

MIT Chemical Engineering Department
Fall 2019 Seminar Series

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“Spatial and Dynamic Control of Engineered Metabolisms Using Subcellular Engineering and Optogenetics”



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3:00 PM (Reception at 2:45 PM)
66-110

Abstract: The performance of engineered microbial metabolisms for chemical production can be greatly enhanced by sequestering metabolic pathways in subcellular compartments (i.e., spatial control), as well as by regulating the time and levels of metabolic activity during fermentation (i.e., dynamic control). I will discuss our work in subcellular engineering to compartmentalize metabolic enzymes in natural and synthetic organelles to retain intermediate metabolites, reduce bottlenecks, and enhance metabolic flux. In addition, I will present new technologies to dynamically control metabolic pathways. This includes new optogenetic circuits to control the timing and levels of expression of metabolic enzymes with the fine-tuning and reversibility capabilities afforded by light. Furthermore, I will describe new strategies to control metabolic activity post-translationally using genetically encoded enzyme inhibitors and dynamic assembly of synthetic membraneless organelles. Finally, I will provide a perspective on how these technologies may come together to prescribe a new paradigm for dynamic control in metabolic engineering.