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AGE CHARACTERISTICS OF CHANGES IN INVERTASE ACTIVITY OF THE
MUCOUS MEMBRANE OF THE SMALL INTESTINE DURING STRESS

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16. Abstract Rats of varying ages were subjected to stress from heat, cold, and hydrocortisone injection. Invertase activity in homogenates of small intestine mucous membranes was studied following sacrifice. Invertase activity was low in young animals, but increased sharply in 30-day-old ones, remaining at a relatively constant level until old age. The study concludes that the stressed thermoregulatory system responds by increasing stress hormone (corticosteroids, etc.) levels in the blood, which affects the formation of enteric enzyme levels and activities, and that age-related peculiarities in invertase activity are a consequence of altered hormone status and epitheliocyte sensitivity.		13. Type of Report and Period Covered Translation
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Various stress factors (heat, cold, immobilization, breathing of gas mixtures, hyperdynamia) substantially alter the rate of enteric enzyme synthesis, lead to abnormalities of the enzymatic spectrum on the external surface of epitheliocyte membranes, and facilitate the genesis of gastrointestinal diseases of noninfectious etiology [1,2]. /41*

However, the research establishing the above was performed on adult animals and did not provide an exhaustive response to the question of possible age-related peculiarities of small intestine enzyme system reaction to the effects of stress factors.

We performed experiments on white rats kept in a normal laboratory vivarium without restriction of food: the growing animals were 10-, 20-, and 30-day-old rats, the adults were 120 days old, and the older ones were 28-30-month-old rats. One subgroup (experimental) was subjected to two hours of cold (6-7°), heat (39-40°C), and an injection of hydrocortisone (4mg per 100g body weight), while the other subgroup served as the control. 24 and 48 hours following the application of stress, 6 animals each in the control and experimental groups were sacrificed and invertase activity in homogenates of the mucous membrane taken from the entire surface of the small intestine (excluding the duodenum) was determined using the arsenic-molybdenum method [3]. The activity of the enzyme was expressed in micromoles of formed reducing sugar per 1g dry tissue weight.

The experiments indicated that invertase activity in the 10-day-old rats of the control group was negligible, at a low level at 20-days of age, and increased sharply by the 30th day of life,

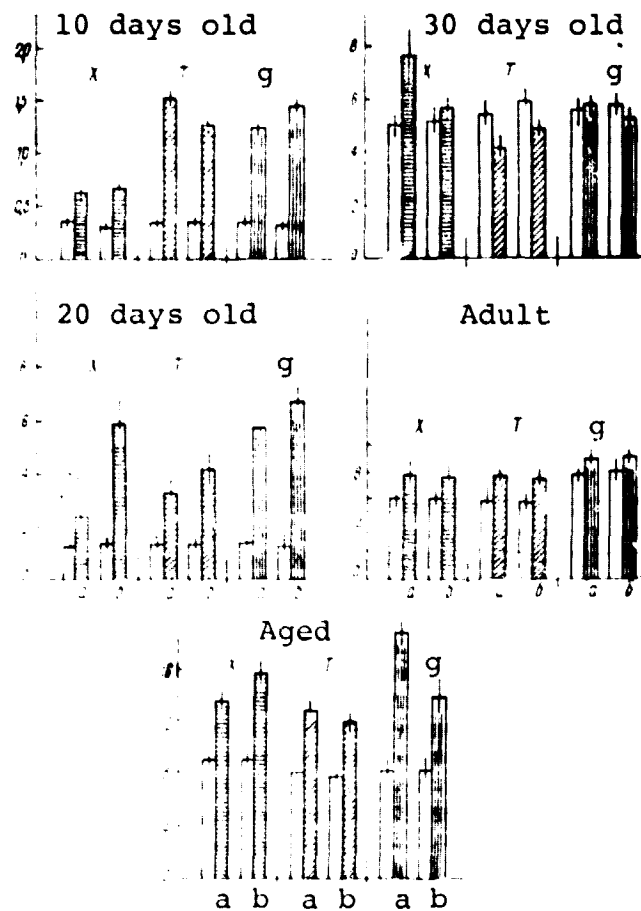
*Numbers in the margin indicate pagination in the foreign text.

remaining at more or less constant levels until old age. The application of stresses led to a considerable rise in invertase activity in the 10- and 20-day-old rats. The inductive effect almost totally disappears by the 30th day, is virtually lacking in adult rats, and reappears in old age (Fig.).

Explanation of the physiological mechanism lying at the basis of this phenomenon should obviously proceed from the following: a short-term animal stay in cold or hot conditions leads to stress of thermoregulatory apparatus functioning, stimulation of hypothalamo-hypophysial-adrenomedullary system activity, and facilitates an increase in the concentration of corticosteroids and other stress hormones in the blood, which, in turn, has a definite effect on the formation of enteric enzymes and possibly on their activities. The results of our studies, obtained following injection of hydrocortisone, which has an effect similar to that of exposure to cold or heat, may be considered particular proof of this supposition. Age-related peculiarities of alterations in invertase activity during stress are probably associated with ontogenetic alterations in the interrelationship between the hormonal status of the body and the sensitivity of epitheliocytes to exogenous and endogenous hormones. Of course, the rate of corticosteroid secretion in the rats in early postembryogenesis initially grows slowly, reaching a maximum during adulthood and gradually decreasing by old-age [4]. We believe that there is a reverse dependency between basal concentrations of corticoids in the blood and the sensitivity of epitheliocyte enzyme synthesizing systems to hormones. This agrees with the data of our previous work [5] which showed that hydrocortisone injection induces small intestine mucous membrane invertase activity in adrenalectomized adult rats where this effect was not present in rats which had been subjected to a pseudooperation. Consequently, the effects of age-related peculiarities of enzyme synthesizing system regulation on alterations in hormonal condition should be taken into consideration when applying hormone therapy using various kinds of corticoids.

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Small intestine mucous membrane homogenate activity in rats of various ages under normal (white columns) and following 24 (a) and 48 (b) hours after exposure to cold (x) and heat (t), as well as after injection of hydrocortisone (g). Along the vertical is enzyme activity in micromoles of formed reducers per 1 g dry tissue weight.

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