

# MODELLING OF BIOLOGICAL ACTIVITY OF TNF $\alpha$ AND ITS SOLUBLE RECEPTORS IN RHEUMATOID ARTHRITIS

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**MODELLING OF BIOLOGICAL ACTIVITY OF TNF $\alpha$  AND ITS SOLUBLE RECEPTORS IN RHEUMATOID ARTHRITIS (MODELOWANIE AKTYWNOŚCI BIOLOGICZEJ TNF  $\alpha$  I JEGO ROZPUSZCZALNYCH RECEPTORÓW W REUMATOIDALNYM ZAPALENIU STAWÓW)**

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The presented study proposed to apply of non-linear dynamics and computer simulation to modify an approach to the biological role of TNF $\alpha$  and its soluble receptors. The aims of the study were as follows: 1/ to assess dynamics of time dependent variations of TNF $\alpha$  and its soluble receptors concentration in plasma in rheumatoid arthritis (III0), 2/to search for rules regulating the fluctuation (usually non-linear and dynamic) of these parameters, 3/ to determine the

velocity of these processes applying characteristic coefficient defining time-dependent changes of TNF system, 4/ to describe the correlation between TNF  $\alpha$  and sTNF-Rs concentration using non-linear differential equation, 5/ to work out a mathematical model of fluctuation in time of the cytokine and soluble receptors in analysed diseases. Mathematical modelling was based on clinical measurements of concentration of both TNF and soluble receptors in 45 patients with rheumatoid arthritis (III0 ).

Dynamic mathematical models were presented in the order of three non-linear differential equations, which regards rapid time-dependent changes in the number of TNF secreting cells, serum levels of TNF and sTNF-Rs fluctuations. Obtained data led to the following conclusions: 1/ Elevated values of TNF serum concentration of its soluble receptors in rheumatoid diseases, 2/ Application of the order of three differential equations in order to perform prognostic analysis of variations of cytokine serum concentration and its soluble receptors in a course of rheumatoid arthritis lead to creation of mathematical model which illustrates dynamic and non-linear fluctuation in time base , 3/ The analysis of obtained solutions makes possible to conduct a theoretical and clinical verification of these data, and moreover can be a vital factor in medical prognosis of survival time.