Comparison of the mechanisms of sensory coding in afferent discharges from catfish electroreceptor organs and rat cold receptors.

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We examined the problem of revealing the differences in the mechanisms of sensory information coding in thermosensitive units of the catfish electroreceptor organs and the rat cold receptors. Spontaneous activity was recorded extracellularly from single afferent fibres supplying the sensory units at various temperatures. The temporal pattern of the afferent activity was analyzed off-line with a program developed to quantify the oscillatory processes that reflect changes in sequence of interspike interval values. The method was reduced to obtaining two – dimensional scatter plot of pairs of consecutive local minimum and maximum for the considered sequence of interspike intervals.

We found the qualitative differences in the relationships between consecutive minimums and maximums of interspike interval values in spontaneous activity Several clusters were revealed on the considered scatter plot for the rat cold receptors. During warming the number of the clusters increased from two to three. Interestingly that the mean value of maximums of two clusters remained in the temperature range of 22°C - 27°C, and the mean value of minimums of the clusters differed in several times. Further, on warming up to 31°C there was an emergence of the third cluster for which the mean value of minimum coincided with the corresponding value of the second cluster, and the mean value of maximum was twice larger.

On warming from 10°C to 12°C only one cluster was observed on the plot of interspike intervals in the catfish electroreceptor organs. During further enhancement of temperature up to 13.5°C, the bimodal distribution developed by separation of this cluster, and a considerable reduction of the area occupied by it. It is worth noting that the cluster orientation changed on the plot with varying temperature. The mean values of minimums of two clusters corresponding to temperature of 13.5°C coincided very closely, and the mean values of their maximums distinguished about five times.

The results obtained provided evidence that the mechanisms of information coding have both common and distinctive features in various animals. The common feature is a variation in a number of clusters with temperature change. The enhancement of the cluster number testifies the emergence of one more type of oscillations and, hence, the change in the structure of temporal patterns of afferent activity.