

Jean-Paul Toussaint: Chemical & Biological Engineering
Mentor: Ross Carlson, Florence Mus -- Chemical & Biological Engineering
Metabolic analysis of lipid accumulation in a microalga

As concern grows about the supply of fossil fuels, new alternative energy sources are being investigated including renewable biofuels. Microalgae represent a competitive biofuel strategy when compared with “traditional” agricultural crops. Green algae and diatoms are of considerable interest as a biodiesel source because they accumulate significant amounts of energy-rich compounds, such as triacylglycerol (TAG) that can be used to synthesize biodiesel. My research project investigates factors that control TAG accumulation in the marine diatom *Phaeodactylum tricornutum* using physiological and molecular approaches. The first phase of the project identified optimal growth conditions that promote TAG accumulation in *P. tricornutum*. It has been found that nitrogen limitation, pH stress and the addition of bicarbonate or acetate stimulate lipids accumulation in *P. tricornutum* cells by 5 to 10 fold as compared to controls. Fundamental physiological data including photosynthetic pigment content, protein levels and carbohydrate content have been collected and correlated to TAG synthesis. A transcriptomic analysis is currently in progress to identify and characterize essential genes involved in TAG accumulation. Information on the abundance of specific transcripts under lipids accumulation conditions will permit description of bioenergetic and metabolic processes involved in TAG accumulation and to identify associated regulatory factors. This project advances algal biofuels research by elucidating both the physiological and transcriptomic basis of TAG accumulation in the marine diatom *Phaeodactylum tricornutum* providing a rational basis for TAG synthesis control.