

Harnessing Microbial Redox Processes for Sustainable Technologies

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Joint Chemistry and
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Seminar
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Abstract: Electron transfer is the basis of most cellular processes, ranging from photosynthesis to cellular respiration. These processes have evolved over billions of years to be highly efficient, far surpassing engineered systems. Our research harnesses this natural efficiency by integrating materials science with synthetic biology to develop versatile, low-cost, and user-friendly technologies. We engineer novel materials to enhance electrochemical diagnostics for infectious diseases and improve electrocatalysis for sustainable chemical conversions. Additionally, we design self-assembled biomaterials to protect beneficial microbes from environmental stressors, enabling their deployment in agriculture and human health as alternatives to harmful chemicals. By decorating microbial surfaces with functional proteins, we create adaptable platforms for applications ranging from pesticide degradation to critical mineral recovery. The combination of materials science and synthetic biology to harness electron transfer processes affords advantages beyond the individual fields alone and demonstrates the power of engineering natural systems to develop equitable and sustainable technologies.

About the speaker: Ariel L. Furst is the Cook Career Development Professor of Chemical Engineering at MIT. Her lab combines biological, chemical, and materials engineering to solve challenges in human health and environmental sustainability. They develop technologies for implementation in low-resource settings to ensure equitable access to technology. She completed her Ph.D. in the lab of Prof. Jacqueline K. Barton at the California Institute of Technology developing new cancer diagnostic strategies based on DNA charge transport. She was an A. O. Beckman Postdoctoral Fellow in the lab of Prof. Matthew Francis at UC, Berkeley developing sensors to monitor environmental pollutants. She is the recipient of the NIH New Innovator Award, the NSF CAREER Award, the Dreyfus Teacher-Scholar Award, and the Sloan Fellowship. She is the cofounder of three startups and is passionate about entrepreneurship, in addition to STEM outreach and increasing participation of underrepresented groups in engineering.