

THE ROLE OF NITRIC OXIDE IN THE IMMUNE SYSTEM

SEMINAR PRESENTATION

BY

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TO THE**

ABSA FINAL YEAR FORUM

DECEMBER, 2015

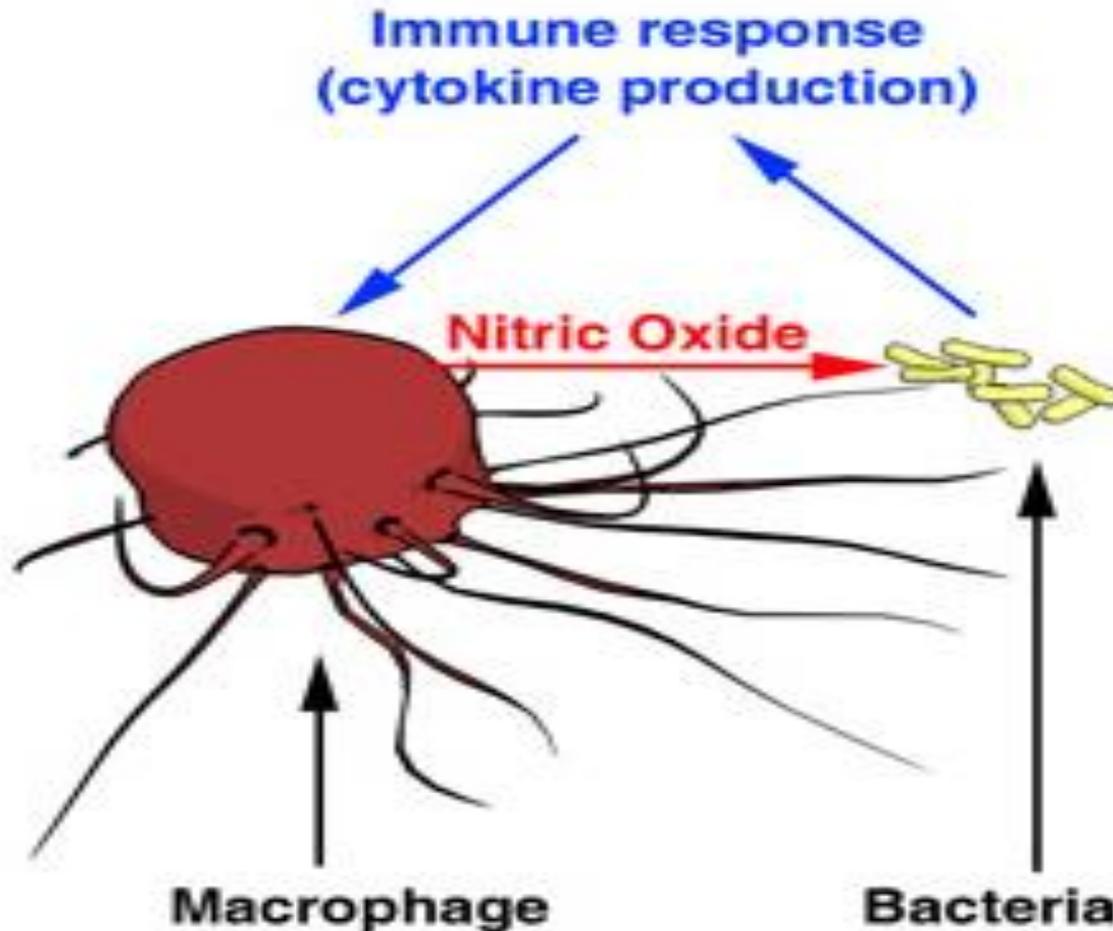
Nitric oxide

Nitric oxide is a colorless gas with the formula NO. It is one of the principal oxides of nitrogen. Nitric oxide is a free radical, i.e., it has an unpaired electron, which is sometimes denoted by a dot in its chemical formula, i.e., $\text{NO}\cdot$. Nitric oxide is also a heteronuclear diatomic molecule, a historic class that drew researches which spawned early modern theories of chemical bonding.

