EFFECT OF EXTERNAL ENVIRONMENTAL TEMPERATURE ON THE TEMPERATURE SENSATION FUNCTION

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An inverse relationship exists between the air temperature, on the one hand, and the latent period of the sensomotor response to temperature stimulation and the threshold of temperature discrimination, on the other hand, in children during the summer vacation.

The system for temperature sensation, with its important role in maintenance of the balance between the organism and the external environmental temperature, is in a state of continuous activity [4, 5, 7, 8]. However, slight fluctuations in environmental temperature under natural conditions are frequently unnoticed, especially by children, although this is associated with changes in the state of the temperature sensory system.

The investigation described below was carried out on children during the summer vacation when they spent virtually the whole day outside. Indices used to define the state of temperature sensation were the late latent period of the sensomotor response to temperature stimulation and the threshold of temperature discrimination.

EXPERIMENTAL METHOD

The temperature stimulation detector was fixed to the medial surface of the distal portion of the forearm [1, 3]. Its theoretical inertia was under 10 msec. Temperature senstivity (in J/cm^2) was determined from the threshold level of temperature stimulation. The computer part of the apparatus recorded the latent period of the response in milliseconds (time from beginning of stimulation to time when the subject

TABLE 1. Latent Period of Response of Children of Preschool Age (10 subjects) to Temperature Stimulation during Colder and Warmer Periods of July

Index studied	Period and time of observation				P between 1st and 2nd periods	
	10—15 July		24—29 July			
	8:00 A.M.	1 P.M.	8:00 A.M.	1 P.M.	8:00 A.M.	1 P.M.
Air temperature (in deg.)						
Limits of variants	16,3—21,1	18,2—24,9	20,4—23,8	25,2±29,6		
M ±m	18,8±0,9	22,6±1,2	22,2±0,6	27,6±1,0	<0,05	<0,05
Latent period (in msec)						
Limits of variants	880—773	815—737	796—674	731—581		
M ±m	820±19	770±14	733±21	675±27	<0,05	<0,05

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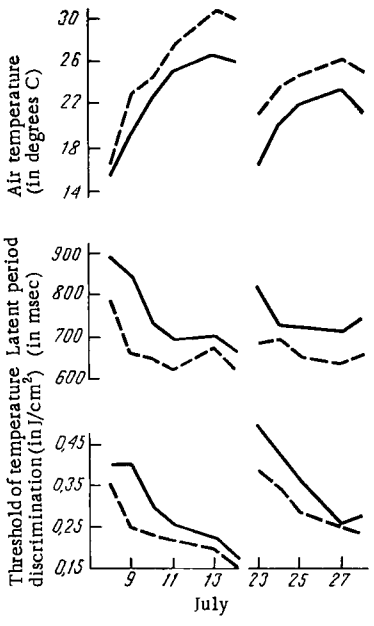

Fig. 1. Changes in air temperature, latent period of response to temperature stimulation, and threshold of discrimination in children of school age during summer vacation in the country near Moscow (mean results for 14 children). Continuous line represents measurements at 9 A.M., broken line measurements at 1 P.M.

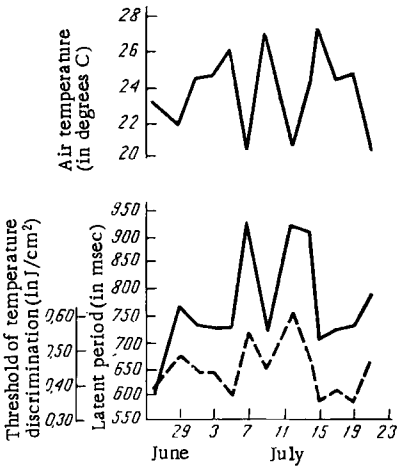

Fig. 2. Changes in air temperature, latent period of response to temperature stimulation (continuous line), and threshold of temperature discrimination (broken line) for children of school age during summer vacation on the Black Sea coast of the Caucasus (mean results for seven children). Measurements made at 9 A.M.

felt the heat and pressed the button). Tests were carried out on children of preschool (6 years) and school (10-13 years) age, during their summer vacation in the country near Moscow and on the Black Sea coast of the Caucasus. Observations on the Black Sea coast continued for a month at the same time of day, the children of the two age groups being tested on different days. In the country near Moscow, observations were made for 6-7 days at the beginning and at the end of the children's stay in tneir Pioneer Camp. The meteorological conditions were recorded at the same time. The physiological and meteorological measurements were made by different individuals.

EXPERIMENTAL RESULTS

In the country near Moscow the air temperature during the period of investigation varied. In the less warm period (July 10-15) the latent period of the response to temperature stimulation was longer than in the warmer period (July 24-29), when the air temperature reached 25.2-29.6°C (Table 1).

Results obtained during tests on 14 children on vacation in the Pioneer Camp the following year are shown in Fig. 1. In this case, at the beginning of each period of testing the children the air temperature was lower than at its end. The latent period of the response to temperature stimulation and the threshold of temperature discrimination varied during each period from higher to lower values.

Changes in the studied indices also were observed during the day. In the morning (9 A.M.) a lower air temperature corresponded to higher values of the latent period and threshold of temperature discrimination compared with those recorded during the afternoon (1 P.M.).

Systematic observations on the air temperature, on the one hand, and the latent period and threshold of temperature discrimination, on the other hand, for a period of one month revealed the dynamic character of the relationship between these indices in the children of school age (Fig. 2) and of preschool age (Fig. 3) on vacation on the Black Sea coast of the Caucasus. These illustrations show that fluctuations of air temperature between days of testing were greater for the children of school age than for those of the preschool group. Correspondingly, the fluctuations in latent period and threshold of temperature discrimination were greater for the children of school age than for the preschool group.

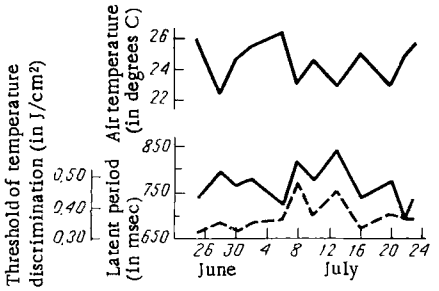

Fig. 3. Changes in air temperature, latent period of response to temperature stimulation (continuous line), and threshold of temperature discrimination (broken line) in children of preschool age during their summer vacation on the Black Sea coast of the Caucasus (mean results for 12 children). Measurements made at 9 A.M.

The results of this investigation thus showed that the latent period of the response to temperature stimulation and the threshold of temperature discrimination are highly labile and that they vary with changes in the external environmental temperature. An inverse relationship exists between the air temperature and the indices studied.

Changes in the activity of the system for temperature sensation in response to adequate stimulation are reflected in changes in the frequency of impulses generated by the thermoreceptors, the level of which is fixed at a given temperature, and there are corresponding changes in the flow of impulses to central structures under these same conditions [6, 10]. As a result, the functional state of the system for temperature sensation as a whole is modified, as reflected in changes in the threshold of temperature sensation and changes in the latent period of the response to temperature stimulation. This explanation is also confirmed by the fact that the changes in latent period of the sensomotor response in man are closely connected with, and in the same direction as, changes in electrical activity of that area of the cortex to which the information is addressed [2, 9].

The changes in the latent period of the response to temperature stimulation and in the threshold of temperature discrimination under natural conditions discovered by these experiments indicate a constant fluctuation in the level of function of the system for temperature sensation in accordance with external temperature conditions. They also indicate a constant interaction between the organism and the external environment, aimed at maintaining equilibrium.

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