

## **Hormesis: umbrella mechanism only for agents present in the environment**

Hormesis is a concept of biphasic dose-response to toxicological and pharmacological stimuli. According to this concept, a harmful factor at a small dose can exert a beneficial action. Among the known hormetic agents are numerous chemical substances and elements that are present in the natural environment, vitamins, heat, light, ultraviolet and probably some other irradiation, exercise, food restriction and different kinds of stress. Hormesis as a general principle is understandable only for the factors that are present in the environment, thus having induced adaptation of living organisms, so that a deviation in either direction from the optimum may be harmful. There are no general reasons to expect hormetic dose-response patterns for factors absent in the natural environment, although they are not excluded. Nevertheless, hormesis has been generalized by certain scientists and used as a theoretic support for homeopathy.

Homeopathy claims curative effects from small doses of substances, of which high doses cause symptoms similar to those from which the patient is suffering. Homeopathy originated in the vacuum of medical knowledge of the 19<sup>th</sup> century, prior to the acceptance of the germ and gene bases of disease; it has never been grounded on scientific evidence. Some publications generalizing hormesis can be cited in support of homeopathy and placebo treatments in gerontology and other fields of medicine. Suggestions that homeopathy is based on hormesis create an illusion that it employs a scientific method. If homeopaths have useful empirical knowledge, it should be discussed in the professional literature and tested by the methods of evidence-based medicine. Moreover, noxious agents can have cumulative effects or act synergistically (mutually amplifying) with other known or unknown harmful factors, for example, upon the cells with a limited or no potential for cellular regeneration (mitosis) such as cardiac muscle cells or neurons. It can be of particular importance for diseases when such cells or organs (heart, brain or other) are pre-damaged by ischemia or intoxication so that even a mild additional impact may act according to the no-threshold pattern without hormesis. In conditions when a cell, tissue, or organ is close to a failure, even minimal additional damage can be detrimental. Unfounded generalizations of hormesis can pave the way for homeopathy, placebos and substances without proven efficiency in the guise of evidence-based drugs or dietary supplements.

There are many examples of marketed compounds without scientifically demonstrated efficacy, in Russia often in the guise of evidence-based medications; while artificial theoretic concepts are created to promote them. Promotion of unproven health schemes can be harmful especially for elderly people. In conclusion, if an agent is present in the natural environment, existence of an optimal level of its impact, corresponding to the current environmental level or some average from the past, can be assumed. This principle does not exclude a possibility that some factors, if even present in the natural environment, can be noxious at a low dose level or exert a synergistic harmful action together with other stimuli. All clinically significant effects, hormetic or not, should be verified by the methods of evidence-based medicine.

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## **Publication**

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