Further studies on dopamine receptors in the brain of *Helix Aspersa*

S. BATTA, R.J. WALKER & G.N. WOODRUFF

Department of Physiology and Pharmacology, University of Southampton, Bassett Crescent East, Southampton SO9 3TU

The isolated brain of the snail *Helix aspersa* contains specific dopamine receptors (Woodruff & Walker, 1969). The present investigation is concerned with the conformational requirements for dopamine-like activity in the snail brain and with the actions of the postulated dopamine antagonist, sulpiride.

Intracellular recordings were made from neurones on which dopamine had an inhibitory action and drugs were applied iontophoretically or by addition to the bath which had a volume of 20 ml. Each drug was tested on at least 5 different preparations.

The rigid dopamine analogue (±)-ADTN (2-amino-6, 7-dihydroxy-1, 2, 3, 4-tetrahydronaphthalene) was always approximately equipotent with dopamine and caused complete inhibition of neuronal firing following doses of as low as 0.5 nmol. (+)-ADTN was approximately 100 times more active than (−)-ADTN. A second rigid analogue tested, (±)-2-amino-5,6-dihydroxy-1,2,3,4-tetrahydronaphthalene was weakly active, being over 250 times less active than dopamine. These results, which are similar to those obtained in studies on dopamine receptors in rat brain (Woodruff, Watling, Andrews, Poat & McDermed, 1977) provide evidence that the active conformation of dopamine at *Helix* dopamine receptors is the extended form (β-rotamer).

The inhibitory effect of iontophoretically-applied dopamine (500 nA for 0.5 to 1 s) was reversibly blocked by (−)-sulpiride (9×10^{-6}M) on some, but not all dopamine-sensitive neurones. The inhibitory action of glutamate on some neurones was similarly blocked by (−)-sulpiride (9×10^{-6}M). These results suggest the possibility that sulpiride might act, not at the recognition site of the dopamine receptor, but at some other site such as an ionophore.

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Voltammetry *in vivo:* effect of stressful manipulations and drugs on the caudate nucleus of the rat

G. CURZON, P.H. HUTSON & P.J. KNOTT

Department of Neurochemistry, Institute of Neurology, 33 John's Mews, London WC1N 2NS

An electrochemical technique for the repeated monitoring of transmitters released from brain tissue *in vivo* has been recently described (Adams, Conti, Marsden & Strope, 1978). In the present study, we have used a method which was essentially similar except that linear sweep voltammetry (McCreery, Dreiling & Adams, 1974) was used for detection of electroactive material in the caudate nucleus of freely moving rats subjected to stressful manipulations or given drugs known to influence dopamine (DA) release and metabolism.

Carbon paste electrodes were implanted in the caudate nuclei (rostral-caudal, + 1 mm; medial-lateral, ± 4 mm; dorsal-ventral, 4.5 mm; Pellegrino & Cushman, 1967) of male Sprague-Dawley rats (200–250 g) which were then kept in a quiet environment and studied not less than 48 h after surgery. The presence of electroactive material at the electrode tip was detected by linear sweep voltammetry (0 to 1 V, sweep rate 40 mV sec^{-1}) at 5 min intervals.

Tail-pinch or restraint increased the height of a peak at 0.35 V (v. Ag/Ag Cl) within 1 min (Figure 1). These procedures also provoked biting, licking and gnawing. This peak probably reflects DA release as similar peaks were obtained following injection of (+)-amphetamine (5 mg/kg i.p.) which releases DA directly or α-flupenthixol (5 mg/kg i.p.) which releases it as a consequence of blockade of DA receptors. Furthermore, the peaks following tail pinch, restraint or (+)-amphetamine injection were all decreased after treatment with the catecholamine synthesis inhibitor α-

methyl-p-tyrosine (200 mg/kg i.p.).

These results are consistent with Antelman & Szechtman (1975) who attributed behavioural changes during tail-pinch to DA release. They also reinforce evidence for increased brain DA turnover on restraint stress (Bliss & Ailion, 1971).

