"El saber de mis hijos hará mi grandeza"

Nanoheaters optically activated within 2^{nd} and 3^{rd} biological windows: engineering plasmonic nanoparticles for biomedical applications

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Within the biomedical context, light-to-heat conversion is used for applications such as photoacoustic imaging (PAI), - based on periodic heat generated upon pulsed optical excitation to create acoustic waves via the thermoelastic effect-, or photothermal therapy (PTT) -eradicating malignancies (e.g. tumors) or being an adjuvant factor, following a controlled local temperature increase. Light-to-heat conversion is frequently performed by plasmonic nanoparticles (P-NPs) featuring high molar extinction coefficient, which can efficiently release heat upon optical excitation resonant with their surface plasmon .

In this talk two different routes for spectral tunability of P-NPs are described: geometry -gold nanostars (GNSts)-, and composition -indium tin oxide (ITO) NPs. GNSTs allows to increase the penetration depth and spatial resolution of the light-to-heat conversion by moving optical excitation into the 2nd biological window (BW-II, 1000 to 1350 nm). Engineering the “spiky” configuration of this nanomaterial also increases the “absorption vs. scattering ratio”, thus favoring heat generation. On the other hand, the proof-of-concept on ITO NPs showcases the concept of all-optical (spectrally) decoupled theranostics, owing to a localized surface plasmon resonance almost exclusively located within NIR-III (>1500 nm), as they can adequately team up with luminescent NPs currently applied in biomedicine without detrimental spectral overlapping. Moreover, heat conversion efficiency (HCE) methodology is thoroughly explained as a pathway to quantify the heat delivery for the studied P-NPs, and to corroborate the absorption percentage value obtained in parallel through integrating-sphere measurements.

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