A study of the behaviour alterations induced by different stimulus in Swiss albino mice(*Mus musculus*)

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Abstract - This investigation into the typical behaviour growth of unaltered mice grown in typical laboratory settings had two goals in mind. The mice has established itself as a valuable experimental animal for both biological and psychological studies. Two main sections make up this article. The first provides an overview of numerous mice behaviour research. Additionally, it is concerned with testing methods, equipment, and behaviour variations that have been created amongst genetic stocks. Studies of environmental influences and how they affect behaviour traits are covered in the second section.

Keywords: overview, environmental influences, hoarding, paroxysmal, pentobarbital

I. INTRODUCTION

This investigation into the typical behaviour growth of unaltered mice grown in typical laboratory settings had two goals in mind. The mice has established itself as a valuable experimental animal for both biological and psychological studies. The literature on the typical evolution of the specific behaviour patterns of many experimental animals, including the mice, is scarce despite the present efforts to construct a science of behaviour. Before doing any systematisation or generalising from the behaviour of an animal, LORENZ underlined the importance of having a full understanding of the realities of development in his writings on "Innate Behaviour Patterns" (1950).

Fig. 1. Swiss albino mice (*Mus musculus*)

II. MATERIALS AND METHODS

Two main sections make up this article. The first provides an overview of numerous mice behaviour research. Additionally, it is concerned with testing methods, equipment, and behavioural variations that have been created amongst genetic stocks. Studies of environmental influences and how they affect behavioural traits are covered in the second section. Techniques for the genetic analysis of behaviour are covered in the last section.

1. OVERVIEW

1.1 MAINTENANCE BEHAVIOUR

1.1.1 EATING AND HOARDING

All mice breeders are aware that feeding occurs in cycles since late in the day, the sound of mice munching on pellets may be heard in their living spaces. The cumulative recorders used in operant conditioning research can provide more accurate data of daily fluctuations in eating activity (Anliker and Mayer, 1956). Normal mice exhibit a significant 24-hour periodicity, with the night time rate being the highest.

In the laboratory, hoarding of food is not observed until favourable conditions are created. Complex consequences of food scarcity led sometimes to satiated animals hoarding more than starving ones. They discovered that wet and dry cotton packets were retrieved more quickly than food pellets, raising doubts about the relevance of hoarding to eating behaviour.

1.1.2 DRINKING

Similar to eating, drinking occurs primarily at night and in cycles. When given unlimited access to water, mice typically drink 4 to 6 ml every 24 hours. Several strains show polydipsia. Virgin males and females show a less pronounced increase in water intake, but female mice eat 10 to 50 ml per day (Hummel, 1960). Because of cystic degeneration in the posterior pituitary, The polydipsia is probably caused by a reduction in antidiuretic hormone brought on by cystic degeneration in the posterior pituitary.

The amount of water consumed by mice is significantly more than is necessary. Hudson looked into the results of limiting access to water for a certain period of time (1964, personal communication). One or two times each day, for a total of 2, 4, 6, 8, or 1 minutes, were allowed for access. The results demonstrate a rather quick weight loss (10 to 17% of body weight), which peaked after around 5 days. Ingestion curves and weight recovery generally followed one other. When access periods were scheduled 12 hours apart as opposed to 24 hours apart, more water was consumed.

1.2 SOCIAL BEHAVIOUR

Laboratory mice share small cages in groups, with the exception of when they are segregated for testing. Wild mice can also grow in numbers quickly in grain ricks or other unusually favourable environments (Elton, 1942). Although they frequently share a space, mice are not thought of as highly sociable mammals because there is little group organisation. Nonetheless, social behaviour as manifested in fighting, mating, and child care has been studied for a variety of reasons, ranging from theoretically oriented research of the causes of fighting (Scott and Fredericson, 1951) to a hunt for medications to regulate aggression (Scriabine and Blake, 1962).

1.2.1 FIGHTING

The tendency for fighting displayed by many strains of mice, particularly by males, is well known to mice breeders. Battles to the death are widespread, and severe injuries are frequently inflicted during fighting. Several researchers have provided descriptions of mice battling (reviewed in Scott and Fredericson, 1951). The features of male-male interaction, according to van Abeelen (1963a), include fixing (staring at the opponent), dancing, boxing, kicking, nosing, wrestling, biting, chasing or fleeing, and adopting a submissive stance. When mice are coupled, their tails and coats frequently fluff up, which could be emotional reactions (Scott, 1947).

