BEHAVIORAL AND NEURAL BIOLOGY **46**, 30–45 (1986)

Behavior and Brain Neurotransmitters: Correlations in Different Strains of Mice

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Correlations of behavioral patterns in a social setting with catecholamines, serotonin, and several metabolites and precursors in three brain regions were examined in the DeFries H2, C1, and L1 strains of mice. In Experiment I, behavioral observations were recorded for two 15-min sessions in same-sex, same-strain pairs at about 65 days of age. In Experiment II, sex and strain groups were subdivided into 4% and 24% protein diet groups about 1 week before a second set of behavioral observations at about 120 days of age. Brain tissue content of neurotransmitters, precursors, and metabolites was determined by high-performance liquid chromatography after the second set of observations. Significant multivariate strain differences were shown for behavioral variables (both experiments) as well as concentrations of various neurochemicals. Strain H2 showed relatively high levels of locomotion, while rearing and social investigation were high in strain C1 and self-grooming in strain L1. Significant neurochemical differences were found in the following sets of variables: dopamine variables in the cortex, norepinephrine variables and serotonin variables in the combined diencephalon and midbrain, and norepinephrine and serotonin variables in the hindbrain. Effects of diet were found only on serotonin and tryptophan in the subcortical regions. Significant multivariate correlation with the behavioral variables was demonstrated for the catecholamines but not for serotonin. The results suggest that these strain differences in behavior may be mediated by catecholamine systems.

Relationships between behavioral variables and brain neurotransmitter chemistry have been the subject of numerous investigations over the last two decades. Pharmacological studies of these relationships have been more common than investigations correlating strain differences between these two sets of phenomena. Yet it has been argued that the study of genetically based covariation of behavior and brain biochemistry will ultimately provide the most convincing evidence for these relationships

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[2] The authors express their appreciation to Jerilee Lehman, Beth Regehr, and Kathy Hayes for technical assistance. Aspects of this paper were presented at the Southwestern Psychological Association Meetings, in Austin, TX, April 19, 1985. This research was supported by the Olive W. Garvey Center, Wichita, KS. Requests for reprints should be addressed to Dwight Krehbiel.

0163-1047/86 $3.00