Ability of Rat to Adapt to Stress of Light Restraint.* (21110)

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In previous reports the phenomenon of thermoinstability induced by light restraint in the cold (*i.e.*, restraint hypothermia) has been observed(1,2). It has also been demonstrated that the emotionality of the animals is correlated with their ability to maintain body temperature while restrained in the cold, *i.e.*, the more emotional the animal the greater the drop in body temperature(3-5). Since animals are emotionally stressed by light restraint, it was wondered if they could become adapted to this stress. The present communication reports a study of the ability of the rat to adapt to the stress of restraint.

Methods and materials. To determine if animals could become adapted to the stress of light restraint, 30 young adult male Sprague-Dawley rats were exposed in restraining cages in the cold room for periods up to 7 hours and changes in the body temperatures were noted with indwelling rectal thermometers. They were then removed from the cold room and maintained in the same restraining cages for a week. During this period of "adaptation," food and water were given *ad libitum* as illustrated in Fig. 1. At the termination of the period of adaptation the animals were again exposed to the cold, while still in the restraining cages, and the changes in body temperature again noted in exposures of 7 hours. On removal from the cold room, the animals were taken from the restraining cages and maintained as were the other animals in the laboratory. At the close of this week in regular laboratory conditions, the animals were again placed in the restraining cages in the cold room and the changes in body temperature once again noted during a 6-hour exposure.

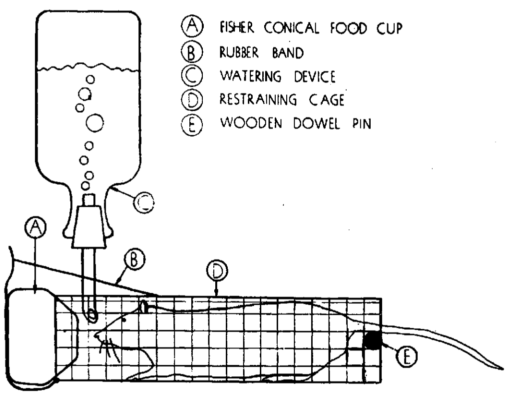

FIG. 1. Method used for giving food and water *ad libitum* during adaptation to stress of light restraint.

Results. In Fig. 2 is shown the body temperature drop of restrained conscious animals before adaptation (A), as well as the body temperature drop of the same animals similarly exposed to cold at the end of the adaptation period(B), and of the same animals one week after the adaptation period (C).

The responses of the animals in each group were arbitrarily placed into one of 3 categories: 1) animals which maintained an essentially normal body temperature and animals whose body temperature fell slightly and then rose to normal or near normal levels; 2) animals whose body temperatures fell gradually during the course of exposure but not falling below 25°C; 3) animals whose body temperature fell rapidly and progressively during the course of the exposure. The percentage of animals falling into each category is noted in Fig. 2.

Discussion. Since emotionality is involved in the phenomenon of restraint hypothermia (3-5), it seems probably that with suitable treatment the animals could become accustomed to the stress of light restraint so that they would remain relatively thermostable when so exposed in the cold. Since intermittent exposure to the stress of confinement results in a measurable increase in the resistance of the animals to the stress in the cold(1), it was thought that continual exposure to the stress of restraint might effect a greater degree

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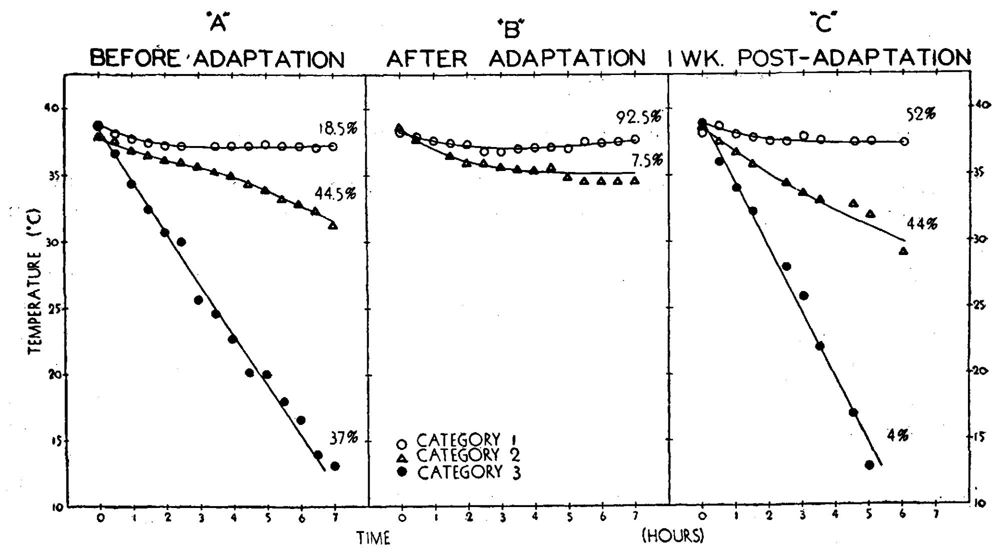

FIG. 2. Body temperature drop of rats exposed to cold. A. Before "adaptation." B. After "adaptation." C. 1 wk after "adaptation."

of thermostability in the animals. Thus, in this experiment, the restraining cages were fitted with food and water containers as shown in Fig. 1, and the animals exposed in them for a period of one week. During this time the animals became somewhat undernourished, losing from 10 to 50 g of weight. In spite of this condition of apparently lowered vitality, their response to caging in the cold, as shown in Fig. 2, showed a remarkable degree of thermostability as compared to their response before the period of adaptation. It has been determined(3) that restricted breathing is not a measurable factor in the hypothermia produced by light restraint. Since these animals were lightly restrained both before and after the period of adaptation, it is most probable that the improved response cannot be attributed to the greater breathing freedom afforded the animals after losing weight.

That some relatively stable change had been effected in the animals during adaptation is evidenced by the fact that the thermostability of these animals had not returned to the pre-adaptation level by one week after the completion of adaptation. Since the phenomenon of restraint hypothermia is possibly "triggered," as it were, by an emotional response, it is possible that this adaptation consists primarily in a "mental acclimatization" to the effects of the stress. However, even if the response of an animal to restraint in the cold is initiated by emotional factors, it is still possible that adaptation might involve increased adrenal cortical activity. In preliminary experiments in this laboratory, it has been demonstrated that cortisone injections impart a degree of resistance to hypothermia under the conditions of restraint in the cold. Biochemical assays of adrenal cortical activity are in progress which should further clarify this point.

Summary. Ability of the albino rat to adapt to stress of light restraint was investigated. Rats were able to adapt to the stress of restraint (for one week) in a cylinder of wire mesh so that they did not become hypothermic when exposed to the stress in the cold. The possible roles of emotional adaptation and adrenal cortical activity in producing the increased resistance to these stresses are discussed.

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