

CHARACTERISTICS OF THYROID FUNCTION IN HYPERTHERMIA

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Experiments on albino rats showed that during hyperthermia the ascorbic acid concentration is reduced and the dehydrogenase, cytochrome oxidase, and phosphatase activity depressed in thyroid gland tissue.

The endocrine glands are now known to participate in the response of the organism to the effects of temperature [6, 8, 9, 11, 13, 14]. Meanwhile the character of changes in the state of thyroid function during acute hyperthermia has not been adequately studied.

In the investigation described below biochemical and histochemical methods were used to study the functional activity of the thyroid tissue in acute hyperthermia. Enzyme activity and vitamin C saturation were used as indices of thyroid gland function.

EXPERIMENTAL METHOD

Sexually mature albino rats weighing 150-200 g were used. Each experimental group consists of 16 animals. Hyperthermia was induced by keeping the animals in a chamber at about 41°C for 1 h, during which time the rectal temperature rose by 2.5-4.5° above its initial level. Intact albino rats were used as the control.

Dehydrogenase activity of the thyroid tissue was investigated by the use of 2, 3, 5-triphenyltetrazolium chloride [8, 15], cytochrome oxidase activity by the NADI reagent [6], and phosphatase activity by a modified Bodansky's method [3, 10]. The ascorbic acid concentration was determined by the dichlorophenol-indophenol method [1].

TABLE 1. Changes in Biochemical Indices of Thyroid Function of Albino Rats During Hyperthermia ($M \pm m$)

| Index | Control | Hyperthermia |
|--|------------------|-----------------|
| Dehydrogenase activity (extinction/weight of tissue in g) | 2.12 ± 0.11 | 1.01 ± 0.07 |
| Cytochrome oxidase (in mg indophenol/g tissue) | 4.91 ± 0.17 | 2.73 ± 0.16 |
| Phosphatase (in μ g phosphorus/100 mg tissue):alkaline | 71.41 ± 3.0 | 26.13 ± 2.1 |
| :acid | 126.17 ± 6.3 | 64.56 ± 5.3 |
| Ascorbic acid (in mg%) | 31.16 ± 1.4 | 13.04 ± 0.7 |

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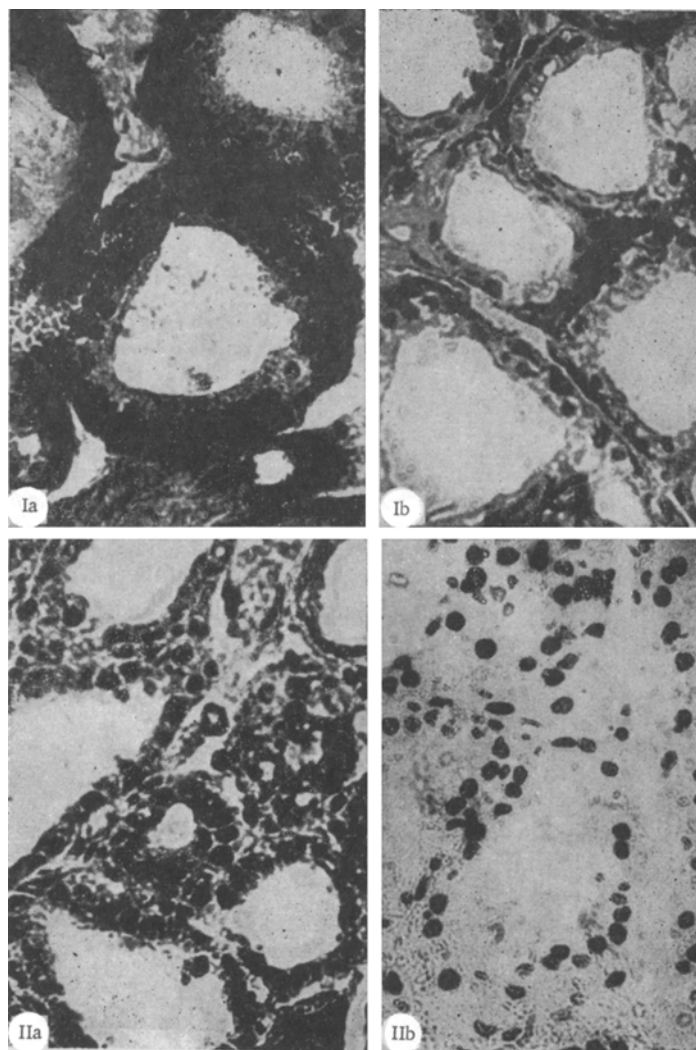


Fig. 1. Activity of alkaline (I) and acid (II) phosphatases in thyroid gland tissue of intact albino rats (a) and hyperthermic rats (b). Gomori, 500 \times .

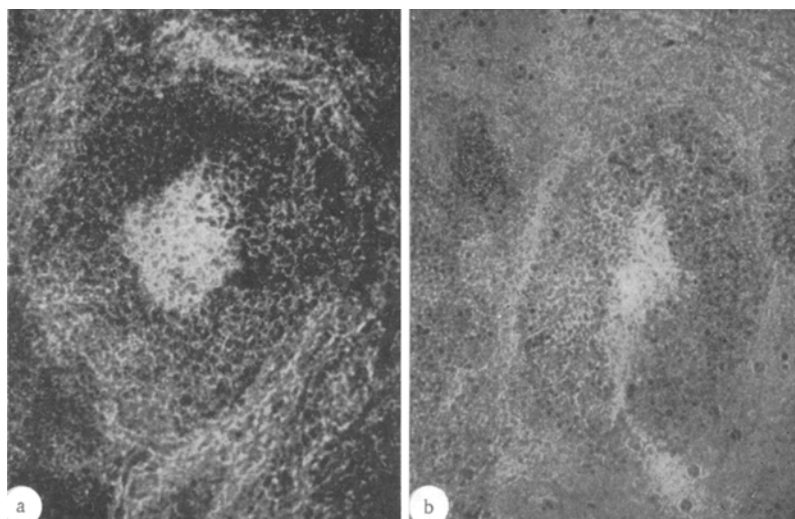


Fig. 2. Cytochrome oxidase activity in thyroid tissue of intact rats (a) and hyperthermic rats (b). NADI reagent, 500 \times .

The content and distribution of succinate dehydrogenase (by Nachlas's method with neotetrazolium), of cytochrome oxidase (with NADI reagent), and of acid and alkaline phosphatases (by Gomori's method) were investigated histochemically.

EXPERIMENTAL RESULTS

As the results in Table 1 show, exposure to a high temperature led to a decrease in the dehydrogenase, cytochrome oxidase, and phosphatase activity of the thyroid gland tissue of the experimental animals. At the same time, hyperthermia was accompanied by a decrease in the ascorbic acid concentration in the thyroid tissue. Since the level of enzyme activity and the vitamin C concentration reflect the intensity of the hormone-forming activity of endocrine glands [2, 4, 5, 13, 14], these results suggest that hyperthermia depresses thyroid function. This conclusion is confirmed by the results of the histochemical tests. At the height of hyperthermia, hardly any succinate dehydrogenase was found in the thyroid tissue of the experimental rats. Under these conditions the phosphatase activity of the thyroid gland tissue was sharply reduced (Fig. 1). These changes were most marked in the nuclei and cytoplasm of the thyroid epithelium and also in the endothelium of the blood vessels. Histochemical analysis showed that during hyperthermia the cytochrome oxidase activity in the thyroid tissue was considerably depressed below the control level (Fig. 2).

These results, taken as a whole, indicate that an increased internal environmental temperature due to general hyperthermia depresses the functional activity of the thyroid tissue.

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