**REDOX Biology and Oxidative Stress (OS)**

OS is defined as an increased ratio between reactive oxygen species (ROS) and antioxidants (AO). ROS regulates numerous molecular pathways essential for homeostasis within cells and biological systems. A balance between these REDOX regulating molecules is therefore critically important (Fig. 1). Ageing and age-related reproductive decline in males is closely associated with a shift from a balanced redox state to a state of OS (Table 1).

**ROS and Male Reproductive Physiology**

ROS are important regulators essential in sexual and reproductive function: epididymal transport, spermatozoa maturation functions including motility, capacitation and the acrosome reaction. Excessive OS, however, is detrimental to male fertility: DNA damage, cell membrane damage, mitochondrial dysfunction and apoptosis associated infertility and poor health outcomes (Fig. 2).

**The Free Radical [OS] Theory of Ageing**

OS is an important mechanism in ageing and related co-morbidities: obesity, CVD, T2DM, malignancy and neurodegeneration. Aging also reduces male reproductive potential. Numerous associated metabolic, immune, endocrine and cellular OS parameters unfavorably (Table 1). OS remains the leading theory associated with age related morbidity and mortality.

**Ageing, Male Reproductive and Impact on Offspring**

Aging associated with increased OS is also associated with male reproductive dysfunction and reduced fertility potential. This is mediated by semen quality decline, endocrine changes and sexual dysfunction (Table 1).

The progression of age related decline is mediated by OS, including poor semen quality, androgen decline in ageing men and reduced steroidogenesis cascades, erectile dysfunction and prostate enlargement.

With increasing life expectancy in many regions of the world, together with an increasing paternal age and associated risk of infertility, pregnancy complications and reduced health potential in the offspring, it is becoming increasingly important to fully understand the mechanism linked with these associations.

**Diagnostics and Assessment**

Appropriate clinical history and examination is essential: exposure to lifestyle and environmental risk factors and exogenous ROS. Nutritional intake for exogenous AO micronutrients is also important. Fertility assessment is based on traditional semen analysis and functional semen tests (Table 1). Particularly relevant are markers of seminal US, Oxidative-Reductive Potential (ORP) and DNA fragmentation as critical predictors of outcomes related to in fertility and overall. AAO micronutrients also important. Fertility assessment is based on traditional endocrine changes. AO as a therapeutic option have the potential to positively modulate these changes. Although evidence suggests AO may be useful in the ageing process and male infertility, caution to excessive or unnecessary use of these approaches is required. Further research on dose, form and length of treatment is required to prevent reductive stress harm.

**Antioxidant Therapy**

Antioxidants that have shown short term benefit in reducing OS markers, detrimental cellular effects and fertility outcomes include: Vitamins A, C and E, other carotenoids, Co-Enzyme Q10 and Ubiquinol, Glutathione, L-Carnitine, N-acetyl-cysteine, Selenium, Zinc and Copper. Furthermore, appropriate nutrition and phytonutrients (e.g. flavonoids and polyphenols) is an important consideration.

**Conclusions**

OS is associated as a mechanism in age-related reproductive decline and associated endocrine changes. AO as a therapeutic option have the potential to positively modulate these changes. Although evidence suggests AO may be useful in the ageing process and male infertility, caution to excessive or unnecessary use of these approaches is required. Further research on dose, form and length of treatment is required to prevent reductive stress harm.