. from the midline. The posterior and middle cerebral arteries appeared to send out branches directly toward their termination on the cortex, but the anterior cerebral artery sends into the cortex large arterial loops which radiate like the spokes of a wheel.

R. M. S.

NEUROPATHOLOGY.


The author's summary of his work and conclusions are as follows:—

1. The results of the investigation of 102 ventricular fluids in cases of brain tumour are presented.

2. In forty-six cases—45 per cent.—a diagnosis of brain tumour was made on the basis of the serological findings. This was confirmed by operation. The diagnosis was based largely on Lange's goldsol curve. The other cerebrospinal fluid tests were found to be of slight value in the diagnosis.

3. No typical curve could be established for brain tumours. The reduc-