NANOINNOVATION 2019 Biosafety of nanomaterials

SiO_2 nanoparticle-neuron interaction: activation of ionic channels and calcium influx

Carla Distasi
University of Piemonte Orientale
Department of Pharmaceutical Sciences
Novara Italy

SiO_2 nanoparticles (SiO_2 NPs) are promising tools in the field of nanomedicine. In this perspective, the knowledge of the mechanisms of interaction between the SiO_2 NPs and their targets is a prerequisite to the rational design of safe and efficient nanotools for laboratory and clinical applications. In previous works, we showed that non-toxic doses of 50 nm SiO_2 NPs induce strong and long lasting calcium influx together with membrane potential depolarization and modulation of the electrical activity in GT1-7 neuroendocrine cells. To clarify the mechanisms of interaction between SiO_2 nanoparticles and the neuronal plasmamembrane and to obtain a detailed biophysical characterization of the multiple pathways activated, we have combined calcium imaging and electrophysiological patch clamp techniques with a pharmacological approach. TRPV4, Connexins and Pannexin-like channels are the major components of inward currents elicited by the NPs. Furthermore, pre-incubation with the antioxidant N-acetyl-L-cysteine (NAC) strongly reduces the $[Ca^{2+}]_i$ increase. These findings suggest that SiO_2 NPs directly activate a complex set of calcium-permeable channels, possibly by catalyzing free radicals production.