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Hydrogel nanocomposites and plasmonic microfluidic platforms via bottom-up synthesis

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Bionanoplasmonics - CIC biomaGUNE

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The localized surface plasmon resonance (LSPR) phenomenon in metal nanoparticles results in the presence of intense localized electric fields near the particles' surface upon their interaction with certain wavelengths of light. This response to light can be leveraged to enhance the signals of chemical or biological analytes near the nanoparticle for sensing applications, in a process known as surface-enhanced Raman scattering (SERS). SERS sensing has gained interest for in vitro models as it offers high imaging penetration depth, applies photostable "nanotags" as the sensing units, and dynamically provides chemical information. To date, bottom-up wet-chemical synthesis is the most reliable route for controlling the size, shape, crystallographic structure, and surface chemistry of plasmonic nanosensors. In this talk, different routes relying on bottom-up nanosynthesis for incorporating plasmonic nanoparticles as SERS sensors in hydrogel matrices, 3D-printed scaffolds, and microfluidic channels for in vitro cell culture will be discussed. Namely, examples of designed hydrogel-based 3D cellular models incorporating SERS nanotags will be shown. Moreover, recent advancements in the "in situ" growth method, whereby bottom-up synthesis is applied to create nanostructures directly on the surface of a target substrate, will also be presented. Overall, advancements in bottom-up synthesis facilitate the integration of functional plasmonic units that enable (bio)chemical monitoring of different in vitro cellular models over time. Such systems can assist in improving our fundamental understanding of cancer biology and in the rapid screening of cancer therapeutics.