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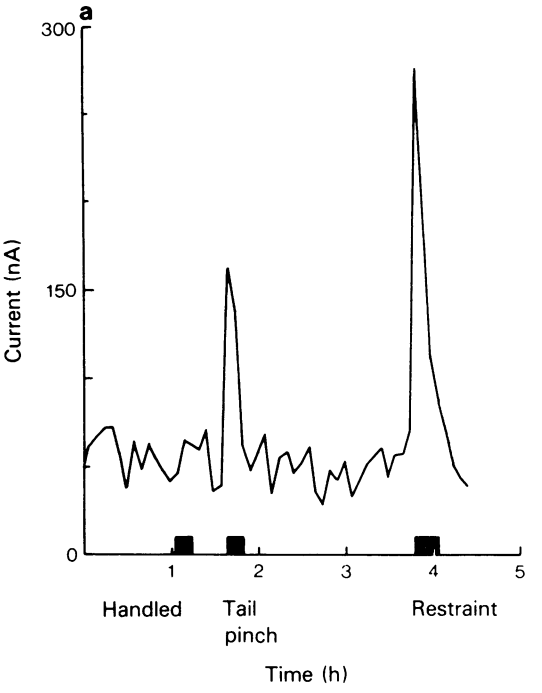

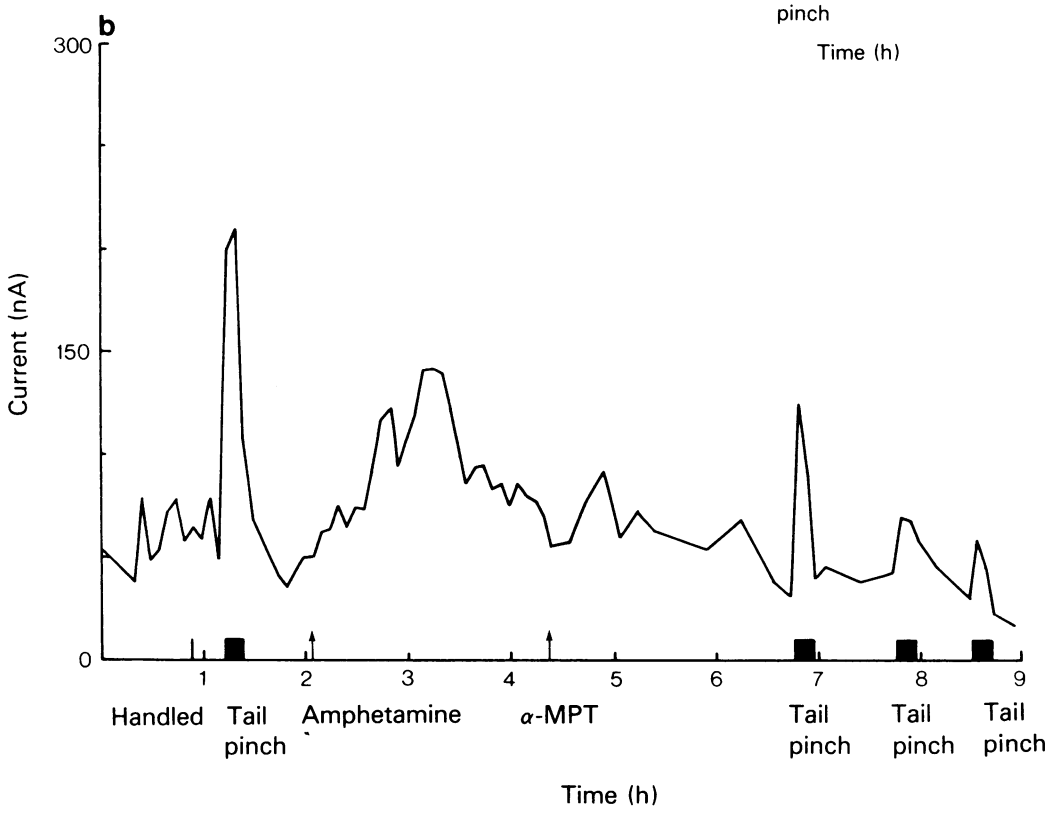

Voltammetric recording from the left caudate nucleus of a freely moving rat on two consecutive days. Oxidation currents (nA) were measured at the peak observed at 0.35 V.

(a) Response to handling, tail-pinch and restraint.
(b) Response to handling, tail-pinch, amphetamine (5 mg/kgi.p.) and tail-pinch after α-methyl p-tyrosine (200 mg/kg i.p.).