Dr. Jeff Tabor

Title:
Engineering bacterial light sensors for reliable control of gene expression in stationary phase

Abstract:
We and others have engineered bacterial photoreceptors and used them for precise control of gene expression in exponential growth phase. However, in applications such as metabolic engineering and microbiome studies, bacteria predominantly reside in stationary growth phase. We find stationary phase dramatically alters the performance of current bacterial light sensors, in large part due to the accumulation of light sensor and output proteins that occurs as a result of cessation of growth. We have overcome this challenge for the widely-used green light sensing two-component system CcaSR. In particular, we use integrated modeling and experimentation to optimize expression of the chromophore biosynthesis, photoreceptor, transcription factor, and output proteins for stationary phase, including leveraging proteolysis tags to ensure their turnover. Using our stationary phase-optimized system, we demonstrate high dynamic range and precise control over activation and deactivation kinetics, similar to the performance of this system in exponential phase. We are applying this stationary phase CcaSR system to optimize engineered metabolic pathway yields in stationary phase conditions.

Biography:
Jeff Tabor received his Ph.D. in molecular biology from UT-Austin with Andy Ellington in 2006. He was an NIH postdoctoral fellow with Chris Voigt at UCSF until 2010. He started his research group in the Bioengineering Department at Rice in 2010 and became an Associate Professor in 2017. His work focuses on engineering bacteria to sense and respond to stimuli in the environment for medical, biotechnological, environmental, and basic science applications. He has received the NSF CAREER, ONR Young Investigator, Hamill Innovation, and Michel Systems Biology awards, and was recently named a fellow of the American Institute of Medical and Biological Engineering.