MECHANISM OF ACTION

Nitric oxide is a compound produced by many cells of the body. Inhaled nitric oxide appears to increase the partial pressure of arterial oxygen (P_aO_2) by dilating pulmonary vessels in better-ventilated areas of the lung, moving pulmonary blood flow away from lung segments with low ventilation/perfusion (V/Q) ratios toward segments with normal or better ratios.

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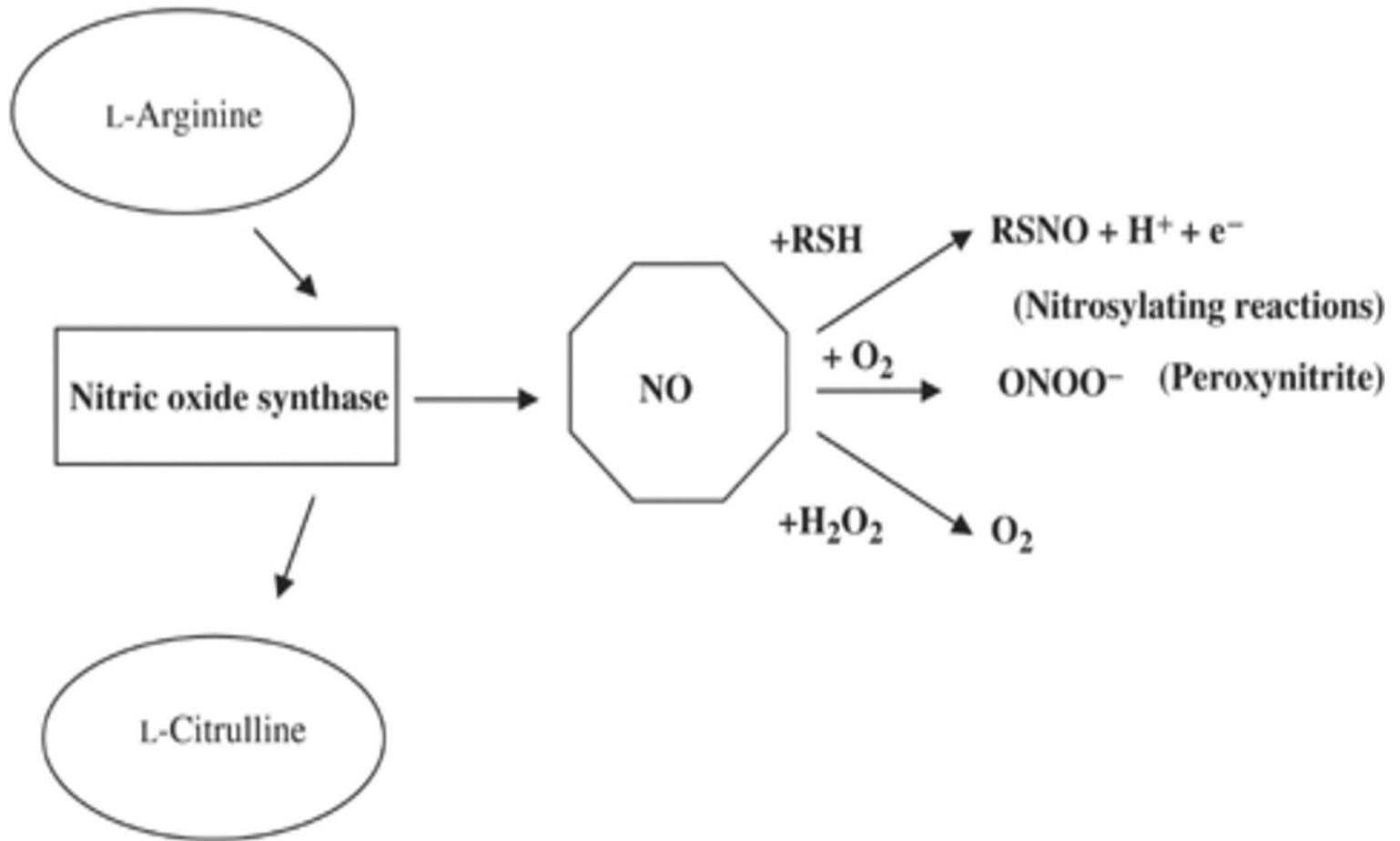
THE ROLE OF NITRIC OXIDE IN THE IMMUNE SYSTEM CONT'D

Nitric oxide is produced in high amounts from specialised cells of the immune system called Macrophages. Following a bacterial infection, for example, the body produces chemicals known as cytokines which activate the cells of the immune system, including macrophages, and help guide them to the site of infection.

