Regional Differences in the Effect of Pargyline on Dopamine Concentrations in the Rat Hypophysis


Summary

Dopamine concentrations were estimated in different regions of the infundibular-pituitary system of the rat. The highest values were found in the pituitary stalk where they are comparable to the concentrations in the striatum, and higher than in the median eminence.

In the anterior lobe the dopamine (DA) concentrations of the upper pole (10% of the lobe tissue) were 2–5 times higher than in the rest of the lobe. Anterior lobe DA was significantly higher in rats about 6 months old than in rats about 3 months old.

After inhibition of MAO, the DA concentrations in the isolated neural lobe (NL) were more than doubled. In contrast there was no increase in the DA concentrations of the intermediate lobe, an observation which is in agreement with our previous finding that DA synthesis in the intermediate lobe after electrical stimulation of the pituitary stalk is much slower than in the neural lobe.

Pargyline treatment caused an increase in the DA concentrations in the anterior lobe by about 150%. This rise (together with a DA increase in the stalk-infundibulum) may be related to the decrease in circulating prolactin which occurs in pargyline treated rats.

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Introduction

The histochemical demonstration of catecholamine containing nerve fibres in contact with capillary loops of the primary plexus of the hypophyseal portal vessels in the cat (Fuxe, 1964) and the presence of high concentrations of dopamine (DA) in the median eminence and the pituitary stalk of the cat, sheep and goat (Laverty and Sharman, 1965) suggested a functional link between a DA system in the basal hypothalamus and the release of hormones from the pituitary gland. The perikaria of these “tubero-infundibular” DA neurones were eventually located in the arcuate nucleus and in parts of the periventricular nucleus (Björklund et al., 1973). In subsequent years it has been established that the DA released from the tubero-infundibular neurones into the blood of the hypophyseal portal vessels is the tonic inhibitor of prolactin release (PIF) from the anterior lobe of the pituitary gland.

A second DA system of hypothalamic origin which is involved in pituitary hormone secretion arises from two distinct cell groups in the arcuate nucleus whose axons descend through the pituitary stalk to the neural (NL) and intermediate lobe (IL) of the gland (Björklund et al., 1973) with nerve endings either in close proximity to the vasopressin or oxytocin-containing neurosecretory fibres in the NL or in synaptic contact with glandular cells in the IL (Baumgarten et al., 1972). The possibility that DA is involved in the regulation of the endocrine functions of the NL and IL was suggested by the observations that DA can inhibit the release of proopiocortin-derived peptides from the IL and affect oxytocin and vasopressin release from the NL (for review see Holzbauer et al., 1983 b). The demonstration of the release of DA from the combined neuro-intermediate lobe (N-IL) (Holzbauer et al., 1982, 1983 a) and the isolated neural lobe (Holzbauer et al., 1984 b) of the rat hypophysis after electrical stimulation of the pituitary stalk, together with the observation that stimulation of nerve cells in the arcuate nucleus whose axons end in the NL causes depression of multunit electrical activity in the neurosecretory axons of the NL (Passo et al., 1981), leaves little doubt that DA acts as a neurotransmitter substance in these tissues.

Because of the functional significance of DA in the pituitary gland a detailed study of the distribution of DA in the pituitary stalk and gland preparation of the rat was carried out using histo-fluorescence and chemical analytical techniques. In addition the effect of pargyline, a non-preferential inhibitor of monoamine oxidase (MAO) on the DA content of various regions of this preparation was studied.