The measurement of dopamine and 5-hydroxytryptamine release in CNS of freely moving unanaesthetised rats

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A voltammetric technique *in vitro* (Wightman, Strope, Plotsky & Adams, 1976) has been adapted for the continuous monitoring of dopamine and 5-hydroxytryptamine (5HT) release from brain tissue of freely moving unanaesthetised rats. A potential (+0.2–+1.0 V) is applied to a micro-carbon electrode stereotoxically placed within a specific brain region and current changes following the oxidation of electroactive compounds in the vicinity of the electrode tip, are recorded. The amount of current produced is proportional to the concentration of substance oxidised. The potential at which the oxidation occurs indicates which compound has been oxidised. Dopamine and 5HT however are oxidised at similar potentials so neuropharmacological tests are used to distinguish between the oxidation of dopamine and 5HT. To ensure the potential at the working electrode is the same as that applied, a three electrode system is used in which the potential is related to a reference electrode through which no current passes (Figure 1). Potentials are applied and current measured using a chronoampometric digitiser on which the result is displayed as a function of the integrated current.

The method has been used to measure dopamine and 5HT release in the caudate and hippocampus following drug administration and electrical stimulation

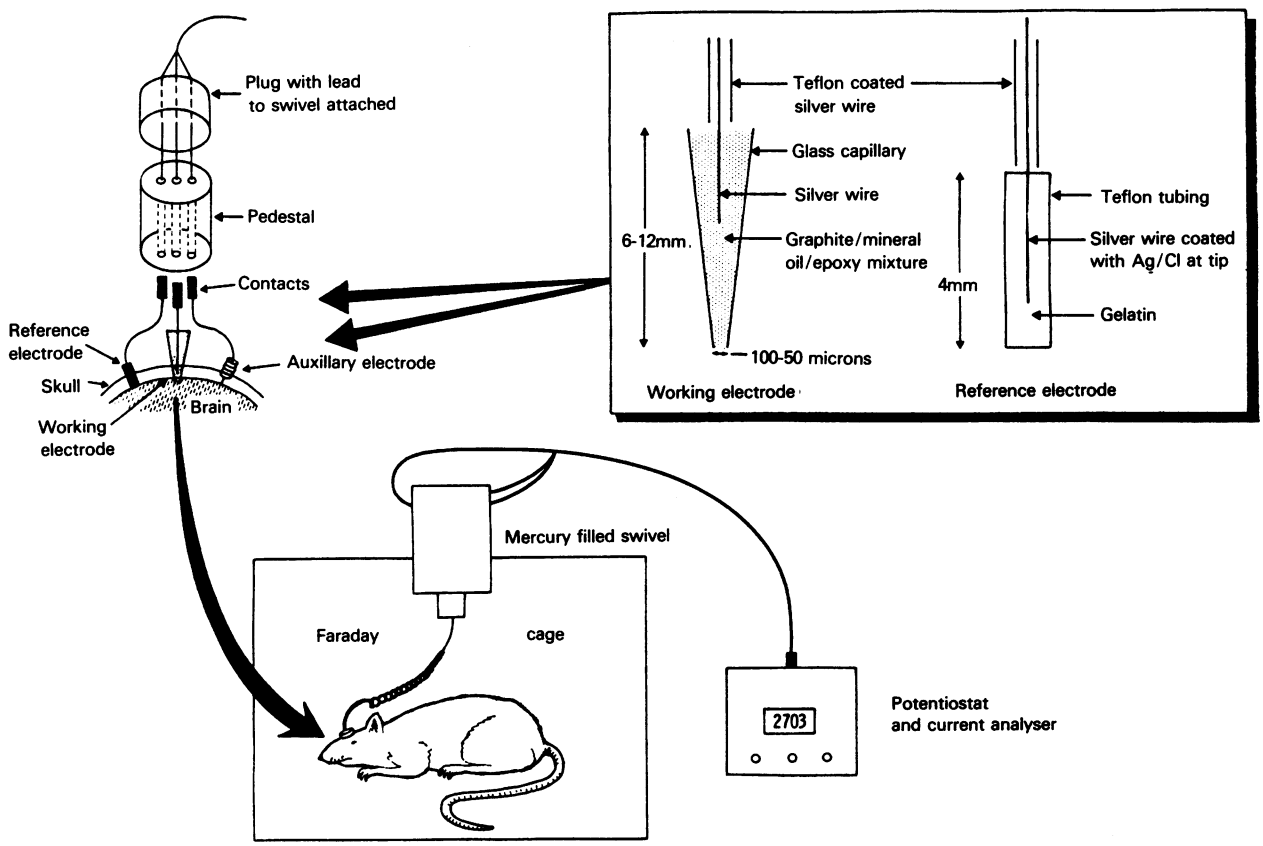

Figure 1 Diagram showing the basic set-up for *in vivo* voltammetric measurement of dopamine and 5HT release from brain. The pedestal with the electrode contacts inserted into it is cemented onto the skull with dental cement. The working electrodes are stereotaxically placed into specific brain regions, the reference electrode is placed on the brain surface and auxillary electrode is a steel screw fixed in the skull with a teflon coated silver wire attached to it.

of the substantia nigra and median raphe nucleus. For example, (+)-amphetamine (7.5 mg/kg) and p-chloroamphetamine (5 mg/kg) are known to release dopamine and 5HT respectively. Both drugs increase the current produced in the caudate and the increase with p-chloroamphetamine does not occur in rats pretreated with p-chlorophenylalanine (2 × 150 mg/kg) indicating it to be associated with 5HT release.

We thank the NSF, NIH, MRC and Wellcome Trust for financial support.

Reference

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Monitoring motor activity using doppler shift radar

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Many psychoactive drugs not only induce changes in total motor activity but also produce a shift from one form of activity (e.g. normal exploratory behaviour) to another (e.g. continuous body movements without exploratory behaviour). Existing automatic activity monitors have only limited capabilities to differentiate between different types of activity. The present system uses the principle of doppler shift radar to analyse both the speed, and the time pattern of bursts of activity. The measurements obtained are recorded using a multi-channel microprocessor controlled printer.

Activity has been classified in two ways. First, in terms of times in seconds the animal spends in each selected form of activity such as fast speed activity (typically normal exploratory behaviour) or slow speed activity (head turning). Second in terms of the number of bursts of either fast or slow activity. A burst ends when the animal has stopped moving for a specified time. The speed bands can be subdivided into three sensitivity levels and burst times adjusted to suit the type of behaviour being measured.

The monitor has been used to observe the behavioural effects on rats of p-chloroamphetamine (5 mg/kg i.p.) at different times during a 12 h light-dark cycle. p-Chloroamphetamine produces a behavioural response consisting of hyperactivity, lateral head weaving, forepaw treading and tremor (Trulson & Jacobs, 1976). The activity monitor is able to distinguish two phases in this response. The first starts within 10 min of administration and consists of increased fast and slow activity but very little burst activity (continuous body movements, head weaving, tremor). Fifty–70 min after injection while total activity is still above normal there is a marked increase in burst activity indicating atypical highly spasmodic locomotive behaviour (Figure 1). There is evidence that the two components of the behavioural response involve different neurotransmitter systems (Crow & Deakin, 1977).

References

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