TOR VERGATA
UNIVERSITÀ DEGLI STUDI DI ROMA

Dipartimento di Scienze e Tecnologie Chimiche

AVVISO DI SEMINARIO

Il Prof. Jeong Wook Lee

Department of Chemical Engineering,
Pohang University of Science and Technology (POSTECH),
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Il giorno 08/06/2026 alle ore 12.00

nell'**Aula Gassano**

terrà un seminario dal titolo

Engineering Programmable Sense-Decide-Act Systems across Cell-Free and Cell-Based Platforms

Proponente: Prof.ssa Simona Ranallo

Abstract

Engineering biological systems capable of autonomously sensing environmental signals, processing information, and executing defined responses—sense-decide-act functionality—remains a central goal of synthetic biology. In this talk, I will present our laboratory's efforts toward realizing this goal across both cell-free and cell-based platforms, each offering distinct advantages for programmable biological function.

In cell-free contexts, we developed a one-pot isothermal assay that embodies cell-free sense-compute-respond logic. The system senses a target RNA through probe hybridization and ligation, computes a binary decision—gating T7 polymerase-driven transcription only upon successful ligation—and responds by producing a fluorescent RNA aptamer. We further extended the platform to single-nucleotide polymorphism discrimination by positioning variant bases at the ligation junction, exploiting differential ligation efficiency to resolve single-base differences.

In cell-based contexts, we have developed a genetic circuit design platform that supports a broader logic repertoire than existing tools and is deployable across multiple microbial chassis. By integrating transcription factor-based biosensors with engineered genetic circuits, we construct sense-compute-respond systems in living cells—where sensing of small-molecule ligands and metabolic intermediates is coupled to multi-layered signal processing and programmed biological responses. This enables sustained autonomous function in complex environments, extending programmable behavior beyond single-decision logic toward complex decision-making and actuation.

Together, these cell-free and cell-based capabilities establish a versatile and scalable foundation for programmable biological systems that sense, decide, and act.