

**March 12, 2025 | Shillman 135 | 12:00PM**

## **Distinguished Seminar Speaker**

***Understanding and mitigating host-part incompatibilities during microbial engineering***

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**Abstract:** One of our major goals is to elucidate and highlight the unexpected outcomes that result from modifying living systems and formalize them under the umbrella of “incompatibilities”. For example, when multiple recombinant proteins are co-expressed in bacteria like *E. coli*, the cellular growth rate reduces, due to the *burden* of protein expression. However, the same system can be considered an *incompatibility* between the resources used for protein synthesis and the bacterial host’s intrinsic resource demands for growth. Similarly, when a recombinant enzyme is expressed in a recombinant host, its off-target activity on host metabolites can result in the re-distribution of fluxes through a number of host metabolic pathways. While such activity is frequently filed under *promiscuous enzymatic activity*, the same can be considered an *incompatibility* between the enzyme and the host’s metabolic network. We have spent significant effort in

systematically exploring the origin of these numerous host-part incompatibilities (where, the added component, like recombinant protein, is referred to as a biological “part”) in efforts to explain previously inexplicable experimental observations. By understanding the origins of incompatibilities, our work has revealed fundamental insights into cellular physiology and enabled the development of more robust and efficient engineered biological systems.

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**Biography:** Jim 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 and a brief stint at Bristol Myers Squibb, where he worked as a manufacturing research scientist in biotechnology purification development, he received 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).

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