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#### Plasmonic chemical dosimeters

*(Supervision: A/Prof Idriss Blakey)*

Surface Enhanced Raman Spectroscopy (SERS) has been shown to be a highly promising molecular sensing technique, especially in aqueous and biological applications due to its high sensitivity, rich spectroscopic information, and excellent water compatibility. Due to the nature of SERS, a plasmonic metal substrate is required to achieve Raman signal amplification and gold nanoparticle (AuNP) assemblies can provide an easy to modify, and simple to synthesise substrate that provide excellent Raman signal enhancement. Most SERS substrates directly detect chemical species when the adsorb to the gold nanoparticles. This approach is useful for simple samples but fails when applied to multicomponent samples such as biological samples. A second approach is to pre-label the gold nanoparticles with a molecule that has specific reactivity with an analyte of interest. This project will involve developing plasmonic chemical dosimeters that uses this second approach.

#### Surface modification of natural polymers

*(Supervision: A/Prof Idriss Blakey)*

Structural anisotropy in viscoelastic materials is desirable for directional-dependent responses to external stimuli (mechanical, electric field, temperature) and transport processes (diffusion, permeability, poroelasticity). It is commonly observed in nature within biological materials where it is crucial to the function of the eye (cornea, vitreous), muscles, and plant growth. However, the fabrication of viscoelastic synthetic materials (hydrogels) with complex structural anisotropy, particularly with the spatial heterogeneity required for biomimicry, has proved very difficult. This project seeks to address this by using charge directed self-assembly of block copolymers to modify the surface properties of nanocellulose, a naturally derived crystalline polymer. This change to the surface chemistry will manipulate the phase properties of these materials to form hydrogels that have applications ranging from biomaterials, to sensors and food additives.