Chemical Engineering Colloquium

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Goddard Hall, Room 227

12:00 PM – 1:00 PM

Synthetic Biology for a Sustainable and Healthy Future

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A central goal of synthetic biology is to predictably and efficiently re-engineer DNA, RNA, protein, and living organisms to carry out specific biological tasks. In this talk, I will highlight our work on engineering macromolecule and bacteria-animal interactions for biomedical and environmental applications. Firstly, messenger RNA-based vaccines efficiently fight against viral diseases including COVID-19. However, a key limitation of mRNA vaccines is the inherent chemical instability. As a result, mRNA vaccines require stringent cold chain conditions for manufacturing, storage, and worldwide distribution. I will talk about our efforts to recode mRNA toward thermally stable and highly efficient mRNA vaccines. Secondly, programming animals' physiology and behavior play a significant role in pest control, environmental remediation, and human health. Although there have been many advances in the bio-computational design of living systems, programming animal behavior and altering animal physiology remain challenges because of the system complexity. I will present our bacteria-animal symbiont system for engineered animal physiology and behaviors through logic gates. Last but not least, proteins are building blocks for living organisms. I will discuss our efforts using protein engineering to address environmental and biomedical needs including plastics degradation, methane fixation, and artificial bi-specific antibody assembly for cancer diagnosis and therapy. All these collective efforts demonstrate the power of synthetic biology to solve urgent biomedical and environmental problems.

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