

the process of hormesis is termed as a hormetin.^{4,5} Exercise is one of the best-known examples of a hormetin.

The aim of this chapter is to discuss the role of hormetins in the maintenance and enhancement of health, and in the prevention and treatment of age-related diseases. However, in order to appreciate the rationale behind the possible use of hormetins as drugs for healthy aging, it will be useful to review first the present understanding of the biological basis of aging and age-related diseases. This will then be followed by a discussion of the phenomenon of hormesis, molecular basis of hormesis and the strategies for the discovery and development of hormetins as drugs for healthy aging.

7.2 Aging in a Nutshell

Biogerontological research has developed a comprehensive scientific understanding about the evolutionary and mechanistic explanations for aging, longevity and age-related diseases. It is now generally accepted that progressive aging and senescence at the biological level occur primarily during the life time beyond the natural lifespan of a species, termed as the essential lifespan (ELS).^{6,7} This view has developed from the basic biological understanding that survival of an organism is a dynamic tug between the occurrence of damage and the processes of maintenance and repair systems (MARS). The main MARS that comprise the ELS-assurance processes are listed in Table 7.1. These are also known as the longevity assurance pathways and involve hundreds of longevity assurance genes (LAG).

“Homeodynamic space” is another way of conceptualizing MARS. Homeodynamic space may also be considered as the “survival ability” of a biological

Table 7.1 Main maintenance and repair pathways (MARS) in biological systems arranged from molecular to whole body level.

Level of MARS	Pathway
Molecular	Nuclear and mitochondrial DNA repair Anti-oxidative enzymes and free radical scavengers Degradation of damaged DNA and RNA Protein repair
Cellular	Degradation of damaged proteins Degradation of damaged organelles Programmed cell death—apoptosis Intra-cellular stress responses
Systemic	Detoxification of harmful chemicals and metabolites Immune responses
Whole-organism	Wound healing and tissue regeneration Thermal regulation Neuro-endocrine balance Daily rhythms Other higher order defenses, including psychological mechanisms