activity were observed in organs having a dense sympathetic innervation (nictitating membrane, iris, pineal gland). As a preliminary step to an investigation of the biochemical properties of intra and extra-neuronal MAO, we have sought a suitable peripheral tissue in which a consistent large reduction in MAO activity can be demonstrated after surgical sympathectomy.

Cat nictitating membranes were obtained at various intervals after unilateral superior cervical ganglionectomy. Rat and guinea-pig vasa deferentia were sampled at various intervals after unilateral sympathectomy by the technique described by Birmingham (1967). Tissues were homogenized in 0.005 M potassium phosphate buffer and samples of the homogenates were taken for enzyme assays and protein determinations. MAO activity was assayed radiochemically using ^{3}H-tyramine or ^{3}H-5-hydroxytryptamine (5-HT) as substrates. Catechol-O-methyl transferase (COMT) activity was assayed radiochemically using 3,4-dihydroxybenzoic acid and ^{3}H-S-adenosyl methionine as substrates. Fourteen days after sympathectomy there was a marked reduction in MAO activity (with tyramine as a substrate) in both the nictitating membrane and vas deferens, to levels between 40 and 60% of contralateral normally innervated control tissues. In both organs, the fall in MAO activity was significantly less when benzylamine was used as a substrate. The reduction was similar using either ^{3}H-tyramine or ^{3}H-5-HT as substrates. On the other hand, catechol-O-methyl transferase activity was not significantly changed in any denervated tissue. The time course of the reduction in MAO activity in both tissues will be described, and appears to parallel the time course of disappearance of the terminal sympathetic innervation. These results suggest that a substantial proportion of the total MAO activity in cat nictitating membrane or in rat and guinea-pig vas deferens is present in the rich terminal sympathetic innervation of these tissues. The sympathectomized vas deferens appears to be a suitable preparation for studies of the intra- and extra-neuronal enzymes.

In agreement with other studies, COMT did not significantly change after sympathectomy and is therefore located extra-neuronally.

REFERENCES

BIRMINGHAM, A. T. (1967). Denervation of the vas deferens of the guinea-pig. *J. Physiol., Lond.*, **190**, 16–17*P*.

BURN, J. H. & ROBINSON, J. (1952). Effect of denervation on amine oxidase in structures innervated by the sympathetic. *Br. J. Pharmac. Chemother.*, **7**, 304–318.

BURN, J. H., PHILPOT, F. J. & TRENDELENBURG, U. (1954). Effect of denervation on enzymes in iris and blood vessels. *Br. J. Pharmac. Chemother.*, **9**, 423–428.

SNYDER, S. H., FISCHER, J. & AXELROD, J. (1965). Evidence for the presence of monoamine oxidase in sympathetic nerve endings. *Biochem. Pharmac.*, **14**, 363–365.

WALTMAN, S. & SEARS, M. (1964). Catechol-O-methyl transferase and monoamine oxidase activity in the ocular tissue of albino rats. *Invest ophthalm.*, **3**, 601–605.

Receptors mediating the effect of catecholamines on glucose release from guinea-pig liver *in vitro*

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There is much uncertainty about the receptors concerned in the hepatic glycogenolysis caused by catecholamines. Part of the difficulty stems from the existence of wide variations between species ; in addition evidence has been obtained

that receptors for catecholamines in the liver of some animals (for example, the rat and the rabbit) differ considerably from the α- and β-subtypes which have been characterized in smooth muscle and in the heart (Ellis, Kennedy, Eusebi & Vincent, 1967).

We have examined this problem in the guinea-pig, as part of a more general study of the actions of catecholamines on liver cells. The experiments were made with tissue slices of 0.3 to 0.35 mm thickness bathed in a Krebs solution in which pyruvate (2 mM) was included as substrate, in preference to glucose.

Under these conditions, the rate of glucose release was increased (to up to 3 times the resting level) by both noradrenaline and isoprenaline, as well as by amidephrine (3(2-methylamino-1-hydroxyethyl) methanesulphonanilide methanesulphonate), a substance reported to be a specific agonist for α-receptors (Dungan, Stanton & Lish, 1965). Isoprenaline was most active, producing a 60% increase in the rate of release at 6×10^{-9}M, as compared with 3×10^{-7}M for noradrenaline and 4×10^{-6}M for amidephrine.

The effect of isoprenaline on glucose release could be abolished by the β-receptor blocking agent propranolol, which at 10^{-6}M caused a 40-fold increase in the concentration of isoprenaline needed to elicit a standard response. Phentolamine (10^{-5}M) had no effect.

In contrast, the effect of amidephrine on glucose release could be antagonized by phentolamine (again at 10^{-5}M, giving a dose ratio of about 7), but not by propranolol (10^{-6}M).

Noradrenaline gave intermediate results. Thus propranolol (10^{-6}M) gave a dose ratio of only about 4, but with propranolol (10^{-6}M) plus phentolamine (10^{-5}M) the dose ratio was 20.

We conclude there are two distinct receptors through which sympathomimetic substances can increase glucose loss from the guinea-pig liver. These may correspond to the α- and β-receptors of Ahlquist's classification; however, relatively high concentrations of antagonists (particularly phentolamine) were needed to block the response.

Noradrenaline and amidephrine also increase the membrane potential of many cells within the slices, decrease tissue potassium, and slightly increase tissue sodium. These changes, and their possible relation to glycogenolysis, are under study.

REFERENCES

DUNGAN, K. W., STANTON, H. C. & LISH, P. M. (1965). Amidephrine-1: pharmacologic characterization of a sympathomimetic alkysulfonamidophenethanolamine. *Int. J. Neuropharmac.*, **4**, 219–234.

ELLIS, S., KENNEDY, B. L., EUSEBI, A. J. & VINCENT, N. H. (1967). Autonomic control of metabolism. *Ann. N.Y. Acad. Sci.*, **139**, 826–832.

Electrophysiological effects of alpha- and beta-receptor agonists and antagonists on Purkinje fibres of sheep heart

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The isolated Purkinje bundles of the sheep heart are suitable for the study of the effects of drugs in the same cell, for they can be impaled by micro-electrodes for