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Animal motor activity and exploratory behaviour in pharmacology

Editorial

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Pharmacologically induced alterations in central neurotransmission of some neurotransmitters as dopamine, 5-HT, GABA, causes profound changes in animal behavior. Earlier notions suggested that drugs affected subject behaviour in a mode similar to the way which other non-pharmacological variables affected behaviour. The drug effects depend on four aspects: the subject (species/individual), what it is doing (response), what is happening to the subject (the causing) and its history? Behavioural neuropharmacology is the study of brain mechanisms and behaviour. It is to observe and quantify behaviour in subjects and to relate this behaviour to specific brain processes. To reach this, it is essential to manipulate CNS using certain drugs, neurochemical/electrolytic lesions of definite brain regions, disease or trauma. Hundreds of behavioural techniques have so far been developed for measuring various behavioural parameters. For ethical reasons, most behavioural studies is performed on experimental animals. Rodents (mice and rats) are a popular choice when exploring the effects of drugs on behaviour as avoidance behaviour. Pigeons and monkeys are much better in this case but the lack of detailed information for neuroanatomy and neurochemistry often prevents them from the study. For animal selection, biological factors (strain, age, sex, and weight) should carefully be considered if rodents are used especially rats. This to diminish biological and environmental variations in behavioural experiments and to study merely drug effects. Behavioural experiments need to be carried out in controlled environmental conditions: avoiding changes in room temperature, humidity, lighting conditions, extraneous odours, running a test in varies time of day, background noise and other confounding effects.

Several methods are available for the measurement and analysis of animal locomotor activity and exploratory behaviour. Use of these methods has made a contribution to the understanding of drug and their underlying neural effects. Considering several issues and factors (see above), the animal and human behavioural studies can provide a rich source of data relevant to basic and clinical neuropsychopharmacology. Several CNS agents either chemicals or natural products that may have effects like neuroleptics, depressants or stimulants affect animal locomotor activity and exploration. Changes in these behaviours can also have consequences for learning, memory, reward or fear. Locomotor activity usually means move from one place to another (spontaneous motor activity, SMA) which is influenced by several factors other than the drive to explore. Exploration is a complex cognitive process, involving sensory processing, investigation and responding to novel stimuli and information gathering. Spontaneous motor activity and exploratory behaviour have widely been studied over the past few decades. Interest in drug effects on such behaviours has much developed in the last years. There are some theoretical notions in SMA and exploratory behaviour includes, instinct or drive theory (external/internal stimulus changes), cognitive theory (acquisition of information), incentive motivation (positive reinforces) and arousal theory and optimal stimulation (interoceptive/exteroceptive stimulus intensity). Determinants of exploration and SMA are varied that its measurement is prone to methodological pitfalls. Animals exhibit interest and fear when exposed to novel situations or stimuli (curiosity and fear as motivating factors) and other important issue is the relationship between SMA and exploration. Other issues that may affect baseline activity are internal factors as circadian rhythms, food and water deficiency, individual variances, previous handling and rearing conditions. Several methods are available for measurement of SMA. Automated methods as photocell activity boxes which is frequently used procedure for measuring SMA. The apparatus is a rectangular plastic box similar to animal cage and is large enough for animal to walk around. Activity in this arena, defined as the total number of counts caused by interruption of photo-beams positioned above the floor. The scores are collected in different intervals. It is important to mention that photocells alone will not necessarily detect other types of SMA as scratching, grooming, and stereotypic movements. Other models as open filed test and home-cage observation which are known as observational methods. The advantage of these methods is that the observer can see the animal at all the times; unusual or unexpected behaviours may be noticed. Several other methods are available for the measurement of exploration. Tests of novelty preference as preference for novel environment and stimulus-elicited investigation are commonly used. Models which measure novelty preference and SMA simultaneously provide the most detailed behavioural analysis. Other methods as automated hole-board apparatus (nose dipping into holes, head-dipping test) defined as the movement of dipping the nose deep enough into a hole to interrupt photo-beams positioned just underneath the floor. This spontaneously elicited behaviour in the animals (rats) and is shown to be very sensitive to drug effects. Other exploration methods as various shapes of the maze: elevated plus-maze, T-maze, Y-maze and radial maze models are also available and frequently used but indirectly. In general, it seems that every laboratory has its own preferred methods of studying behavioural pharmacology. A new researcher to the field of psychopharmacology is faced with confusing choice of techniques to measure various behavioural patterns: motor activity, learning, attention and memory.

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Conflict of interest

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