

# Reliability of Technosystems and Biosystems: From Analogy to Real Knowledge

Vitaly K. Koltover

*Bio-Reliability Group  
Institute of Problems of Chemical Physics, Russian Academy of Sciences,  
Chernogolovka, Moscow Region, 142432, Russia,  
koltover@icp.ac.ru*

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The field of system biology, in dealing with the problem of reliability (“robustness”), was initiated by regular conferences in the former Soviet Union starting from the first one in Kiev, Ukraine, in 1975 (Grodzinsky, Voytenko, Kutlakhmedov & Koltover, 1987). All biomolecular constructions are designed to perform preset functions. All of them operate with limited reliability, namely, for each and every device or bionanoreactor normal operation alternates with accidental malfunctions (failures). Of the primary importance are the random malfunctions of mitochondrial respiratory enzymes since they produce chemically reactive free radicals of oxygen. Timely preventive maintenance (prophylaxis) of functional elements, the so-called turnover, is the main line of assuring high systems reliability in biology. There is a finite number of critical, longevity assuring genetic structures of the highest hierarchic level which perform supervisory functions over preventive maintenance. However, reliability of the supervisors is limited too. On this reliability basis, the universal laws of aging, such as the Gompertzian increase of mortality and the correlation of longevity with the species-specific resting metabolism, are naturally explained. Moreover, the mortality rate functions, generated from this theory, supply good quantitative fits to the experimental data, contrary to other models, which provide only qualitative descriptions.