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Nanotechnology strategies for the detection and monitoring of glycosylation patterns in disease biomarkers



Thursday, 24th April
12.00 p.m.

CIC biomaGUNE - Seminar Room

Glycosylation is the enzymatic process of covalently adding carbohydrate molecules onto proteins and lipids, primarily as a post-translational modification. This modification occurs in approximately 70% of the proteins in human serum, playing a crucial role in various biological functions, such as proper protein folding, cellular interactions, and signal transduction. The process is regulated by a well-conserved array of enzymes, whose behavior can be significantly dysregulated by changes in environmental conditions, leading to the synthesis of altered glycosylation patterns. These abnormal patterns are often associated with pathological conditions, making them valuable biomarkers for disease diagnosis and monitoring. Conventional methodologies for glycoproteomics frequently require specialized and expensive pre-treatment protocols prior to sample analysis followed by glycan separation, sometimes lacking specific recognition molecules or suffering from cross-reactions. To address this limitation, this thesis tackles different nanotechnology-based approaches involving the use of nanoparticles to enhance the detection of glycan profiles via surface-enhanced Raman scattering (SERS). SERS has been developed during the past 50 years as a versatile technique in the biological sensing and imaging fields, offering high sensitivity as well as robust multiplexing capabilities and long-term signal stability. Finally, this thesis also delves, though in a preliminary manner, into the use of glycan moieties as vectorization molecules. By functionalizing gold nanoparticles with specific glycans, we intended to take advantage of its strong interaction with the asialoglycoprotein receptor (ASGPR), primarily expressed in hepatocytes, directing the new nanocarriers to be internalized, preferably in the liver.