When kept in cages, laboratory mice often form a social structure based on the dominant male's sole domination (Uhrich, 1938). The dictator often holds onto power for a few months. The domination of one male over another, who in turn rules over others beneath him in the social hierarchy, is known as linear dominance. In newly formed groupings, dominance relationships can be equal or uncertain. In Ulrich's colony of heterogeneous albino mice, dominance was only not linked with weight when older animals were paired against juveniles. Regardless of his prior high social status in another circumstance, a considerable "home-cage" effect was observed in the normal advantage of residents over an introduced stranger. Victory in combat did not guarantee success in mating.

1.2.2 MATING

While courtship contains features unique to each species, it follows a pattern similar to those of other laboratory rats. Sniffing, following, mounting, mounting-with-intromission, and post-copulatory grooming are the basic steps in the sequence (van Abeelen, 1963a; Grant and Mackintosh, 1963; Lipkow, 1960; McGill 1962). Males who are sexually aroused frequently crawl in front of or even under females ("rooting," McGill, 1962). Before ejaculation, which is frequently indicated by the male rolling over on his side and frequently carrying the female with him, there may be one to more than 100 intromissions. The male accessory glands secrete a substance during ejaculation that solidifies to form the vaginal plug. Typically, a single ejaculation takes place each day.

1.2.3 CARETAKING

Usually, the pregnant woman builds a hollow nest out of a material that is at hand. She huddles close to the babies and spends a lot of time in the nest. The perineal area is the most frequently licked area of the young. A quantitative rating scale for mother behaviour has been developed using the retrieval of young who have been removed from the nest, the amount of huddling, and nest construction (Leblond and Nelson, 1937; Leblond, 1940).

Younger mice are far more effective at eliciting retrieval than older mice. For 1-day-old pups, 83 percent of retrievals were successful. With 5-day-olds, 78 percent, 10-day-olds, 54 percent, and 15-day-olds, 11 percent. Leblond (1940) discovered that the hormones of parturition and breastfeeding had minimal effect on the manifestation of maternal behaviour in mice. By leaving the young in the cage, a procedure known as "sensitization," intact and hypophysectomized males as well as virgin females could be made to exhibit maternal behaviour. It was discovered that males recovered dislocated baby mice just as easily as females did.

The in-depth studies of Beniest-Noirot (1958) have proven that the so-called maternal conduct is not under the influence of hormones. Her maternal behaviour tests, which included retrieving, nest-building, nursing care, and assuming of a nursing position, were equally successful in postpartum and virgin females and males. When faced with newborn mice, adult mice of both sexes, with and without breeding histories, ate placentas, bit umbilical cords, and cleaned the young. These actions aren't strictly maternal in nature; rather, they're reactions to the right cues. Beniest-Noirot observed that postpartum females enhanced their defence of the nest as the sole possible hormonal consequence. Although not being dependent on prior experience with baby mice, caregiving behaviours were more frequent in mice that had spent three days with their dam's second litter.

1.2.4 EMOTIONALITY

In various contexts, Willingham (1956) measured urination, defecation, activity, freezing, emergence into open and enclosed places, and squeaking. Six factors were recovered during factor analysis of the matrix of intercorrelations. All of the defecation and urination measures exhibited significant loadings in the first, which was referred to as "elimination." Freezing was the second element. Willingham came to the conclusion that the idea of generic emotionality is oversimplified and that there are numerous, essentially independent sorts of emotional activity.

Bruell (1963), who examined defecation in 25 distinct genotypes, has presented an important argument against the usefulness of elimination as a measure of emotionality. Males poop more frequently than females do, and hybrid males poop more frequently than their inbred sires do. But, compared to their inbred dams, hybrid females had less faeces. According to Bruell's interpretation, male mice's defecation in an unfamiliar location is a territory-marking reaction. Decreased adaptive responses brought on by inbreeding were therefore seen as being restored by greater defecation in hybrids.

According to Antalfi (1963), laboratory mice may exhibit less freezing (William's second factor) under stressful conditions than do wild house mice. Freezing may potentially have adaptive implications.

2. ENVIRONMENT AND PHENOTYPE

The information in this section is intended to help readers understand how early environments and maintenance circumstances might affect behavioural traits.

