

Oxidative stress: can we and should we measure it in science and practise?

Malcolm J Jackson

MRC-Versus Arthritis Centre for Integrated Research into Musculoskeletal Ageing (CIMA),
Department of Musculoskeletal and Ageing Science, Institute of Life Course and Medical Sciences,
University of Liverpool. L7 8TX.

The role of reactive oxygen species in causing oxidative modifications in proteins, DNA/RNA and lipids has been recognised for many years. Initially oxidative modifications were seen as damaging to the molecules and the term “oxidative stress” was coined to reflect situations where the balance between the production of reactive oxygen species and defences against oxidation (antioxidants) was modified in favour of increased oxidation of biomolecules. A major change in understanding has occurred following from the recognition that some reactive oxygen species play potentially beneficial roles in normal physiology, primarily acting to signal changes in gene expression. This has been called “redox regulation” and has prompted a refinement of oxidative stress to reflect oxidative “eustress” (for a positive oxidative event) versus oxidative “distress” (which can be toxic).

The distinction between oxidative eustress and distress reflects in part the degree or extent of the oxidation which occurs although this is not the only discriminator. Understanding of oxidative eustress (or redox signalling) is in its infancy and research in this area has required use of highly specific techniques to monitor individual reactive oxygen species (e.g. hydrogen peroxide) rather than consider reactive oxygen species as a group of molecules. It also requires investigation of the specific reactions which individual species they can undertake with proteins in signalling pathways and the potential compartmentalisation of these effects. The nature of these new techniques and approaches will be discussed in the context of skeletal muscle adaptations to exercise.

Supported by UKRI MRC and BBSRC.