

Photoporation as a Versatile Tool Against Cancer: From Gentle Immune Cell Transfection to a Powerful Approach for Inducing Anti-Tumor Immunity

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Photoporation is a technique based on the use of photothermal nanoparticles (NPs) and pulsed lasers in which a tremendous amount of light is absorbed in such a way that the water of the surrounding environment evaporates to form vapor nanobubbles (VNBs) emerging around the surface of the NP.[1] VNBs will first expand and then collapse, thereby generating fluid jets and high-pressure shockwaves, which can mechanically damage nearby biological structures. Photoporation have been successfully applied for delivery of a plethora of molecules to a wide variety of cell types,[2-4], and for disruption of biological barriers ex vivo,[5,6] and even in vivo for tissues easily accessible for laser irradiation.[7] Recent studies have demonstrated that photoporation from melanosomes could be used to induce immunogenic cell death (ICD), a process where damage-associated molecular patterns (DAMPs), such as ATP and calreticulin (CALR), are released or exposed at the cell's surface.[8] this novel finding positioned photporation as a promising strategy not only for direct cytosolic delivery but also as a therapeutic strategy for enhancing ant-tumor immunity.

In this talk, I will present our recent work focused on the use of photoporation for genetic engineering of NK cells. Our results demonstrated the successful transfection of NK cells with eGFP mRNA and gene editing by delivery of Cas9 RNPs for knock-out of the inhibitory receptor NKG2A. Importantly, no alterations to the phenotype of the cells (e.g. expression of surface markers and release of cytokines) could be detected, nor was the proliferation or cytolytic capacity of the cells influenced by either of the treatments. In addition, I will present our last results on the use of photoporation cell killing and exposure of ICD hallmarks upon irradiation.

References

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Figures

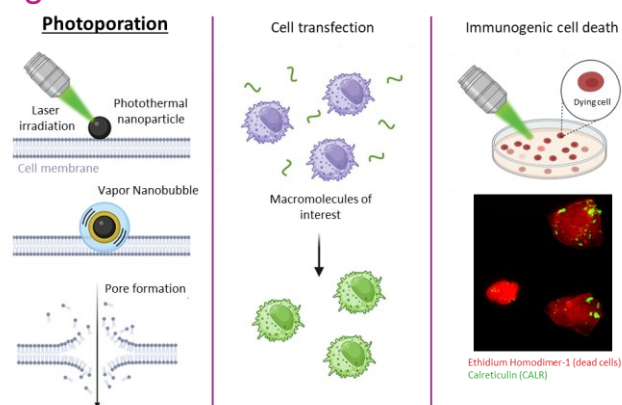


Figure 1. Photoporation as a versatile tool in immunology against cancer: (i) photomechanical effects upon pulsed laser irradiation of photothermal nanoparticles, as a consequence of the formation and collapse VNBs are exploited for (ii) transfection of immune cells and (iii) ICD induction.