2.1 MAINTENANCE CONDITIONS

2.1.1 LIGHT CYCLE

Circadian rhythms in laboratory mice have been so convincingly proven that artificially controlled light-dark cycles in the animal room must be regarded as necessary for quantitative behavioural and physiological studies. Circadian rhythms in laboratory mice occur every 24 hours.

Halberg et al. (1955) found that Strain I mice were significantly more vulnerable to audiogenic seizures at night, and that the peak times of susceptibility could be changed by intentionally reversing the illumination cycle in the animal quarters (Halberg et al., 1958). Moreover, Halberg et al. (1959) shown that changes in seizure susceptibility are only one of numerous physiologic processes that change quickly throughout the day (e.g., such diverse phenomena as blood cortisone, number of mitoses in adrenal cortex, and total body activity).

It is abundantly obvious that controlling time-of-day effects is crucial in psychological research. Evening hours have been associated with higher paroxysmal activity in electrocorticograms (ECoG), which may enhance vulnerability to audiogenic seizures (Harner, 1961). As ECoGs were obtained while the subject was sedated with pentobarbital, it is also plausible that the changes were mostly caused by a cycle in medication susceptibility. The diurnal cycle and drug sensitivity have a complicated relationship. Pentobarbital sleeping time did not vary with the time of day under constant illumination, however under cyclic lighting, grouped participants slept longer when examined during the light phase but not throughout the night (Davis, 1962).

TABLE : 1 PENTOBARBITAL ANESTHESIA (60 MG/KG IP) UNDER VARYING CONDITIONS OF LIGHTING AND HOUSING: A AND B ARE DUPLICATE EXPERIMENTS.

(AFTER DAVIS, 1962, WITH PERMISSION OF THE AUTHOR AND EXPERIENTIA.)

		Duration of anesthesia after drug injection, minutes			
		In light period		*In dark period*	
Prior lighting	Maintenance housing	A	B	A	B
12 hour on-off cycles	Grouped	110	81	62	44
	Isolated	80	67	61	44
Continuous light	Grouped	86	68	94	60
	Isolated	75	59	78	59

Even mice born and raised in the dark were able to preserve periodicity in their behaviour, however these cycles were not associated with the natural cycle of day and night (Wolf, 1930).

2.1.2 TEMPERATURE

Controlling the temperature in the animal room is also frequently viewed as crucial. Mice, however, have successfully acclimated to ambient temperatures as low as -3°C if enough nesting material is available (Barnett, 1956, 1959). The ability of mice raised in cold environments to produce more heat allowed them to survive low-temperature stress considerably better than animals raised in warm laboratories, demonstrating that both physiological and behavioural adaptation had taken place. The adaptation must have originated from increased heat output because it was largely driven by improved body insulation.

2.1.3 POPULATION DENSITY

Many studies have been done on the connection between crowding and the endocrine system. Christian (1955) hypothesised such endocrine effects as a mechanism for controlling population density as a result of larger adrenals and smaller male sex components in crowded animals. Christian's conclusions were not all supported by all of the research, which raised doubts about the density control theory. The adrenal weights of CFW male mice raised in groups of 2, 4, 8, and 16 per cage or in isolation showed no differences, according to Southwick and Bland (1959). However, they did not discover enlarged adrenal glands in injured mice (presumably socially subordinate animals subjected to chronic stress). Contrary to Christian's prediction, the males in groups of four or eight actually produced more offspring than the isolates when females were added to their cages.

These latter investigations must indicate that there is a complex link between the behavioural and physiological degrees of integration. One of the best animals to study these interactions is the laboratory mice, which also has the benefit of allowing the evaluation of genetic consequences.

III. CONCLUSIONS

To put the genetic and environmental factors that influence behavioural phenotype in the appropriate context, one more thing must be said. Our writing has placed a significant and simplistic focus on genetic determinants of behaviour out of convenience, clarity of exposition, and a reflection of our own interests and those of the anticipated readers. Let's clear up the confusion: Just as an organism cannot exist without a genotype, the same is true of an organism that cannot exist without developing, being maintained, and being tested in a specific environment.

We definitely believe that theories of behaviour that do not take into account both environment and heredity are ridiculous (Moltz, 1965). Traditionalist psychologists have come under fire for failing to give hereditary influences on behaviour after enough consideration. Potentially, behaviour geneticists run the opposite risk. Both approaches will improve our understanding of behaviour when combined intelligently.

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