INTERFERENCE OF STEROIDOGENESIS BY GOLD NANOROD CORE/SILVER SHELL NANOSTRUCTURE: IMPLICATIONS FOR REPRODUCTIVE TOXICITY OF SILVER NANOMATERIALS

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Silver nanomaterials are widely used in personal care products. Recent studies have indicated that these nanomaterials may penetrate the blood-placental barrier and gain access to the ovaries. It is largely unknown how silver nanomaterials influence ovarian physiology and functions such as hormone production. This study examines the in vitro toxicology of silver nanomaterials, focusing especially on cytotoxicity and steroidogenesis while exploring their underlying mechanisms. In this study, primary rat granulosa cells were exposed to gold nanorod core/silver shell nanostructures (Au@Ag NRs), which were compared to cells exposed to gold nanorods only. The Au@Ag NRs generated more reactive oxygen species (ROS), reduced mitochondrial membrane potential, and decreased production of adenosine triphosphate. Au@Ag NRs promoted steroidogenesis, including progesterone and estradiol, in a time and dose-dependent manner. Chemical reactivity and transformation of Au@Ag NRs were then studied by electron spin resonance spectroscopy (ESR) and X-ray absorption near edge structure, which identified the generation of free radicals and intracellular silver species. These results suggested that both particle-specific activity and intracellular silver ion release of Au@Ag NR contribute to the toxic response of granulosa cells.

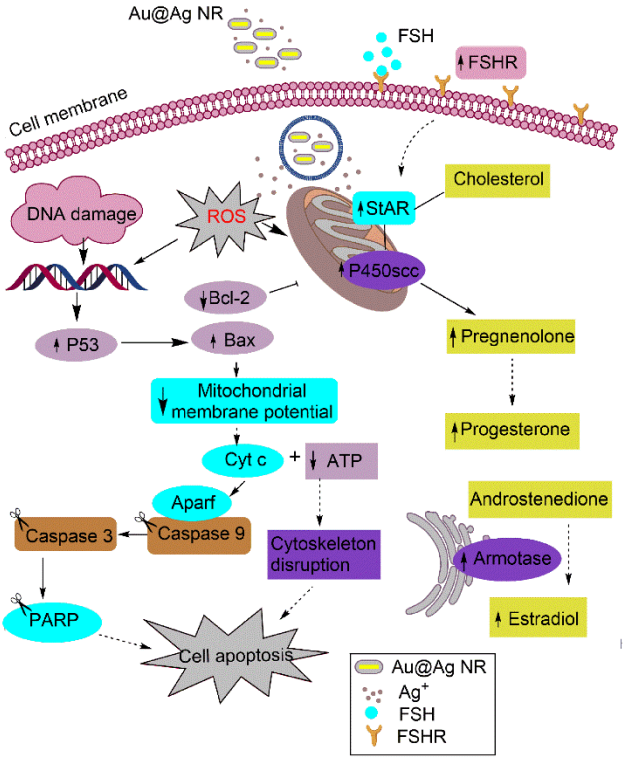

Figure 1, Schematic representation of the proposed mechanism for cell apoptosis and steroidogenesis interference induced by Au@Ag NRs exposure.