DEMONSTRATIONS

A method for investigating neurotransmission in the basal ganglia using combined stimulation and intracerebral drug injection

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Unilateral electrical stimulation of the neostriatum in the rat induces turning of the head to the contralateral side (Barnett & Goldstein, 1975). This response is easy to quantify and may provide a useful model for the study of neurotransmission within the basal ganglia. Although the main anatomical pathways within the basal ganglia have been established there is considerable interest in the identity of the neurotransmitters within these structures. The techniques demonstrated have been employed in a novel way to study transmission in the basal ganglia using the head-turning model. Putative transmitter agonists and antagonists have been injected directly into the basal ganglia, including the output pathways, through indwelling cannulae and the effects on striatally-mediated head-turning assessed in freely moving animals.

Female Sprague-Dawley rats (170–220 g) are anaesthetized with sodium methohexitone (Brietal; 50 mg/kg, i.p.) and bipolar stimulating electrodes are stereotaxically positioned in the neostriatum at the coordinates A 8.5 mm; H − 1.0 mm; L 2.6 mm (König & Klippel, 1967). The electrode assembly consists of two insulated silver wires (diameter 0.25 mm) coaxially twisted for added rigidity and soldered to a miniature bipolar socket cut from a length of printed circuit board connector. The implanted part of the assembly is insulated with epoxylite resin (Clark Electromedical) and the wires are cut to the appropriate length thus exposing the tips. A mating plug is made from a printed circuit board and has flexible wires to allow the animal free movement. A permanent cannula guide of 23 G stainless steel tube with a removable stylus is inserted 1 mm above the target for drug injection. Two 10 BA stainless steel screws (3 mm long) are inserted into tapped holes in the skull. The electrode and cannula guide are secured to the screws with dental acrylic cement to fix the whole assembly firmly to the skull. After a 1–2 week recovery period the animals are ready for experimentation. A Grass S88 stimulator with isolation units supplies trains of biphasic, rectangular stimulating pulse pairs (pulse duration 0.5 ms; interpair interval 3.0 ms; pulse pair frequency 25 Hz). The current is monitored on an oscilloscope. The threshold current needed to produce a contralateral head-turn is determined (usually 0.1–0.3 mA) and the time taken for a 90° head-turn is measured as the mean of 10 consecutive trials (2 min between trials) using the threshold current. Following intracerebral drug injections the animals are re-tested using the same stimulus parameters. Drugs, dissolved in 1 µl of sterile saline, are injected at a rate of 0.5 µl/min through the guide using a 31 G cannula connected to a 10 µl syringe.

At the conclusion of the experiment the position of the electrode tip is marked by passing a d.c. current (2.0 mA for 15 s) and the cannula tip by injecting 1 µl of indian ink. The brains are then examined histologically.

L.A.L. is an SRC student.

References

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