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High Throughput Screening for Compounds that Induce Lipid Accumulation in Algae for Biofuel Production

Abstract.

Global energy demand continues to increase and fossil fuel sources will likely become limiting within this century. One alternative is oil from algal sources, however, sufficient biomass and oil yields are presently limiting. We have performed pilot metabolome and proteome analyses in *Chlaydomonas reinhardtii* induced to accumulate lipid to 20-40% dry weight and found lipid production comes at the expense of reduced biomass. These findings led us to develop a high throughput screening system to identify chemical compounds that increase lipid production without compromising algal growth and without reducing photosynthetic capacity. We employed a test library of 1770 compounds from the NIH Molecular Libraries Program (MLP) collection. Five hit compounds were selected that caused lipid accumulation to at least 3 times the negative control level but did not affect total protein or chlorophyll levels. These data demonstrate the feasibility of screening large chemical libraries for lipid storage inducers. We propose to conduct an HTS screening of at least 100,000 compounds from the MLP using these newly devised methods. These compounds will be of value since: [1] with the appropriate testing for safety and efficacy, they can be used directly to induce lipid accumulation for biofuel production without compromising biomass; [2] they can be employed to identify pathway changes leading to lipid production using “omics” approaches; and [3] they may be useful to identify protein targets that channel metabolism toward lipid production using new mass spectrometry-based target capture methods.