הטכניון - מכון טכנולוגי לישראל

TECHNION - ISRAEL INSTITUTE OF TECHNOLOGY

הפקולטה להנדסה כימית
ע"ש וולפסון
The Wolfson Department of Chemical Engineering

**Wolfson Department of Chemical Engineering Seminar**
**Zoom Seminar**

**November 20, 2023 at 13:30**

Zoom Seminar - https://technion.zoom.us/j/93206261316

# "Harnessing Microbial Metabolic Repertoire for Biological Upcycling of Wastes: Towards Sustainable Development"

**Dr. Jinjin Diao - Washington University in St. Louis**

How to achieve sustainable development is a major challenge we are facing now. Biomanufacturing – a process that implements a broad range of biotechnologies to reprogram microbes for producing specialty chemicals – has been considered as a promising alternative to support our society's sustainability. However, the complexities of the biological system, especially in the non-model microorganisms, have emerged as the substantial challenges for constructing and optimizing the microbial chassis with desired functionalities. Therefore, my research interests revolve around the understanding of intracellular metabolic and regulatory mechanisms and the development and leveraging of cutting-edge synthetic biology techniques to harness the microbial metabolic repertoire for biological upcycling. Specifically, I engineered cyanobacteria chassis for the *de novo* biosynthesis of astaxanthin directly from $CO_2$, paving a new way for $CO_2$ valorization. For the lignin stream, I deciphered the transcriptional regulation of the aromatic catabolic pathways and the mechanisms controlling aromatic catabolic operons in response to different aromatic mixtures in *Rhodococcus opacus* PD630, which facilitates the development of *R. opacus* as a promising chassis for valorizing lignin. To address the waste plastic concern, I developed a new biotechnological method for upcycling PET via the identification of the hyperosmotic stress-tolerant microbial chassis *Rhodococcus jostii* Strain RPET (RPET), which can be paired with a highly efficient PET depolymerization method to enable the valorization of waste PET. We also showcase the application of multi-omics analyses in comprehending intracellular metabolic and regulatory mechanisms of the microbes, which can enable us to improve the performance of the microbial chassis we developed. Moreover, I have expanded my field of study to the area such as developing 'smart' microbes which programmed to commit 'suicide' after they accomplish their mission, such as the remediation of phenolics contaminated environments. These advanced microbial chassis, along with the tools and principles we developed, will eventually help us to address not only sustainability but also the climate crisis and food inequality.