# CHEMICAL ENGINEERING

## DISTINGUISHED YOUNG SCHOLARS SERIES

## SUCHOL SAVAGATRUP

**Monday, July 23, 2018**

Postdoc
Massachusetts Institute of Technology

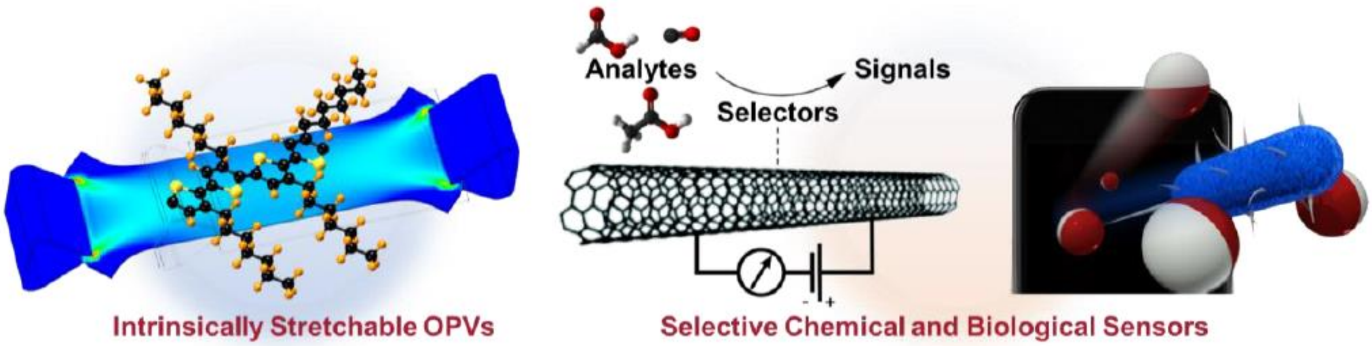
# Imitating nature's approach: molecular engineering of organic materials for energy and sensing

**ABSTRACT:** While conventional electronic devices are composed of hard materials, the pliability and chemical reactivity of organic materials may enable game-changing solutions to pressing scientific challenges. Here, I present two examples of molecular engineering of organic materials for (1) mechanically robust organic photovoltaics (OPVs) and (2) bio-inspired selective chemical sensors.

First, I will discuss the relationships between mechanical deformability and charge transport in polymeric systems, and the rational design principles that afford intrinsically stretchable OPVs. Organic photovoltaics hold promises to produce devices with performance approaching that of silicon-based electronics, but with the mechanical stability of conventional plastics. However, obtaining this “plastic” deformability and high photovoltaic performance has proven challenging. In addition, the mechanical fragility of many high performing conjugated polymers limits their applicability for large-area, low-cost, and printable devices. Using mechanical, spectroscopic, photovoltaic device-based measurement, I demonstrate the impact of molecular structure and solid-state packing on bulk mechanical properties, allowing for the co-optimization of OPVs towards the “best of both worlds.”

Second, I will also discuss the designs of two novel chemical sensors—based on single-walled carbon nanotubes (SWCNTs) or complex liquid colloids—that translate molecular and biological recognition into sensory systems for environmental and health monitoring. Although selectivity underpins the utility of any sensing platform, obtaining a selective and practical sensor is often elusive. To address this challenge, I integrate bio-inspired molecular receptors into the sensing platforms to impart high selectivity and responsiveness. Specifically, a heme-inspired iron porphyrin provides controllable sensitivity towards carbon monoxide in SWCNT-based gas sensors, and carbohydrate-lectin binding allows for the detection of Escherichia coli bacteria using complex

emulsions. These nature-inspired examples serve as an important step in demonstrating the possibility of translating chemical principles to practical devices.




**BIOGRAPHY:** Suchol Savagatrup received a B.S. from UC Berkeley in 2012 and a Ph.D. from UC San Diego in 2016, both in chemical engineering. He is currently a NIH postdoctoral fellow at MIT in the department of chemistry. His research interests sit at the interface of soft materials science and device fabrication for applications in energy, human health, and environmental sustainability.

**LECTURE 4:00 - 5:00 (PAA) A110**
**Happy Hour in Benson Hall Lobby Following**