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МАТЕРИАЛЫ КОНФЕРЕНЦИИ И ШКОЛЫ

INTEGRAL SPATIO-TEMPORAL EEG PARAMETERS AS MARKERS OF HUMAN FUNCTIONAL ADAPTATION TO VARIOUS LOADS

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The developing of objective electrophysiological markers to estimate the functional state of a person under various loads, such as, hypoxia, psychological (cognitive) stress, etc., has an important applied meaning. The markers sought should: (a) represent the generalized characteristics of the multi-channel EEG and characterize the integral response of the brain as a unified system to the effects of loads; (b) be the proportionate measures, i.e. to ensure a minimum of inter-individual variability of the their values; (c) to be expressed in the form of dimensionless (relative) units taking the values in the given range; (d) to allow a meaningful physiological interpretation. As markers we propose to use the normalized integral parameters of brain bioelectrical activity pT and pS ($0 \le pT, pS \le 1$), evaluated based on the calculation of the structure function of multichannel EEG. The parameter pT characterizes the internal connectivity of EEG processes over time and serves as a measure of the functional lability of nervous processes. The higher its value, the higher the functional lability of nervous processes, and vice versa. The parameter pS characterizes the internal connectivity of the EEG processes over space and is determined by the determinant of the sample correlation matrix of the EEG. The lower its value, the higher the level of spatial connectivity between all channels, and vice versa. The limit pairs of parameters (0.0) and (1.1) correspond to two situations not achievable in practice. The first one relates to the EEG processes that are constant in time, and the second one relates to the uncorrelated EEG processes (white noise). The paper gives examples of the construction of an integral EEG representation in the space of variables pT and pS under the hypoxia, the execution of the inverse account (consecutive subtraction of a given two-digit number from a given four-digit number), and the verbal test, as well as under mental exercises. The displacement trajectory of this representation relative to eyes-closed resting state is shown to reflect the individual adaptive capacity of the people to a specific load, and the parameters pT and pS are its markers.

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