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Mr George Porter
(*Medical Research Council Laboratory Animals Centre, Carshalton, Surrey*)

Pre-weaning Loss of Laboratory Animals

This paper is concerned with the effects of physiological abnormalities, disease and physical environment on postnatal deaths of rats and mice. The existence of strains of animals in which particular malformations occur spontaneously gives certain investigators an opportunity to study the interaction of genotype and intrauterine variables. On the other hand, when such animals are used in a wider field of disciplines, and the defects causing death are not fully recorded, confusion may arise when experimental results are analysed. It has been shown that commonly recurring diseases are directly or indirectly responsible for 97·5% of all pre-weaning losses in young mice produced under conventional conditions. The diseases of rats and mice have been largely eliminated by subjecting animals to hysterectomies and maintaining their offspring either in germ-free isolators or behind barriers designed to exclude pathogens. It was soon realized that animals so produced had a different gut flora from the conventional. Furthermore, as a number of nutrients in the diet are destroyed by sterilization, malnutrition was responsible for a high percentage of pre-weaning deaths. These nutritional deficiencies have now been largely overcome and pre-weaning losses from such causes are now virtually non-existent.

The age at which an animal is mated has an influence on the number of young produced. Studies on the effects on reproduction and pre-weaning loss of mating mice at 19, 42, 84, 126 and 168 days have shown that the 19- and 42-day-old groups raise a higher percentage of young than the three other groups. Caging and animal house lighting must be considered in relation to each other and assessed for their effects on the number of viable young produced. The number of young weaned per breeding pair of mice was 23·0 per 100 days in opaque cages, and only 13·1 in transparent cages.

The effects of strong and diffused light on the breeding performance of two strains of mice (one albino, one coloured) were studied, and it was found that there was a strain difference in reaction to strong light. The pre-weaning loss of the albino strain was 3·7 pups per litter under strong light and 0·45 under diffused light. The coloured strain was not seriously affected by strong light, but still raised fewer pups than under diffused light.

Another factor that adversely affects pre-weaning mortality is the number of breeding females that are housed together in one cage. When female mice were caged (*a*) separately, (*b*) 2 together, and (*c*) 3 together, it was found that the percentage of pups lost was 1·1, 4·7 and 3·6 respectively.

An acceptable nesting material, the correct method of handling, and the level of noise in an animal breeding room are related to environment and it is necessary to have some knowledge of their effects on reproduction and pre-weaning loss. Furthermore, it is essential for the effects of these simple facets of animal husbandry to be fully recorded. Scientific workers should be provided with relevant information of the species and strain of animal they are using. Such information must include details of postnatal deaths and the causes must be related to the physiological condition of the parent animal, and the environment under which it is being maintained.

Dr W Lane-Petter
(*Carworth Europe, Alconbury, Huntingdon*)

Cannibalism in Rats and Mice

The incidence of cannibalism in mammals is normally low, and varies according to a number of factors and between species. It has been described by Steven (1957) in bank voles (*Clethrionomys*), by Hindle & Magalhæs (1957) in golden hamsters (*Mesocricetus auratus*), by Schwentker (1957) in short-tailed shrews (*Blarina brevicauda*) and by Steward (1957) in swamp rice rats (*Oryzomys palustris*), in rabbits (*Oryctolagus cuniculus*), as well as in rats and mice.

The evidence is that some strains of rats and mice are more prone than others to eat their

young, which points to a genetic factor (Beniest-Noirot 1958, Hauschka 1952). There are also many environmental influences that can provoke parent rats to attack and devour their offspring. These include noise, especially of high frequency; disturbances such as rough handling, too frequent cage changing, an unfamiliar technician, or undue movement of the cage; and also a shortage of water or food, or an inadequate diet. Jelínek (1967) reports malnutrition as a cause, and McCoy (1949) refers to a relative excess of vitamin B_1 or of manganese (but not of both together) as leading to cannibalism.

An interruption or disturbance of mothering behaviour is likely to lead to neglect, death and perhaps eating of young in nest, especially in species like the rabbit, where the behaviour pattern is complex.

The causes of cannibalism seem to fall under three main headings:

(1) Infant care in mammals, especially in those species in which the young are born very immature and require a long period in the nest before weaning, is a complex pattern of behaviour, to a large extent innate and, except in man, devoid of affective involvement. Anything that can overlay this pattern by a more urgent reaction, such as fear, the need to escape, disturbance by noise or rough handling, will lead to a breakdown of the complex pattern and neglect of the young, and the subsequent eating of the carcases may often be just tidying up the nest.
(2) Malnutrition, as distinct from undernutrition, can produce a perversion in the dam, whose lactational demands will intensify the deficiency. This will lead her, as well as other adult or growing animals in the cage, to devour carcases, and even to attack and kill the young in order to eat them.
(3) Cannibalism may develop as a vice. Whisker eating in mice is not uncommon; it can go on to ear or toe chewing, and from there to total cannibalism.

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Dr Philip Evans
(Guy's Hospital, London)

Infanticide

'Infanticide' is a legal term, and although we are not concerned with that aspect here it does provide a link with the subjects of previous speakers, for when Mr Leo Abse MP introduced his Infanticide Bill he declared that: 'Nineteenth century juries . . . knew that at about the time of birth, dogs, cats, sows, white mice, rabbits – all of them – sometimes killed their young. They were not prepared to extend less compassion to a mentally sick woman than they would to an excitable bitch' (Abse 1965).

Mental sickness is not the only reason for killing infants; we shall find it done on grounds of religion, culling, family planning, shame and commerce as well as anger and childbirth psychosis. Human infanticide has a long history, probably as long as the evolution of man, and it has been practised almost all over the world. Indeed, we may wonder what has prevented it from being a universal as well as an immortal custom. One factor is maternal feeling. It is thought to have been rare in matriarchal societies, particularly in fruitful regions of the earth, such as ancient China, the Nile Valley and Babylon (Garrison 1923). Generally in primitive tribes, as in Ancient Greece, it is the father who decides whether the child shall be kept or not. The warlike Roman emperor, Valentinian I, made it a capital offence in the year 374, presumably unsuccessfully for Charlemagne had to repeat the legislation four hundred years later. Religion has been a more potent force. Mohammed permitted abortion but forbade infanticide. The Christian doctrine that the soul is formed at the moment of conception has outlawed infanticide for Christians, although it is difficult to see why, if the soul is immortal. When the Icelanders were converted they stipulated that their right to slay their infants should not be removed (Encyclopædia Britannica 1910, Carr-Saunders 1922).

Religion does not only prevent infanticide, it may lead to it. When children had been thrown into the sacred River Ganges, the crocodiles who devoured them were venerated. The first-born beast or baby is an acceptable sacrifice, especially as a spring offering (Frazer 1936). At the last moment Abraham was persuaded to sacrifice a ram instead of Isaac, but the King of Moab made a burnt offering of his eldest son (Genesis xxii, 2–13; 2 Kings iii, 27). The first born is moreover often a rival to the father; in some groups he is the