



Significant Role of Free Radicals in Inflammation

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Description

Free radicals are products of normal cellular metabolism. An atom or molecule that has one or more unpaired electrons in its valence shell or outermost orbit is considered a free radical. Free radicals are unstable, short-lived and highly reactive due to their odd number of electrons. Due to their high reactivity, they can remove electrons from other compounds. Thus, the attacked molecule loses its electron and becomes a free radical itself. Finally, a chain reaction begins that damage the living cell.

The role of free radicals can be found in inflammation, which is a complex process that leads to many human diseases. Inflammation is mainly divided into acute and chronic inflammation depending on different inflammatory processes and cellular mechanisms. In recent years, much attention has been paid to the chemistry of free radicals. Free radicals, such as Reactive Oxygen Species (ROS) and Reactive Nitrogen Species (RNS), are formed in our body by various endogenous systems, under the influence of various physical and chemical conditions or pathological conditions. Free radicals cause inflammation in humans through cellular damage. Chronic inflammation creates a lot of free radicals that eventually cause more inflammation. This continuous vicious cycle can damage many systems in the human body.

In 1956, Denham Harmon proposed the free radical theory of aging. In 1969, McCord and Fridovich discovered superoxide dismutase. On the other hand, some research groups have discovered the involvement of free radicals in the fight against infection as part of the cellular immune response, where ROS and Reactive Nitrogen Species (RNS) act together with reactive halogen species to fight invading microorganisms. Halliwell and Gutteridge reported in 1989 that ROS include both free-radical and non-radical oxygen derivatives.

Acute inflammation

Acute inflammation is a short procedure that lasts from minutes to several days. The main signs of acute inflammation are the leakage of plasma proteins or fluid and the movement of leukocytes into the extravascular area. These cellular and vascular responses are mediated by cell or plasma-derived chemical factors and are responsible for the classic clinical symptoms of inflammation, such as swelling, redness, pain, heat, and loss of function. Although an inflammatory response can occur to any noxious stimulus, the characteristic of this process is the response of vascularized connective tissue.

Chronic inflammation

Inflammation is a vital response of the human immune system. Chronic inflammation can have several secondary biological response effects associated with increased risk of chronic diseases and disorders. Chronic tissue inflammation usually occurs due to infections that are not resolved either by endogenous defense mechanisms or by some other resistance mechanism of the host's defense mechanisms. They can also occur with physical or chemical substances that cannot be broken down, as well as with some genetic susceptibility. Persistence of foreign bodies, continuous exposure to chemicals, recurrent acute inflammation, or specific pathogens is all crucial causes of chronic inflammation. The molecular and cellular process of chronic inflammation depends on the type of inflamed cells and organ.

Free radicals

Reactive Oxygen Species (ROS): In a living system, the most important radicals are those derived from oxygen, and these are called reactive oxygen species. ROS are formed as products of normal physiological conditions due to the partial reduction of molecular oxygen. ROS can be generated from several endogenous sources, such as xanthine oxidase, cytochrome oxidase, cyclooxygenase, me-

diated oxidation of unsaturated fatty acids, catecholamine oxidation, mitochondrial oxidation, inflammation, phagocytosis, ischemia reperfusion injury, leukocyte activation of nicotinamide adenine dinucleotide phosphate oxidase, iron release, and the redox reaction.

Hydrogen peroxide (H_2O_2): Hydrogen peroxide is the main oxidizing product of xanthine oxidase. Hydrogen peroxide is

also directly produced by a number of oxidase enzymes, including glycolate and monoamine oxidases.

Superoxide: In the biological system, superoxide ion is the most significant widespread ROS. It is formed as a result of various enzymatic (auto oxidation reaction) and non-enzymatic processes (an electron is transferred to molecular oxygen).