Opportunities and Challenges for Engineered Biology in Bioremediation

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Advances in our ability to engineer biology for applications from therapeutics to agriculture to bioremediation continue to grow exponentially since the human genome project was completed 20 years ago. What took over a decade and more than $1 billion back then can be done in hours for a few hundred dollars today. Gene editing technologies such as CRISPR facilitate high throughput screening of thousands of genetic modifications at a time, dramatically reducing the time required to develop new biological solutions to challenging problems. In the environmental arena we are confronted with major global issues such as recalcitrant chemicals such as PFAS that have extremely low regulatory limits, a drive toward decarbonization of many industries, increasing demand for critical metals while ore quality is declining, and a desire to create more circularity in the lifecycle of manufactured consumer products like plastics. Engineered biology could provide at least part of the solution for many of these problems where mechanical and chemical systems are approaching their limits.

During the panel we will discuss many of the opportunities in front of us, including the engineering of environmental microbes to improve their suitability in specific applications or to give them a novel function such as a new enzymatic pathway for contaminant degradation or upcycling of plastics, or novel protein expression for the binding of target metals. Another important opportunity to be discussed is the synthesis of proteins, including enzymes, that could be applied directly into a treatment or resource recovery process, or that could be applied to a surface such as a bead or membrane. In addition to the opportunities for engineered biology it is important to recognize and discuss some of the challenges with its implementation. In this panel we will discuss regulatory and stakeholder acceptance, as well as potential impacts to the native microbiome in environmental applications and possible mitigation strategies.