

INDIVIDUAL DIFFERENCES IN BEHAVIOURAL REACTION TO A CHANGING ENVIRONMENT IN MICE AND RATS

by

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(With 5 Figures)

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Introduction

Wild house mice (*Mus musculus domesticus*) live in groups with a specific social organization called 'demes'. A group occupies a restricted territorial area and within this area a number of males possesses subterritories which they defend against intruders, but also against the other males in the group. Most females, and sometimes a top-dominant male, have more or less free access to the whole area (CROWCROFT, 1966). As a consequence the social environment of a male mouse is highly variable: at one moment it has to act as a dominant and defend its own subterritory, and the other moment it has to be submissive against the top-dominant or against other males when they trespass in their subterritories.

For successful functioning in such a system a highly developed socially adaptive ability is required (BARNETT, 1975; VAN ZEGEREN, 1980). However, from many physiological studies it appears that an individual differentiation exists with respect to the functioning in a social system. HENRY & STEPHENS (1977) showed a difference in the occurrence of hypertension between dominant and subordinate males in a mouse colony in which the dominants suffered from hypertension. In rats, which live in a social structure comparable to that of the house mouse, it was demonstrated that hypertension mostly occurred in those animals that took a position just below the top-dominant in the social hierarchy (the sub-dominants). But also top-dominants in a socially unstable situation, in which it was difficult for the top-dominant to maintain its position, developed hypertension (ALEXANDER, 1974; FOKKEMA, 1985).

MANUCK *et al.* (1983) demonstrated comparable results in cynomolgus monkeys. He housed males in either periodically reorganized or stable

social groups. Dominant males which were assigned to the reorganized (unstable) groups developed significantly larger coronary artery atherosclerosis than did subordinate males from the unstable group or dominant males from the stable social condition.

So, especially in socially unstable situations, a clear differentiation in the occurrence of stress pathologies is shown. Since a socially unstable situation is characterized by many changes in the social environment, it can be imagined that this differentiation is due to a fundamental difference between dominant/sub-dominant and subordinate animals in their reaction to a changing (social) environment. One difference between dominant and subordinate males is the level of aggression, as it is shown by the existing significant positive correlation between aggression and social position in a rat colony (FOKKEMA, 1985). Hence, it can be theorized that the supposed difference between dominant and subordinate males in their reaction to a changing environment may be better analysed from the comparison between aggressive and non-aggressive individuals. VAN OORTMERSSEN *et al.* (1985) demonstrated that aggressive and non-aggressive house mice indeed differ behaviourally in their reaction to changes in the social environment. When six males were released simultaneously in a new area, starting from familiar home cages, the aggressive males soon left their home cages, actively explored the new environment and furiously attacked every mouse they met. However, it was also often seen that they suddenly changed their behaviour into flight, possibly because they had lost contact with familiar ground. Non-aggressive males were much more cautious and after leaving their home cage they tended to return to it regularly. In this way they became gradually acquainted with the new surroundings and knew where to hide when attacked.

In order to investigate whether this differentiation between aggressive and non-aggressive individuals in a social situation reflects a more general and fundamental difference, we tested mice as well as rats in three experiments in a non-social situation. To measure the behaviour in such a situation a simple maze was used in which intra-, extramaze cues or the configuration of the maze could be changed.

Experiment 1

Introduction.

In a first experiment aggressive and non-aggressive male mice were tested on their reaction to a single change in a formerly invariable non-