A MATHEMATICAL APPROACH TO THE ANALYSIS OF DATA ON A COMBINED INFLUENCE OF ECOLOGICAL FACTORS ON THE ORGANISM (*Igor Zavgorodnii, Olena Litovchenko, Irina Perova, Valeriy Kapustnyk, Irina Böckelmann*)

It is highly relevant nowadays to improve the methods for determining the nature of the combined impact of environmental factors in order to develop measures to prevent their negative impact on the body.

The aim. Establishment of the changes of an animal organism under the simultaneous exposure to electromagnetic radiation (EMR) and moderately low temperature (MLT) and to determine the contribution of each factor to the overall biological effect using mathematical analysis.

The laboratory experiment was being conducted for 30 days on male rats. The animals were divided into 4 groups: the group of combined exposure to electromagnetic radiation (70 kHz, 600 V/m) and MLT (from 2°C to 6°C); the group of isolated exposure to MLT, the group of isolated exposure to EMR and the control group. Changes in the body were assessed according to biochemical and immunological blood parameters (36 indicators), functional status of spermatozoa (9 indicators) and morphometric indicators of internal organs (18 indicators). Mathematical processing of gathered data was carried out via methods of computational intelligence (Neuro-fuzzy system).

Within the study, at the first stage, the degree of membership of the group of combined exposure as well as the groups of isolated effect was calculated, making it possible to calculate the contribution of each factor to the overall biological effect. Analysis of the data showed that the greatest negative impact was exerted by EMR, degree of membership $\mu = 0.54$; degree of MLT membership $\mu = 0.46$.

At the second stage, criteria-significant indicators were determined: the concentration of malondialdehyde (MDA), low-density lipoproteins, the activity of superoxide dismutase and catalase, the NBT-test, the width of the fasciculate zone and glomerular zone of the adrenal glands, the number of motile and non-motile spermatozoa and the total concentration of spermatozoa. At the third stage, strong negative correlations were established between the parameters of the NBT-test–the total concentration of spermatozoa ($r = -0.91$) and direct correlations of MDA–catalase ($r = 0.70$) $p < 0.05$.

Therefore, the mathematical approach allowed analyzing the data obtained within the animal experiment and determining the key role of each studied factor in conditions of their combined impact on various systems and organs. Such an analysis made it possible to predict the likely response of the whole organism and to reasonably develop appropriate preventive measures.

Herr Igor Zavgorodnii