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A method of stimulating different segments of the sympathetic and parasympathetic outflows from the spinal cord in the pithed rat

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A simple technique (Gillespie & Muir, 1967) permitted electrical stimulation of the entire sympathetic outflow from the spinal cord in the pithed rat. This technique has now been refined to permit electrical stimulation of different segments of the autonomic outflow. Responses have been obtained from the adrenals, the bladder, the blood vessels, the colon, the heart and the vas deferens.

Rats (200–250 g) were anaesthetized with halothane and respired artificially. Each animal was pithed by first inserting a short steel tube (13 S.W.G.) through the orbit and into the foramen magnum. Through this tube were passed successively a teflon tube and inside that a fine steel tube (26 S.W.G.) which was extruded at the sacral end to complete the pithing. A steel rod, inserted under the skin behind the skull and pushed down between the vertebral column and the skin, acted as an indifferent electrode. The level of stimulation was determined by varying the depth of insertion of the shielding teflon tube. The number of segments stimulated was regulated by altering the length of central steel electrode protruding. These levels and lengths were checked by radiography. (+)-Tubocurarine (1 μg/g) was given to reduce skeletal muscle twitches.

Stimulation of the cranial outflow produced vagal slowing of the heart which was abolished by atropine. Stimulation of the sacral outflow produced an increased bladder pressure and, less frequently, a rise in intra-colonic pressure. These effects were achieved without affecting either the blood pressure or the heart rate, indicating specific stimulation of the sacral parasympathetic outflow. The colonic response, which was less reproducible than the bladder response and rapidly diminished after repeated stimulation, was reduced by atropine. The bladder response was little affected by atropine (1 μg/g), hyoscine (2 μg/g) or ophenadrine (10 μg) but was reduced by an additional dose of (+)-tubocurarine (2 μg/g) and increased by eserine.

Stimulation in the lower thoraco-lumbar region produced sympathetic responses; an increase in the hind limb perfusion pressure with little effect on the systemic blood pressure and none on the heart rate. Stimulation at a higher level in the column produced longitudinal contractions and increased resistance to perfusion of the vas deferens without affecting the cardiovascular system. These responses were similar to those produced by intravenously administered noradrenaline but were blocked

by guanethidine. As the electrode was moved upwards towards the cervical region, stimulation increasingly affected the heart rate and the blood pressure, both of which dramatically increased. Adrenalectomy reduced this response and abolished the secondary pressor effect, which increased for some time after stimulation ceased. Stimulation in the upper thoraco-lumbar region caused an immediate cardio-accelerator effect without affecting the blood pressure.

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The effect of decentralization and reserpine-treatment on the sensitivity of the isolated vas deferens of the guinea-pig to stimulant drugs

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The non-specific, time-dependent supersensitivity to drug stimulation which is observed *in vivo* in smooth and cardiac muscle following decentralization or treatment with reserpine is not always seen *in vitro* (Tsai *et al.*, 1968; Westfall & Fleming, 1968). The purpose of the current investigation was to determine whether such supersensitivity could be demonstrated *in vitro* in the smooth muscle of the vas deferens.

Desheathed vasa deferentia from guinea-pigs were suspended in organ baths in Krebs solution at 37° C. Contractions in response to drugs were recorded with strain gauges. The tissues were obtained from guinea-pigs which received (1) no treatment (control), (2) reserpine-treatment for either 1 or 5 days (1·0 mg/kg per

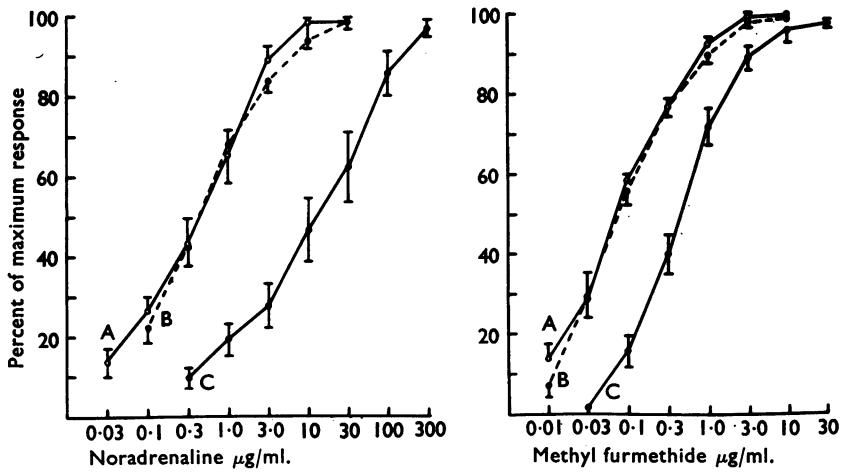

FIG. 1. Mean dose-response curves to noradrenaline and methyl furmethide in isolated vasa deferentia from guinea-pigs receiving no treatment (N=15), 5 days of reserpine (N=10) or 5 days after decentralization of the vas deferens (N=8). Abscissa, dose of agonist expressed as μg/ml. of bath solution; ordinate, amount of contraction expressed as % of the maximum contraction. A, reserpine (5 days); B, decentralized (5 days). C, control.