Reproductive health and health in general is linked via evolution and genetics to cell metabolic processes capable of modulating apoptosis, detoxification and appropriate gene response. Mitochondria play a central role in cellular metabolism and dysfunction is involved in various disease processes including infertility. Deficiency in appropriate metabolic cofactors and substrates to mitochondria results in aberrant functionality of the respiratory chain resulting in reduced energy and increased free radicals escaping into the cell. This also induces inflammatory processes due to the misfolding of proteins and other mechanisms.

Mitochondriotropic agents such as carnitines, coenzyme Q10 and nicotinamide have shown potential to improve various factors associated with body energy, hormonal regulation, uterus weight as well as possible stabilization of cellular membranes and the genome (review Virmani et al., 2013). The role of these compounds in epigenetic effects and effects upon genomic stability per se is also becoming important in fertility. L-Carnitine, which is essential in fatty acid metabolism, has been shown to prevent mitochondrial damage induced in the rat choroid plexus by medium chain fatty acids or by mitochondrial toxins.

Conception depends on production of the ovum, quality of the ovum and the state of the uterus. There is growing consensus that egg quality declines with age and in conditions of abnormal energy balance such as in polycystic ovary syndrome (PCOS). There is a critical period between ovulation and implantation when the egg has to rely exclusively on its own energy reserves. This energy comes from the fixed number of mitochondria present at moment of ovulation. If energy runs out the egg stops dividing and implantation is not achieved. In PCOS insulin resistance inhibits ovulation, impairs maturation of viable eggs, reduces egg quality and implantation. Restoring energy balance and providing adequate energy stores to the egg prior to ovulation would improve success of pregnancy.

Further the oocyte genome quality could be improved by substances such as carnitines which improve genomic stability and therefore reduce chances of aneuploidy.