AVVISO DI SEMINARI

Il giorno 03/06/2025 alle ore 12:00

nell'Aula Seminari del Dipartimento di Scienze e Tecnologie Chimiche

Dr. Ana Sol Peinetti

Assistant Professor,

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Terrà un seminario dal titolo:

Functional DNA for Infectious Disease Diagnostics and Environmental Monitoring

Proponente: Prof. Alessandro Porchetta

Abstract:

In our lab, we combine functional DNA molecules, such as aptamers and DNAzymes, with nanostructures and synthetic biology strategies. By leveraging the unique selectivity and programmability of DNA molecules, we develop innovative amplification methods for biosensor applications.

In this seminar, I will present two applications from our ongoing research. First, we address key challenges in the development of diagnostic tools for viral infections. I will show how aptamers can confer remarkable selectivity to biosensors, enabling them to distinguish between infectious and non-infectious viral particles, or differentiate among viral variants [1]. By integrating these DNA molecules into solid-state nanopores [2], we harness confinement effects to achieve detection limits comparable to qPCR, while maintaining the advantages of a rapid and portable format.

Second, I will discuss our efforts to create portable tests for environmental monitoring. Cell-free transcriptional biosensors are emerging as a powerful platform to detect chemical contaminants in field settings, especially where conventional analytical tools fail to meet societal needs. However, achieving the required sensitivity and selectivity, while maintaining portability, remains a major hurdle. I will present how we use DNA engineering and programmability to enhance *in vitro* transcription (IVT) assays regulated by allosteric transcription factors (aTFs) [3]. Specifically, we have developed a rapid and ultra-sensitive turn-on lateral flow assay based on nucleic acid avidity effects, capable of detecting Pb(II) in untreated spring water from a basin that exemplifies real-world environmental monitoring challenges. Additionally, we are applying *in vitro* selection techniques to evolve new DNA operator sequences, allowing us to fine-tune aTF affinity and reduce background signal in IVT-based sensors.

Reference

[1] a) Peinetti *et al.*, *Science Advances* 2021, *7* (39), eabh2848. b) Li *et al.*, *JACS* 2022, *144* (4), 1498–1502.

[2] a) Pérez-Mitta and Peinetti *et al.*, *Nano Letters* 2018, 18 (5), 3303–3310. b) Peinetti *et al.*, *Analytical Chemistry* 2024, *96* (13), 5282–5288. c) Gramajo *et al.*, *Chem. Commun.* 2025, *61*

[3] a) Jung *et al.*, *Nature Biotechnology* 2020, 1–9. b) Li *et al.*, *Nat Chem Biol* 2025, 1–10.