

Optimization of Algal Lipid Production for Human Nutrition and Bioenergy

The need for a new, renewable nutrition and energy resources is critical in a crowded and hungry world. We propose to investigate and improve the production of lipids by the unicellular green alga, *Chlamydomonas reinhardtii*, to 1) provide a new source of polyunsaturated fatty acids for human nutrition, and 2) provide a new feedstock for production of biodiesel. In order to obtain maximum lipid yields, we will utilize our diverse expertise to optimize metabolic pathways exploring synergies among genetic, biochemical, fluid mechanical and control engineering approaches.

The potential of microalgae for human nutrition and bioenergy production is truly unknown until modern genetic techniques have been applied to its improvement. Our central hypothesis is that the optimal growth, and lipid production of *Chlamydomonas* depend on genetic capabilities of the algal strains, hydrodynamic mixing, and environmental conditions present during growth. The proposed laboratory and field research will integrate the fundamental genetic research with the applied engineering research to explore fully the potential of *Chlamydomonas* from micro-liter and multi-liter volumes in a laboratory to hundred-liter volumes in a bioreactor in the field. Our interdisciplinary research team is well positioned to provide educational leadership to demonstrate the power of research approaches that bridge basic and more applied disciplines. We will be able to generate opportunities for interdisciplinary education that will rely heavily on visualization of microbiological and physical processes, in effect, a 'virtual' laboratory. An exhibit on the production of lipids by microalgae will be developed in collaboration with the Science Museum of Minnesota.