



## Redox Regulation in Animals for Slowing Ageing

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### Editorial

Utilization of oxygen in varieties of biochemical reactions especially, in mitochondrial electron transport chain (ETC) to reduce  $O_2$  to  $H_2O$  in aerobic organisms, lead to produce several active oxygen molecules. So, mainly ETC acts as the main hub in producing partially reduced  $O_2$ , as several active oxygen species. These intermediate molecules are commonly known as reactive oxygen species (ROS; such as superoxide radical, hydroxyl radical and hydrogen peroxide). ROS being highly cytotoxic in nature produce deleterious effects on biomolecules. They can oxidize biomolecules non-specifically to produce lipid peroxides, protein carbonyls and nucleic acid adducts from lipids, proteins and nucleic acids, respectively [1]. When these important bio-molecules are damaged, cells are pushed to a stress condition called as oxidative stress. Cells have their own redox regulating system by using which they control the levels of the over produced ROS. Commonly, it is called as antioxidant defense system. Antioxidant defense system protects cells from the oxidation, done by the oxidants or ROS. Antioxidant defense system constitutes enzymatic and non-enzymatic molecules. Non-enzymatic antioxidant defense system is mainly constituted by small redox regulatory molecules (such as reduced glutathione (GSH), ascorbic acid (AA), carotenoids etc). Enzymatic antioxidant constitutes a cascade of enzymes namely superoxide dismutase (SOD, EC1.15.1.1), catalase (CAT, EC 1.11.1.6) and glutathione peroxidase (GPx, EC1.11.1.9) [2].

The increased rate of decreasing physiological competence by the cells make them susceptible to various diseases. This process is progressive as a function of time and usually describes the process of "ageing". Finally, it leads to (early) death, if the above process is not lowered down. Aging is a manifestation of multiple factors in cells such as chronic, progressive low-grade inflammation via ROS, ROS-mediated exacerbation of telomere dysfunction and, cell senescence, inflammation with high level of necrosis factor Kb and DNA damage. ROS mediated protein mis-folding and cellular senescence are closely linked and it is believed that oxidants especially, ROS induced oxidation of biological macromolecules due to failure of the required level or activity of redox regulatory molecules induces aging and its associated complications and diseases [3]. Senescence-associated loss of functional capacity is due to the accumulation of toxic ROS and its consequences as molecular oxidative damages have been well established. Failure in tissue repair and regeneration is an important cause for aging. Different research groups have highlighted that ageing has a strong positive correlation with OS in animals. Therefore, the role of antioxidants in redox regulation in cells came into picture and cells proved to have high longevity under high redox state. Caldwell and Hughes have wrote the first article on ageing in 1946, that ranks 16807th article in PubMed and probably the first article on this issue of ageing [4]. They worked on the contribution of Vitamin-A on ageing induced carotenoid pigmentation. Since, the current era of research is

dominated by nanotechnology; the latest research on ageing has also been led by various research groups to correlate effects of nano - formulations on ageing. Nano particle and antioxidant composites are believed to work against the aging induced skin wrinkles [5]. Research from 1946 to 2017 on the topic "antioxidants and ageing" indicates that many articles have been published and many biomarkers and therapeutic molecules with or without redox regulatory capacity have been identified or discovered. The intention was for the treatment of ageing related complications in elderly persons. Mainly, most of the works have been dedicated to slow down ageing and to deal with ageing related complications. Despite of continuous research from 1946 on ageing, still more seems to be done on this issue. This is because, continues publications of articles and emerging many specific journals on this issue, signifying ageing and its complications are not adequately addressed [6].

Redox regulating molecules are capable to diminish the possibility of senescence by maintaining the magnitude of oxidants under control by means of removal. Therefore, to many, "antioxidants" and "anti-ageing" go hand-in-hand. Particularly, antioxidants can be given as dietary supplements, or may be supplied as composites in cosmetics for lowering the rate of integumentary ageing, can also be used as antidote against cell-damaging ROS. Such therapies finally may provide long-lasting youth via the above molecules. Although, literature reveals an intricate relation between the process of aging and the role redox regulatory molecules on it, lowering the rate of ageing is essential than high longevity, as long life span with early ageing is associated with many old age related complications. So, what next in this context, if in an expected life span as per geographic location, genetic makeup, food habit etc. maintaining youth for long term is more important? Is lowering high oxidants by antioxidant supplementation or slowing their production rate are two preferred options? If both seems to be equally important, which one is more preferable or both can be adopted at a time? "You do not need to have lowered free radical production to live long" as per, Siegfried Hakim, a molecular geneticist at McGill University. The advocacy is non-free radicals oxidants namely  $H_2O_2$  has also much credit in controlling several signal transduction events. For this reason, lowering oxidant level in cells may not be always useful. Therefore, adopting a healthy life style including healthy food habit is needed to control redundant ROS from body. Preventing surplus ROS production may be avoided rather than its control by antioxidant supplementation. A healthy life style may restrict many unwanted issues related to ageing and other complications such as cardiovascular problems, brain malfunction and nerve related complications [7,8]. Side by side, it also restricts unnecessary production and accumulation of ROS in the body. Our future, having more chance of premature aged population in the earth, both animal and plant sources of antioxidants especially non-enzymatic small antioxidant molecules and vitamins are more

preferred. Therefore, modern research may be focused on natural food sources that are rich in small antioxidants.

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