TAILORING ELECTROACTIVE BIOMATERIAL-PROTEIN INTERFACE AND INTERACTIONS

Presenter:
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Abstract:

While global life expectancy continues to rise, maintaining health during aging remains a major challenge, highlighting the need for strategies that prolong both lifespan and health span. Tissue engineering (TE) addresses this through biomimetic scaffolds, highlighting electroactive biomaterials as they provide dynamic electrical cues that stimulate native tissue. Since adsorbed extracellular matrix proteins mediate cellular responses, understanding how the material properties and the external stimuli affect protein adsorption is essential for TE strategies.

This talk investigates protein behavior on polyvinylidene fluoride (PVDF)-based electroactive surfaces, focusing on the synergistic role of material structure and external stimulation. We first establish a baseline for protein adsorption by quantifying the process on planar PVDF surfaces using Neutron Reflectivity (NR). Next, we characterize the nanoparticle-induced structural modifications in PVDF composite films and correlate them with the macroscopic properties using Small-Angle Neutron Scattering (SANS). Finally, we explore the impact of magnetic stimulation applied to the PVDF composites on the adsorption of key extracellular matrix proteins, collagen and fibronectin. The overall findings demonstrate how electric and magnetic cues can effectively modulate protein–surface interactions, providing crucial insights for the rational design of next-generation biomaterials, particularly in tissue engineering.