ABSTRACT

The purpose of this study was to observe the effect of atropine and physostigmine sulphate on the behavioural arousal of the developing rat with the aim of determining the exact age at which these drugs became effective.

The spontaneous motor activity of rats aged 15 - 28 days was measured using a photocell activity cage and a Y maze. In the photocell activity cage, motor activity was measured for sixty minutes while the observation period in the Y maze was 3 minutes, subsequent to the administration of atropine, physostigmine or saline. The drugs were administered intraperitoneally.

Control studies revealed that the 15 - 18 day old rats habituate slowly while the 20 - 28 day olds show a more precipitous decline in motor activity as time progressed. This age-related ability to habituate resulted over a period of 60 minutes, in higher activity scores in the younger rats. This decrease in motor activity has been attributed to a gradually developed acetylcholine inhibitory system.

In contrast, in the Y maze, there were increases in the activity scores as the rats aged. It has been suggested that the age-related increase in activity is a result of an increased ability to explore.

The intraperitoneal administration of atropine resulted in decreases in the spontaneous motor activity of the 15 - 18 day olds. At 19 days however, atropine had no effect on the activity and only after the 20th day of life, were increases in activity recorded. These increases continued until day 25, after which atropine had virtually no effect on activity.

The decrease in the motor activity of the drug-treated 15 - 18 day olds may be a result of drug blockade of cholinoreactive elements of the reticular activating system. In addition, the increase in activity observed between 21 and 25 days may be related to (i) an alteration in the cholinergic/dopaminergic balance of the brain in favour of the dopaminergic system (ii) the development of a cholinergic inhibitory system after day 20 of life.

Compared with saline controls, the administration of physostigmine (0.2 mg/kg) to rats aged 15 - 21, 25 and 28 days resulted in significant decreases in the activity of the 15 - 20 day olds only. Increases in the locomotor activity of the 21, 25 and 28 day old rats were observed.

Physostigmine (0.05 mg/kg) was administered to 16, 18, 21, 25 and 28 day old rats. At this dosage, a depressant effect was noted in the 16 day olds only. By day 18, however, a tendency towards an increase in motor activity developed. By 21 days, a definitely significant increase in motor activity was detected.

The decrease in the activity of the younger rats (15 - 20 days) is possibly due to a combination of drug action at the neuromuscular junction and on response inhibition.

Increases observed after day 20 are a result of physostigmine-induced increase in both cortical and behavioural arousal in the intact animal.

The changing pattern of the rat's response to the effects of atropine and physostigmine may be correlated with the gradual maturation of forebrain inhibitory structures (frontal neocortex and hippocampus) responsible for the modulation of reticular

excitability.