Plasmonic nanoparticle layers based optoporation system towards precise and controllable intracellular delivery of biomolecules

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Abstract

The gold nanoparticle (AuNP)-based intracellular delivery systems became very promising due to the last decade. The advantageous properties of AuNP comprise strong wavelength-dependent plasmonic properties, low cytotoxicity and immunogenicity, availability of protocols for reproducible and scalable chemical synthesis, surface modification and functionalization with biospecific ligands. In this lecture, I discuss recent achievements in the development of plasmonic-mediated delivery systems combined with laser irradiation, so-called laser transfection or optoporation systems. In particular, I consider to our recently developed optotransfection system based on the AuNP layers assembled directly on the culture plastic. I will focus on the rational design, on the adjustable AuNP layers parameters and irradiation modes in regard to the best transfection performance. I will demonstrate the benefits of our approach on various cell models and discuss the underlying mechanisms that can be considered to understand the working principle of our system and explain the cell recovery after optoporation. Finally, I will evaluate the future prospects of plasmonic-mediated optoporation technologies for current research and clinical trials.