# 11436 P

## The Sympathetic Component of the Sciatic Nerve.

DONAL SHEEHAN AND AMEDEO S. MARRAZZI. (Introduced by A. J. Goldforb.)

*From the Departments of Anatomy and Pharmacology, New York University College of Medicine.*

Our present knowledge of the course of the preganglionic nerve fibers is based largely on the early experiments of Langley[1,2] and Bayliss and Bradford[3] who used erection of hairs, sweating and vascular changes for recording sympathetic activity. These types of effector activity do not lend themselves readily to quantitative estimation. Moreover sweating and vasomotor changes offer additional difficulties in that they are complex responses. Sweating is influenced by accompanying vascular changes while vasomotor effects in turn are subject to rapid modification by compensatory reflexes.

In the present experiments a direct insight into the kind and magnitude of the sympathetic nerve impulses themselves was obtained by recording the action potentials in the efferent nerves. A direct current amplifier, which Marrazzi[4] had found, in recording action potentials from other parts of the sympathetic system, to be especially suitable, was utilized to actuate a Matthews oscillograph. This technique provides not only a means of tracing the pathway of preganglionic fibers to an organ or a limb but enables the analysis of an exact point-to-point representation of the sympathetic component of each ventral root in any peripheral nerve.

*Method.* In a series of experiments on 19 cats, lightly anesthetized with nembutal or sodium amytal the spinal nerve roots from T7 to L7, inclusive, were severed from the cord, the dorsal root and ganglion excised, and the distal cut end of the ventral root stimulated, after insulation from surrounding tissues, by accurately controlled shocks from a thyratron stimulator. The activity resulting in the sciatic nerve was detected by electrodes placed on the main branches of the ipsilateral nerve and connected to the amplifier. The B and C waves thus recorded enabled us to map the exact roots

1 Langley, J. N., *J. Physiol.*, 1891, **12**, 347.

2 Langley, J. N., *J. Physiol.*, 1894-95, **17**, 296.

3 Bayliss, W. M., and Bradford, J. R., *J. Physiol.*, 1894, **16**, 10.

4 Marrazzi, A. S., *J. Pharm. and Exp. Therap.*, 1939, **65**, 18.

through which sympathetic fibers passed to the lower limb via the sciatic nerve. Since all slowly conducting fibers are not exclusively autonomic, the possibility that some of the B and C waves might have originated elsewhere was considered and excluded by the fact that the intravenous injection of nicotine, which in the doses given acts at autonomic ganglia without affecting postganglionic nerve trunks, was effective in blocking the previously recorded impulses.

Usually 3 or 4 roots were stimulated in each experiment. By separation of the medial and lateral popliteal nerves and recording from each in turn, while repeating the stimulus to the ventral roots, the sympathetic component of each division of the sciatic nerve was determined. Similarly, by recording from the contralateral sciatic, data were obtained on the extent of extraspinal crossed pathways between the sympathetic chains.

*Results.* Nicotine injected intravenously in doses producing a ganglionic block abolished both the B and C waves appearing after stimulating L1, L2 and L3. Nicotine has not yet been utilized in the experiments in which the other roots have been stimulated. The results show that in the cat the preganglionic outflow to the lower limb via the sciatic nerve emerges constantly from the spinal cord by the ventral roots as high as T11 and as low as L4, and that the roots giving the greatest contribution are T13-L3 (inclusive) of which L1 and L2 invariably gave a response. T11 rarely contributes and T12 and L4 only occasionally (¼-⅓ of the animals).

From the positive roots B and C waves or C waves alone were recorded. The C waves appeared in all cases except in 2 where the animal was in poor condition. In these apparently only the fibers of lower threshold responded giving B waves alone. Similarly, in several experiments, not tabulated because the records were taken immediately after cessation of the circulation, again B waves only were obtained.

Recording from the medial and lateral popliteal divisions of the sciatic nerve separately gave the same result as recording from the combined nerve. No responses from the contralateral sciatic nerve were ever obtained, if care was taken to avoid spread of current. Crossed pathways, between the sympathetic chains, of fibers destined for the opposite sciatic nerve have therefore not been demonstrated.

The results agree with Langley's[1,2] analysis of outflow of *secretory* fibers to the hind limb of the cat, made from naked-eye observations of sweating on the foot pads during ventral root stimulation. In dogs Bayliss and Bradford[3] used the plethysmographic method of recording changes in volume in the lower limb during spinal root stimulation, and found *vasoconstrictor* fibers to the lower extremity emerging in T11-L2 (inclusive) and to a lesser extent in L3. Oughterson, Harvey and Richter[5] indicate by recording the temperature changes in the lower limb of dogs after interrupting the vasomotor pathways by transection of the spinal cord, that vasoconstrictor fibers to the lower extremity may emerge below L6. Derom[6] would limit the vasomotor fibers to the first 3 lumbar nerves in the dog, on the grounds that section of the rami communicantes of these roots abolishes all vasomotor reflexes in the lower extremity.

The existence of B as well as C waves, amongst the responses that were shown to be autonomic by their disappearance after nicotine, is of considerable interest. The presence of B fibers in the sympathetic outflow to the limb has not hitherto been clearly indicated, though Erlanger[7] speaks of some "inconstant results" in cats and dogs. Such fibers imply the possibility of control over effectors differing in function and distinct from those supplied by fibers of the C group. The number of B and C fibers contributed by each root would then determine the possible extent of its control over the various types of sympathetic response.

11437

## A Difference in Effect of Distilled Water and of Isotonic Solutions in Intestine on Pancreatic Secretion.

J. O. CRIDER AND J. EARL THOMAS

*From the Department of Physiology, Jefferson Medical College of Philadelphia.*

The fact that water in the intestine stimulates the external secretory function of the pancreas was first demonstrated by Damaskin in Pavlov's laboratory[1, 2] and later by Babkin[3, 4] and Bylina.[5] In the

[5] Oughterson, A. W., Harvey, S. C., and Richter, H. G., *J. Clin. Invest.*, 1932, **11**, 1065.

[6] Derom, E., *Mém. de l'Acad. Roy. de Méd. de Belg.*, 1938, **25**, 1.

[7] Erlanger, J., in Erlanger, J., and Gasser, H. S., *Electrical Signs of Nervous Activity*, Philadelphia, University of Pennsylvania Press, 1937, p. 67.

[1] Pavlov, I. P., *Die Arbeit der Verdauungsdrüsen*, Weisbaden, 1898.

[2] Pavlov, I. P., *The Work of the Digestive Glands*, London, 1910, p. 144.

[3] Babkin, B. P., *Arch. d. Sci. Biol.*, 1904, **11**, No. 3 (Reference from Babkin[4]).

[4] Babkin, B. P., *Die aüssere Sekretion der Verdauungsdrüsen*, Berlin, 1914.

[5] Bylina, A. S., *Prakt. Arzt*, (russ) 1911, No. 44-49 (Reference from Babkin[4]).