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COMMENTARY

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Source and Roles of Reactive Nitrogen Species

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Description

The active nitrogen species are a family of antimicrobial molecules found in nitric oxide and superoxide produced by the enzymatic activity of inducible nitric oxide synthase 2 and NADPH oxidase respectively [1]. Functional nitrogen species work together with active oxygen species to damage cells, causing nitrosative stress. Functional nitrogen species are also continuously produced in plants as products of aerobic metabolism or stress response [2].

Peroxynitrite can react directly with proteins containing metal conversion centres. Therefore, it can convert proteins such as haemoglobin, myoglobin, and cytochrome c by incorporating ferrous heme into its corresponding ferric species. Peroxynitrite may also be able to alter protein formation by reacting with various amino acids in the peptide series. The most common reaction with amino acids is cysteine oxidation. Another reaction is tyrosine nitration; however peroxynitrite does not react directly with tyrosine. Tyrosine combines with another RNS produced by peroxynitrite. All of these reactions affect the formation and function of proteins and thus have the potential to cause changes in the catalytic activity of enzymes, the modified cytoskeletal organization, and the transmission of impaired cell signals [3].

Sources of reactive nitrogen species

In the human body, many sources produce RNS, such as meningeal cells, smooth muscle cells, platelets, and hepatocytes. However, RNS is particularly prominent in the various parts of the male reproductive system and these sources can be differentiated by structure and various cell types such as seminal ejaculate, prostate gland, epididymis, penis, testicles, and fallopian tubes.

Roles of reactive nitrogen species

Function of reactive nitrogen species in signal transduction: At the physiologic level, RNS is essential for various functions within the male reproductive system. Although the literature fails to elaborate on the specific levels of RNS that cause pathogenesis, studies have shown that concentration below one small molar plays an important role in regulating various signaling pathways [4]. Additionally, low concentrations of nitric oxide, less than one micromolar, can cause mitogen-signaling protein signaling pathways. These methods transmit information to manufacturers, amplify signals, direct incoming information from other display methods, and allow for a variety of response patterns [5].

Role of reactive nitrogen species in the blood-testis-barrier: Although NO is clearly important in intracellular signaling pathways; it is also involved in the regulation and assembly of tight junctions within the blood-testis barrier. This barrier creates an environment in which the bacterial cells grow with a change in the chemical composition of the liquid. The blood-testis barrier also prevents the passage of toxins into the seminiferous tubules [6]. Specifically, NO regulates the timely opening and closing of this barrier, which has been found to be important in the process of spermatogenesis, cell maturation, and development. In contrast, studies show that NOS inhibitors facilitate the integration and strengthening of the Sertoli cell-tight junction barrier, preventing the passage of spermatocytes and their full maturation from spermatogonia to haploid spermatozoa in this barrier. Therefore, by understanding the importance of nitric oxide in binding strong fusion forces, appropriate male contraceptive methods can be directed to prevent sperm maturation throughout the blood-testis barrier, thus preventing the formation of active sperm in pregnancy [7].

Function of reactive nitrogen species in the immune system and male reproductive organs: Other physiologic roles of RNS include mediation of cytotoxic and pathological events, hormone production, and facilitation of inflam-

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mation by inhibiting platelet aggregation and adhesion of neutrophils to endothelial cells. RNS also contributes to the normal tone of the arteries, which is very important during the formation of NO / guanyl cyclase / cyclic GMP signature.

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