2024 FALL SEMINAR SERIES

SCHOOL OF
CHEMICAL ENGINEERING
College of Engineering, Architecture and Technology

North Classroom Building 203 | October 1, 2024 | 10:30 - 11:45 a.m.

Using deep sequencing to guide enzyme engineering and mechanistic studies

Modern deep sequencing techniques enable generation of large genetic datasets and subsequent development of testable hypotheses in basic and applied life science research. When coupled with combinatorial protein engineering approaches, deep sequencing can be used to provide a comprehensive map of sequence–function relationships to explore the fitness landscapes, uncover functionally relevant sites, improve molecular energy functions, and identify beneficial combinations of mutations. In this talk, I will describe our efforts to apply this deep mutational scanning (DMS) approach to characterize and study an enzyme called Phenylalanine ammonia-lyase (PAL). PAL is widely found associated with secondary metabolism in plants, bacteria, and fungi but has garnered significant recent interest since it was approved as a therapeutic for a rare genetic disorder called phenylketonuria (PKU). I will describe development of a high-throughput screen and its application to enable DMS. Insights from experiments guided a deeper understanding of PAL enzymology while also enabling development of several variants with multi-fold improved activity.

Nik Nair, Ph.D

Nik Nair (naa-year) received his B.S. in Chemical and Biomolecular Engineering from Cornell University (Ithaca, NY) in 2003. While at Cornell, he was a founding member and lead guitarist of the not-so-well-known progressive metal band called “Rubicon”. After graduation in 2003, he had a brief stint at Bristol Myers Squibb where he worked as a manufacturing research scientist in biotechnology purification development. He then went on to receive his M.S. and Ph.D. in Chemical and Biomolecular Engineering from the University of Illinois, Urbana-Champaign under the guidance of Prof. Huimin Zhao. He joined Tufts in 2013 after completing a 3-year postdoctoral fellowship in Microbiology and Immunobiology at the Harvard Medical School in Prof. Ann Hochschild’s lab. He was promoted to Associate Professor with tenure in 2020. He is a recipient of the 2016 NIH Director’s New Innovator Award. The Nair Synthetic Biology & Systems Bioengineering Lab focuses on two major areas of research – 1) biosynthesis of renewable fuels and chemicals from sustainable feedstocks, and 2) engineering proteins and microbes to improve human health. In his spare time, which is increasingly rare, he likes to play guitar, golf, and video games and watch trashy TV shows like 90 Day Fiancé and Sister Wives. His long-term plans include starting several companies based on lab-developed technologies and eventually resurrecting “Rubicon” once his young sons are old enough to master their instruments (Kiran: guitar; Liam: keyboards).