GENERATION AND REGULATION OF NITRIC OXIDE IN IMMUNE SYSTEM

Production of nitric oxide by macrophages and endothelial cells is quantitatively and qualitatively different. NO production from endothelial cells starts on demand at a low level and is released for short periods in response to receptor activation or mechanical stimulation. In contrast, macrophages are capable of sustained release of high levels of NO initiated by inflammatory cytokines and bacterial products.

SYNTHESIS OF NITRIC OXIDE



SYNTHESIS OF NITRIC OXIDE CONT'D

Nitric Oxide is synthesized universally from L-arginine and molecular oxygen by an enzymatic process that utilizes electrons donated by NADPH. The NO synthase (NOS) enzymes convert L-arginine to NO and L-citrulline via the intermediate *N*-hydroxy-L-arginine. One molecule of L-arginine produces one molecule of NO, the nitrogen atom of the latter deriving from a terminal guanidino group of the arginine side chain.

EFFECTS OF NITRIC OXIDE IN THE IMMUNE SYSTEM

One of the most prominent functions of NO in the immune system is its participation in protective immunity against various intracellular pathogens including viruses, bacteria and protozoa. Furthermore, the killing activity of NO has also been showed effective in host defense against tumor cells and alloantigens. Considering its direct microbial toxicity, NO can exert a microbiostatic or microbicidal effect, or even act as a microbial metabolic product.

EFFECTS OF NITRIC OXIDE IN THE IMMUNE SYSTEM CONT'D

Peroxynitrite can induce nitration of tyrosine residues as well as the reversible binding of NO to metal centers in microbial targets that are involved in vital processes, including nutrition and respiration. In various infections, cysteine-containing proteins, metalloproteins, calcium transport systems, as well as essential enzymes of energy metabolism have been identified as important intracellular targets for the toxic actions of peroxynitrite.

EFFECTS OF NITRIC OXIDE IN THE IMMUNE SYSTEM

CONT'D

In addition to the direct toxicity, other effects of NO over leukocyte biology were described, which can influence several physiological processes ranging from DNA transcription and replication to protein synthesis and secretion. The signaling processes through which NO acts to regulate immune cells are extremely complex and are only just beginning to be revealed, but are largely indirect through generation of reactive nitrogen oxide species that chemically modify enzymes, signaling proteins and transcription factors.

SUMMARY

Nitric oxide (NO) is a molecule that was biologically active and one of the most versatile components of the immune system. It is a readily diffusible gas that mediates cell. Cell communication and this has been branded as a universal messenger. Inhaled nitric oxide appears to increase the partial pressure of arterial oxygen (P_aO_2) by dilating pulmonary vessels in better-ventilated areas of the lung, moving pulmonary blood flow away from lung segments with low ventilation/perfusion (V/Q) ratios toward segments with normal or better ratios. Nitric oxide plays many important roles in the immune system.

SUMMARY

It is produced in high amounts from specialized cells of the immune system called macrophages. The high amounts of nitric oxide produced by the macrophages is actually toxic to the bacteria and plays an important role in their destruction, also help protect against other types of infection including viruses and parasites. Nitric Oxide is synthesized universally from L-arginine and molecular oxygen by an enzymatic process that utilizes electrons donated by NADPH (Nicotinamide Adenine Dinucleotide Phosphate, is an essential electron donor in all organisms). One of the most prominent functions of nitric oxide in the immune system is its participation in protective immunity against various intracellular pathogens including viruses, bacteria and protozoa.

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**THANKS
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