



SHELL SEMINAR SERIES

CHEMICAL & BIOLOGICAL ENGINEERING

Synthetic Biology for Microbiome Engineering

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ABSTRACT The population dynamics of the human microbiome correlate with a wide variety of human disease states. As engineers, the question we ask is “How can we manipulate the microbiome to improve human health?” The Mansell lab approach to this question uses the toolbox of synthetic biology to engineer prebiotics, probiotics, and targeted antibiotics to shape the human microbiome. First, we have developed high-throughput screens for synthesis of human milk oligosaccharides (HMOs), a set of prebiotic carbohydrates that control the microbiome of the infant gut. We have also engineered the well-known probiotic strain *E. coli* Nissle to metabolize HMOs and used this metabolism to control population dynamics and protein expression. Another objective is to improve the function of probiotics by developing genome engineering tools in gram-negative and gram-positive probiotics to enable their persistence in the human gut environment and, ultimately, engineered in situ secretion of therapeutic biomolecules by live probiotics. Finally, we are studying ways to replicate quorum sensing of pathogens such as *Staphylococcus aureus* (MRSA) and *Clostridium difficile* (CDiff) in non-pathogenic hosts in hopes of using quorum sensing disruption as a potential non-lethal pathogen management strategy. Taken together this work advances strategies for manipulation of microbial communities in the human gut and beyond.

BIO Dr. Thomas Mansell earned B.S. and M.S.E. degrees in Chemical Engineering from Johns Hopkins University (Advisor: Marc Ostermeier) and a Ph.D. in Chemical & Biomolecular Engineering from Cornell University (Matthew DeLisa). He did postdoctoral training at the University of Colorado-Boulder (Ryan Gill). In August 2015, Tom began as an Assistant Professor at Iowa State University, hired under a Presidential High Impact Hires Initiative in Translational Health. He is also a member of the Iowa State Interdepartmental Microbiology Graduate Program and the Karen and Denny Vaughn Faculty Fellow in the CBE department. Tom's research interests are in protein engineering, glycobiology, synthetic biology, and genome engineering in bacteria for human health outcomes and biorenewable chemical production. Recently, Tom was honored with the NSF CAREER Award.

