Environmental Engineering Candidate Seminar

Joshua Jack, Ph.D.

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Joshua Jack is a postdoctoral research scholar in the Andlinger Center for Energy and Environment and the Civil and Environmental Engineering department at Princeton University. Jack previously earned a bachelor's degree in Civil and Environmental Engineering from the University of Massachusetts, Amherst and holds a doctoral degree in Environmental Engineering from the University of Colorado, Boulder. During his graduate studies, Jack obtained extensive interdisciplinary research experience at both the DOE-National Renewable Energy Laboratory and NASA Langley Research Center, and has received numerous awards including a NASA Outstanding Research Award and NSF Fellowship. Jack's current research focuses on energy and resource recovery as part of a sustainable water-energy-climate nexus with a special focus on process design of bioelectrochemical technologies toward scalable CO2 valorization and water treatment. Jack collaborates with many researchers from the Department of Chemical and Biological Engineering as well as various DOE laboratories and private companies such as Shell Energy. Jack has recently published in many highly cited journals including Applied Energy and Green Chemistry and plans to begin a tenure-track academic position in the near future.

Research Seminar

Monday, February 14, 2022
11:00 AM - 12:00 PM
ENGR 326

Engineering a New Circular Economy: Waste CO2 valorization and resource recovery towards an improved water-energy-climate nexus

Understanding and advancing the water-energy-climate nexus is key to mitigating the immense threats of climate change and solving many of the related environmental issues we face today. Due to the rapid decrease in the cost of renewable energy, it is now practical to design devices that use renewable electrons to drive the transformation of CO2 and other waste feedstock (wastewater, food waste, biomass) into high-value products while also recovering important resources such as water, nutrients, and energy. Overall, these new green technologies can help us decarbonize various sectors and enable a new circular economy. This presentation will discuss opportunities to leverage cutting-edge hybrid electrochemical-biological technologies in diverse environmental applications including wastewater treatment, water reuse, remediation, and CO2 capture and conversion. Current lab scale experiments have demonstrated excellent production rates, titer, and energy efficiencies. Efforts towards improving reactor scalability, expanding the portfolio of products, and implementing new types of waste streams are on going.

Teaching Seminar

Monday, February 14, 2022
3:30 PM - 4:30 PM
UWRL 301

Environmental biotechnology utilizes microorganisms to improve environmental quality and is the cornerstone of critical wastewater treatment practices including the conventional activated sludge process. As such, designing effective wastewater treatment technologies requires an in-depth knowledge of how microbes grow and capture energy from their surrounding environment.

This teaching seminar will discuss foundational concepts of bacterial energetics and substrate portioning with the goal of delivering students a comprehensive understanding of microbial metabolism that can be applied to many environmental applications. Specifically, this seminar will review basic stoichiometry and thermodynamic concepts, will discuss various microbial metabolisms, and guide students through several in-class examples. Overall, the concepts taught in this seminar can be applied to novel wastewater treatment, resource recovery, water reuse, and carbon capture and utilization technologies.