Understanding the Role of Duckweed Transcription Factor in Triacylglycerol Metabolism and Abiotic Stress

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In nature, plant oils represent one of the most energy-rich sources of renewable hydrocarbons. They are stored as triacylglycerols (TAGs) or oils, which can be used as alternative feedstocks for biodiesel production. As an alternative feedstock, plant-based oils have several advantages over other fuels, including high energy content, no need for fermentation, compatibility with existing fuel technologies, and being environmentally friendly. Life cycle analyses have shown that the production and use of jet fuel from oilseeds can result in lower greenhouse gas emissions as compared to petroleum-derived fuels. However, supplies of these energy-rich oilseeds compounds are limited due to low crop yield and limited available arable land This project aims to use a combination of genomic, molecular biological, and biochemical analyses to explore transcription factor regulatory networks that regulate TAG/oils production in plants, and how they can be manipulated to increase the carbon conversion to oils in oilseed plants. Specifically, transcriptional regulators that have been found to increase oil content when over-expressed in *Arabidopsis* will be targeted to better understand the mechanism by which seed oil storage is enhanced. The central hypothesis of this project is that a transcription factor described in duckweed is also required to regulate TAG metabolism in Brassicaceae oilseed crops such as *Camelina*, Canola, and Pennycress. Three objectives will be pursued, which are to (1) determine requisite duckweed transcription factor functions in oil storage metabolism; (2) to alter oil content and agronomic performance in *Camelina*; and to (3) define an overall metabolic engineering strategy to leverage duckweed transcription factors for increasing TAG yield. Knowledge gained from this research will unlock new and creative avenues to use genetic engineering to enhance the TAG in oilseed crops, which will help fulfill the world’s growing fuel needs.