ANALYSIS OF NEURONAL MECHANISM FOR BEHAVIORAL THERMOREGULATION IN RATS

M. Maruyama, M. Nishi, Y. Takashige, K. Nagashima and K. Kanosue, Department of Physiology, School of Allied Health Sciences, Osaka University, Osaka, Japan.

Homeothrmic animals regulate their body temperature by using behavioral as well as anatomic processes. Behavioral thermoregulation means the behavior for looking for a better thermal environment, including wearing clothes and building houses in humans. While the brain mechanisms for the autonomic process is well documented, that for the behavioral thermoregulation has not been as well understood, partly because there was no appropriate experimental model. Chen *et al.* (1998) recently developed a new operant system for studying behavioral thermoregulation. In this system, a rat in a box of high load temperature can get a cold reinforcement for 30 s when it moves into a specific area in the box. This system is based on rats' natural behavior and they easily learn the procedure. The purpose of the present study is to analyze the neuronal mechanism for behavioral thermoregulation using this system. In the first experiment, we analyzed the heat-escape behavior, and brain regions activated were surveyed by immunohistochemical analysis of c-Fos protein. Male specific pathogen-free Wistar rats (300-400g, Charles River Japan, Osaka, Japan) were used in this study. Under sodium pentobarbital anesthesia (50mg/kg, *i.p.*), a biotelemetry device was implanted in the perioneal cavity of each rat for the measurement of body temperature. After this surgery, the heat-escape experiment (40°C load temperature and 5°C reinforcement) was conducted for 3 h twice on separate days. Immediately after the last experiment, all the rats were deeply anesthetized with sodium pentobarbital and perfused with formaldehyde. The brains were removed and the whole brain sections were made for the immunohistochemistry analysis. In the rat performing heat-escape behavior strong Fos immunoactivity was found in the median preoptic nucleus (MnPO), the dorsomedial hypothalamus (DMH), and the parastrial nucleus as compared with the control. In the second experiment, the effects of the brain lesion or transection on behavioral thermoregulation were evaluated. As in the first experiment, each rat did heat-escape behavior twice. Then, the rat received electrolytic lesion of the MnPO, the DMH, or the amygdala or microknife transection of the stria terminalis. Ten days after the surgery, the heat-escape behavior was basically same in the number of getting reinforcement as that before the surgery in all the rats. These destroyed regions might not be responsible for the control of heat-escape behavior. Another possibility is that although they play some role for behavioral thermoregulation, the behavior is under the control multiple neuronal mechanisms working in parallel.

Chen, X-M., Hosono, T., Mizuno, A., Yoda, T., Yoshida, K., Aoyagi, Y., Kanosue, K. (1998) New apparatus for studying behavioral thermoregulation in rats. *Phyiol. Behav.* 64:419-424.

kanosue@sahs.med.osaka-u.ac.jp