Membrane-targeted nanoparticles for neuronal photo-modulation

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Selective targeting of nanoparticles to the neuronal interface is central for the tailored development of precision neurotechnologies [1,2] . We present a bioorthogonal approach for retaining gold nanoparticles [3] on the membranes of primary neurons and SH-SY5Y neuroblastoma cells. Using confocal and electron microscopy, ICP-MP, we determined that our approach can anchor hundreds of nanoparticles to the membrane of an individual cell. The labeled neurons we tested in wireless photothermal neuromodulation using an NIR laser showed a 45% decrease in MFR at a moderate energy dose of 13 J/cm ^{2} per pulse, corroborating results obtained by exposing the neurons to bulk reversible thermal heating. Nanoparticle retention at the membrane is rapid, requiring only one hour of total incubation, with no cytotoxic effect. These results expand the repertoire of light-activated nanomaterials for non-invasive neuromodulation.

Keywords:
Gold nanoparticles, plasmonics, neurotechnologies, neuromodulation

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