

Università degli Studi di Padova



Thursday 3rd April 2025 at 1:30 pm in room F

Dr. César Pascual García

Luxembourg Institute of Science and Technology Luxembourg

will hold the seminar entitled:

Innovative Electrochemical Platforms for Probing

Peptide-Protein Interactions in Personalized Medicine

In recent years, immunotherapies -such as chimeric antigen receptor (CAR)-modified cells and cancer vaccines- have shown remarkable success in treating aggressive diseases like pancreatic cancer. These therapies leverage the patient's immune system to target specific protein fragments expressed by tumors designed as neo-epitopes. While the fundamental principles behind **immunoprotein-peptide interaction-based treatments** are well established, personalizing these therapies remains a major challenge due to the vast number of patient-specific peptide mutations involved. This complexity creates a combinatorial bottleneck for clinical adaptation.

Advances in the electronics industry offer powerful tools to address this challenge. With millions of transistors capable of executing highly parallel tasks, semiconductor technology holds the potential to manage the diversity of tumor-specific sequences. We introduce an **innovative electrochemical microreactor platform** that harnesses this potential enabling the in-situ deprotection of acid-labile groups and facilitating high-purity **peptide synthesis directly on planar Field Effect Transistor** (FET) **sensors**. These FET sensors not only allow for the real-time detection of protein-peptide interactions but also provide kinetic data crucial for selecting the most promising therapeutic candidates.

Our integrated microfluidic systems automate peptide synthesis and reduce the time-to-result by streamlining the entire process. Moreover, these sensors enable continuous quality monitoring by detecting electrochemical signatures of protection and deprotection steps. Finally, we showcase the potential of **next-generation graphene FETs to detect individual amino acid fingerprints**, laying the foundation for a novel approach to point-by-point peptide sequencing. By coupling this with Edman degradation, our method paves the way for next-generation protein sequencing and in-depth analysis of post-translational modifications -key components in the future of personalized medicine.

Your presence will be very welcome.

Il Direttore del Dipartimento Stefano Mammi

Marta De Zotti



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Bio – César Pascual García

César Pascual García earned his PhD at the *Scuola Normale Superiore*, where he studied electron correlations in quantum dots. Early in his research career, he explored diverse topics ranging from light sensors to superconducting thermodynamics. He later established his independent research group in Luxembourg after being awarded the prestigious FNR-ATTRACT fellowship, focusing on the development of microreactors capable of controlling chemical reactions by modulating acidity in miniaturized environments.

Currently, he serves as Coordinator and Principal Investigator of multiple research projects at the Luxembourg Institute of Science and Technology (LIST). His research activity focuses on the development of lab-on-a-chip devices that can synthesize, detect, modify, and degrade DNA and proteins using advanced microchip technologies integrated with biological systems.

He coordinated the *ELECTROMED* project, funded by the European Innovation Council, to create a platform for high-throughput screening of cancer vaccines. His ongoing projects explore cuttingedge technologies for protein sequencing and the development of next-generation biosensors, including applications in battery diagnostics. He also actively promotes innovation in the health sector at LIST. In recognition of his contributions, he was recently appointed as an Ambassador of the European Innovation Council, a role he held until end of 2024.

