process and longevity;[28–30] all these genes represent attractive drug targets. Currently, many pharmacological agents targeting the putative mechanisms of aging are under development.

Taking into account the extraordinary complexity of the mechanistic pathways underlying the aging process, the recognition of these pathways and development of anti-aging interventions seems a challenging task. Significant progress has, however, been achieved in the last few years in this research field. A number of pharmacological agents with the potential to target particular aging-associated pathways and to produce protective responses against age-related pathologies are currently under investigation. In recent years, several classes of bioactive chemical agents and nutraceuticals have been shown to have potential therapeutic efficacy in anti-aging medicine.[3,31] In experimental studies, many substances have been identified as having life-extending properties. Among them are calorie restriction mimetics, such as resveratrol, rapamycin and metformin,[32,33] antioxidants (vitamins A, C and E, quercetin, melatonin, coenzyme Q10, *etc.*),[34] autophagy inductors, such as spermidine,[35,36] senolytics,[37] phytochemicals, *e.g.*, curcumin, genistein, catechins and epigallocatechin gallate (EGCG),[38] and several other natural and chemical compounds. In recent years, modern biotechnological approaches have been used for developing novel anti-aging pharmaceutical applications. For example, the coupling of curcumin-based nanoparticles with the Tet-1 peptide, which has affinity for neurons and possess retrograde transportation properties,[39] as well as mitochondria-targeted antioxidant SkQ1,[40] have been recently explored as promising therapeutic applications for the treatment of Alzheimer's disease. Over the last decade, consistent evidence has also been reported for the role of epigenetic factors, including DNA methylation, histone modifications and microRNA regulation, in the aging process as well as in the pathogenesis and progression of age-related diseases.[41,42] A lot of hope is being pinned, therefore, on pharmacological agents targeted to the epigenetic regulation of gene activity, such as inhibitors of DNA methyltransferases and histone deacetylases, including sodium butyrate, trichostatin A, sodium 4-phenylbutyrate and suberoylanilide hydroxamic acid.[43]

It should, however, be noted that all agents that can be classified as potent anti-aging therapeutic compounds are multi-functional and targeted at multiple signaling pathways mediating aging. Moreover, the evidence remains limited regarding the overall health benefits of these substances, including epidemiological studies exploring the consequences of their long-term intake for human health. Furthermore, there is evidence that uncontrolled intake of some anti-aging agents can be useless or even harmful. For example, the consumption of antioxidants is considered as quite reasonable by many researchers, especially in the cardiovascular research area.[44] The appropriateness of antioxidant intake, however, still remains a matter of debate. Meta-analysis of observational studies and randomized controlled trials conducted in well-nourished and healthy populations demonstrated that antioxidant supplementation may be associated with undesirable consequences for health and all-cause mortality.[45] Another example is the fact that supplementation with several promising pro-healthspan compounds can