

GENE EXPRESSION DURING SKIN WOUND HEALING IN AGING

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Skin wound healing (WH) was studied in mice of different ages. The middle age is often ignored in biogerontological research despite the fact that many functions that decline in an age-dependent manner have starting points in mid-life. With this in mind, we examined gene expression patterns during skin WH in late middle-aged versus young adult male mice, using the head and back punch models. The rationale behind this study was that the impact of age would first be detectable at the transcriptional level. We pinpointed several pathways which were over-activated in the middle-aged mice, both in the intact skin and during WH. Among them were various metabolic, immune-inflammatory and growth-promoting pathways. These transcriptional changes were much more pronounced in the head than in the back. In summary, the middle age has a significant impact on gene expression in intact and healing skin. It seems that the head punch model is more sensitive to the effect of age than the back model, and we suggest that it should be more widely applied in aging research on wound healing.

FREE-RADICAL THEORY OF AGING: FROM BIOCHEMICAL PHYSICS TO THEORY OF RELIABILITY OF BIOLOGICAL SYSTEMS

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Each and all biological systems are devices constructed to perform the preset functions according to the information planes, i. e. the genetic programs. Similarly to technical devices, biological constructions are not perfectly reliable in operation: malfunctions happen alternating with the normal operation functions. In engineering, reliability is defined as the ability of a device to perform its function for a given time under given specific conditions. The same intuitive definition of reliability fits biological systems. The field of biology systems in dealing with the problem of reliability, incorporates theoretical and experimental investigations of quantitative characteristics and mechanisms of failures and renewal processes. Regular conferences on the problems of reliability of biological systems, starting from 1975 in Kiev, former USSR, have given the strong impetus to research in this direction.

In this mini-review, I present the results of application of the systems reliability theory to the problem of aging. On this basis, the universal features of aging such as the exponential growth of mortality rate with time and the correlation of longevity with the species-specific resting metabolism are naturally explained. The stochastic malfunctions of the mitochondrial electron transport nanoreactors, which produce superoxide radicals, seem to be of first importance. The longevity of human brain could reach 250 years should the antioxidant enzyme defense against the free-radical failures be perfect. Thus, aging is a stochastic consequence of the limited programmed, i. e. preset reliability of the biomolecular constructions. Furthermore, the systems of reliability approach serve as heuristic methodology for development of new preventive medicine, including novel anti-stress protectors based on the stable magnetic isotopes. [Supported by Russian Foundation for Basic Research, project # 14-04-00593].

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