SUMMARY FOR PUBLIC RELEASE

Project Title: Enhanced production of algae lipids and carbohydrates for fuel and polyurethane precursors

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In this project, we will combine genetic engineering, traditional breeding, high-throughput screening, chemical processing, and cultivation technologies that have been developed over the last 10 years at the California Center for Algae Biotechnology, to generate high quality biomass for the production of fuels and high value polyurethane (PU) co-products from commercial strains of algae and cyanobacteria. Specifically, we will characterize commercial strains of microalgae, one cyanobacteria and one green algae, for carbohydrate, lipid, and key metabolites, to identify their levels of these naturally occurring polyurethane precursors (PUPs). We will translate the entire suite of genetic tools we have previously developed to these commercial strains and make both the strains and tools available to the entire algae community (APEX Challenge). Using recursive iterations of evolutionary engineering techniques, we will evolve these strains for improved biomass productivity in high salt and high pH media, as well as increased PUP production. In parallel, we will use synthetic biology and high-throughput screening to engineer metabolic pathways to optimize production of fuels and PUPs in these strains. We will also develop chemical methods to convert these PUPs into fuels and PU monomers. We will cultivate these strains at pilot scale at the UC San Diego biological field station. In collaboration with our key industrial partner Algenesis we will isolate and chemically convert these PUPs (both lipid and carbohydrate) into novel polyols and demonstrate their utility by formulating commercially relevant PU products, with the residual biomass being converted into fuels. Finally, in collaboration with Dr. Alissa Kendall at UC Davis, we will conduct full techno-economic analysis (TEA) and life cycle analysis (LCA) to model and understand the impact of producing microalgae-derived fuels and high value co-products.