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学位論文内容の要約

博士専攻分野の名称：博士（文学）

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学位論文題目

Effects of Prenatal and Postnatal Ethanol Exposure
on the Development of Ultrasonic Communication and Sociality in Rats
(出生前及び出生後のエタノール曝露がラットの超音波コミュニケーションと
社会性の発達に及ぼす影響)

Rat pups produce ultrasonic vocalizations (USVs) as distress calls on isolation from their dam. Similarly, juvenile rats during play fighting and adult rats during mating and inter-male aggressive interactions produce USVs, indicating their situation-specific emotional states. USVs produced by juvenile and adult rats during social interactions are of two types: 22 and 50 kHz USVs. The 22 kHz USV is considered to reflect negative emotionality such as anxiety, fear, and distress, whereas the 50 kHz USV is considered to reflect positive emotionality such as joy, happiness, and satisfaction. Therefore, USV is considered as a sensitive tool for measuring emotionality in socially interactive situations. It is evident that prenatal and postnatal ethanol exposure leads to a reduction in USVs in pups and have the potential of inducing difficulties in attachment behavior between pups and the dam. But studies concerning the effects of prenatal and postnatal ethanol exposure on play fighting, mating and inter-male aggression induced USVs in

rats are yet to be determined. In this study, we recorded USVs produced by prenatal and postnatal ethanol-exposed rats upon maternal isolation, play fighting, mating and inter-male aggression and examined the acoustic characteristics of USVs. For prenatal exposure, 13 pregnant rats were randomly assigned into three groups and ethanol was administered to the high- and low-ethanol groups in three gradually increased concentrations between gestational days (GDs) 8 and 20. From GDs 14 to 20, ethanol-containing tap water at concentrations of 30% and 15% (v/v) was administered to the high- and low-ethanol groups, respectively. For postnatal exposure, 18 pregnant rats were randomly assigned into three groups and ethanol-containing water was administered to the high- and low-ethanol groups in three stages by gradually increasing the concentration between PNDs 5 and 21. From PNDs 11–21, 30% and 15% ethanol-containing water (v/v) was administered to the high- and low-ethanol groups, respectively. Tap water without added ethanol was given to the control group. On postnatal days 4, 8, 12 and 16, individual newly born pups were isolated from their dam and USVs produced by them were recorded for 5 min. On postnatal days 40–42, three rats from the same sex and same ethanol concentration but from different litters were placed together into the playing cage and play fighting-induced USVs were recorded for 10 min. On postnatal days 90–95 for prenatal exposure and 90–99 for postnatal exposure, one male and one female rats from

the same ethanol concentration group but from different litters were placed into the mating cage together and USVs were recorded for 10 min. On postnatal days 100–102 for prenatal exposure and 102–104 for postnatal exposure, two adult male rats from the same ethanol concentration group but from different litters were placed into the aggressive encounter cage together and USVs were recorded for 10 min. Prenatal ethanol exposure increased the number of USVs in high-ethanol pups. Elevation of negative 20–35 kHz USVs and reduction of positive 45–70 kHz USVs along with decreased play attacks and increased anxiety were evident in high-ethanol male group during play fighting. During mating, negative 20–35 kHz USVs were elevated and positive 45–70 kHz USVs were reduced with decreased frequencies of mounting (males) and lordosis (females) in prenatal high-ethanol pairs. These results suggest prenatal ethanol-induced difficulties in social interactions throughout the life span indicating anxiety, fear or distress. Postnatal ethanol exposure, on the other hand, elevated the number of USVs in high- and low-ethanol exposed pups on maternal isolation as well as increased the negative 20–35 kHz USVs in high-ethanol juvenile female rats upon play fighting. 45–70 kHz positive USVs were reduced in high-ethanol pairs during mating. These results suggest the most adverse effects of ethanol in infancy but less adverse effects in juvenile and adult periods, indicating anxiety, fear and distress in pups. Both prenatal and postnatal

ethanol exposure exerted no altered effects in inter-male aggression. Attenuation of GABAergic inhibition due to ethanol exposure might elevate the neuronal excitability in basolateral amygdala and ventral tegmental area and resulted in elevated negative emotionality and decreased positive emotionality in high-ethanol exposed rats.