GRADATION OF FUNCTIONAL TONE OF THE SKIN-TEMPERATURE ANALYZER UNDER THE INFLUENCE OF LIGHT OF DIFFERENT INTENSITIES ON THE SKIN AND EYE

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UDC 612.563:611.77/.014.44

The author has shown previously [1-6] that the visual and skin-temperature analyzers are functionally interconnected. The existence of this link is biologically important, for because of it an additional reserve is created for adaptation of the body to constantly changing conditions of existence [8, 12].

Later observations [7] have led to the conclusion that light has an influence on the functional tone of the skin-temperature analyzer, exerted both through the visual analyzer and through direct action on the skin.

In this paper the results are described of observations made with the object of determining whether the reaction of the tone of the skin-temperature analyzer to photic stimulation of different intensities, acting on the skin in isolation or on the eyes and skin simultaneously, is stepwise in character.

EXPERIMENTAL METHOD

Observations were carried out on human subjects in an experimental dark room which was illuminated when required by daylight lamps. The use of daylight lamps excluded the action of infrared radiant heat. The room temperature was kept constant and its intensity of illumination varied from 0 (darkness) to 80, 150, and 300 lx. The responses of the skin-temperature analyzer to photic stimulation of different intensities were judged from changes in the number of functioning cold receptors (from a total number of 15 previously located cold points). To begin with, by means of a cold thermoesthesiometer, fitted with a thermoprobe 1 mm in diameter, 15 cold points were located on the medial surface of the forearm. The number of functioning receptor points, i.e., responding to cold stimulation, was then determined in the following order: after dark adaptation for 30-40 min, 1.5 and 10 min after the beginning of illumination of exposed areas of the skin with the eyes covered, and also 1.5 and 10 min after the beginning of illumination of the skin and eyes simultaneously with light of the same intensity. Immediately after this, dark adaptation was again produced and the number of functioning cold points again determined in the same order, but during the action of light of a different intensity. To insulate the eyes from the action of light, the subjects wore dark glasses with a special firm binder excluding penetration of light. Altogether 57 observations were made on 5 subjects.

EXPERIMENTAL RESULTS AND DISCUSSION

When the eyes were covered, illumination of the experimental room led to a decrease in the number of functioning cold receptors by comparison with their number in darkness. Illumination of the skin and eyes simultaneously with light of the same intensity led to a still greater decrease in the number of functioning cold receptors. The results of one of the observations are illustrated in Fig. 1. After dark adaptation for 40 min the number of functioning cold receptors was 14-15, during illumination with an intensity of 80 lx the number fell to 10, and when the eyes were also illuminated with light of the same intensity a further decrease in the number of functioning cold receptors to 8 or 7 took place. As a result of subsequent dark adaptation the initial level of mobilization of the cold receptors was restored (up to 14). Next the skin was illuminated with light of higher intensity (300 lx), and this led to a decrease in the number of functioning cold receptors practically to the same level (10-9) as that observed during illumination with light of lower

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Translated from Byulleten' Éksperimental'noi Biologii i Meditsiny, Vol. 64, No. 12, pp. 17-19, December, 1967. Original article submitted January 25, 1966.

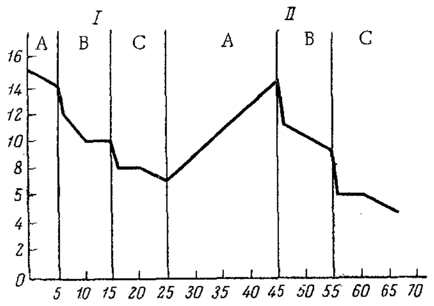

Fig. 1. Changes in functional level of cold receptors in the skin during illumination of the experimental room at different intensities. Abscissa) time (in min); ordinate) number of functioning cold receptors. I) Intensity of illumination 80 lx; II) 300 lx. A) Dark adaptation; B) illumination of the skin; C) illumination of the eyes and skin.

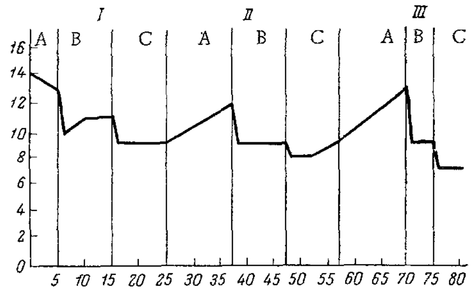

Fig. 2. Stepwise character of response of skin-temperature analyzer to photic stimulation of the skin and of the skin and eyes together at different intensities (mean data). I) Intensity of illumination 80 lx; II) 150 lx; III) 300 lx. Remainder of legend as in Fig. 1.

intensity (80 lx). However, illumination of the skin and eyes simultaneously by a bright light caused a greater decrease in the number of functioning cold receptors (to 6-5) than illumination with light of lower intensity. The results of analysis of the data are given in Fig. 2.

If the changes in the number of functioning cold receptors during photic stimulation of different intensities are studied only on the receptor surface of the skin, it can be seen that during illumination of the skin by light of an intensity of 80 lx the number of functioning cold receptors falls by comparison with their number in darkness. Illumination of the skin with an intensity of 150 and 300 lx also leads to a lowering of the level of mobilization of the cold receptors by comparison with that after dark adaptation. However, the magnitude of the response remained practically the same whatever the intensity of illumination of the skin. It was slightly more marked with an intensity of 300 lx. A different picture was observed when the response of the skin-temperature analyzer to the action of light of different intensities on the eyes and skin together was compared. This showed that the magnitude of the response depended on the intensity of illumination (80, 150, 300 lx). If the skin and eyes were illuminated simultaneously with light of an intensity of 80 lx the number of functioning cold receptors fell from 13-12 to 9, at 150 lx the number fell to 8, and at 300 lx to 7.

It may be concluded from these observations that the skin-temperature analyzer reacts to changes in the intensity of illumination of the experimental room both through the visual analyzer and also, when the eye is completely insulated, when the light acts directly on the skin. However, during the action of light of different intensities directly on the skin, a stepwise character of the reaction of the skin-temperature analyzer can be detected only with considerable jumps in the intensity of illumination (darkness – light, 80 – 300 lx), whereas if the jumps of intensity are smaller (80-150 lx) they do not produce such a marked difference in the response.

It is evident that the receptor system of the skin, although responding to the direct action of light and darkness, can analyze the intensity of light only to a limited decree, when sharp jumps are made from one level of intensity of illumination to another. Exclusion of the visual analyzer, responsible for the fine analysis of photic stimuli, leads to a reflex change in the functional tone of the skin-temperature analyzer, corresponding to the intensity of acting illumination during smaller jumps in its intensity also.

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