Ira A. Fulton Schools of Engineering
Arizona State University

Seminar

School of Sustainable Engineering and the Built Environment

Graham Peers, PhD
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Wednesday, March 30, 2022
3:00-4:00pm
College Avenue Commons (CAVC) 333

Dark and Light is not Black and White: Engineering Photosynthesis for the Real World

ABSTRACT: Photosynthetic organisms experience light fluxes across a wide range of time scales and intensities. This places a burden on photosynthesis to balance efficient light capture in low light with energy dissipation mechanisms. The latter processes prevent cellular oxidative damage in excess, full sunlight. This issue is exacerbated during industrial growth of algae because the dense cultures and mixing required for economical agronomy create a rapidly changing environment that does not exist in nature. Therefore, algae in mass culture experience a dysregulation of physiology, resulting in lowered yields compared to what is measured in controlled lab conditions. In the first part of talk, I will present a summary of our work showing computational fluid dynamics can be coupled with photo-physiology to uncover which energy dissipation mechanisms contribute to lower yields in photobioreactors. This information is then used to guide strain engineering strategies that increase biomass production. In the second part of the presentation, I will present our discovery-based efforts to better understand the biogenesis of light harvesting pigments with the goal of improving overall light utilization efficiency. And finally, I will describe our synthetic biology efforts, how they can be applied to manipulating algal biology and our plans for tailoring metabolism during the day-night cycle for the production of valuable bio-molecules and the efficient remediation of wastewater.

BIOSKETCH: Graham Peers' career has focused on the application of algae to better human society through the discovery of proteins and processes that enable their distinct biology. These experiences have ranged from enabling the synthetic control of gene expression in algae to performing mesoscale open ocean enrichment experiments. Prior to joining Colorado State University he worked with Synthetic Genomics Inc./Exxon Mobil on algal biofuels. Currently, his research team focusses on increasing photosynthetic efficiency, control of novel metabolism within these diverse clades of organisms and the industrialization of algae for the circular carbon economy and for the production of high value molecules.