

This slide explains diagrammatically the importance of the redox (Reduction/Oxidation potential) environment in a cell. In order to understand the importents of this slide we to ask a few questions:

What are ROS? Reactive oxygen species (ROS) can include oxygen radicals, OH radicals and H_2O_2 . They can be generated a number of ways in the cell.

How are ROS generated? ROS are the natural product of cellular respiration in the mitochondria and are used as part of the immune system to combat viral and bacterial invasion. There are also undesired ROS generated in the cell. Cellular components particularly Fe can generate ROS. Ionizing radiation also produces ROS which cause most of the cellular damage.

What tools do cells use to combat ROS? Cells use antioxidants and proteins to react and neutralize ROS. These components include antioxidants like thiols, ascorbic acid, glutathione. They also use proteins like superoxide dismutase, catalase and oxidase and nitric oxide synthetase.

What does the slide show? Draw your attention to the slide again particularly the bottom two diagrams. The left diagram illustrates that under normal (basal) conditions the generation of ROS is balanced with the cell's ability to neutralize the ROS. The right diagram illustrates oxidative stress. This oxidative stress occur via two mechanisms, 1) either the ROS is increased beyond the cell's ability to combat it or 2) the cells ability to combat ROS is lowered both resulting in an increase in ROS which can cause damage to cellular components including RNA, DNA and proteins.

Finally, what does this have to do with space radiation?

Astronauts are exposed to a number of stresses. Its well established that astronauts in space live in a constant state of oxidative stress. Therefore it is important to keep this already unbalanced state in mind when considering the effects of space radiation on the health of astronauts during long duration missions.

Significance of the Redox Environment

- Role of mitochondria
- Activation of oxidases
- Induction of nitric oxide synthases
- $\uparrow\downarrow$ Antioxidants

