John Gordon

Manchester, MO

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Junior
Biochemistry

Faculty Mentor: Dr. Abe Koo, Biochemistry

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Engineering of High-Oil Plants and Characterization of Their Resistance to Biotic and Abiotic Stress

John Gordon, Aidan Ireton, and Abe Koo

Triacylglycerol (TAG) is a major chemical form of plant storage oil. Besides its use as vegetable cooking oil for human consumption it has numerous other applications as industrial feedstock and as renewable energy source for biofuel production. Hence, there have been constant efforts to increase oil content through various means including genetic engineering. The genes encoding WRINKLED-1 (WRI1) and BIOTIN ATTACHMENT DOMAIN-CONTAINING (BADC) proteins have been identified as genes of interest because they are key regulators in oil biosynthesis as a major transcription factor and a component of initial committed steps to Fatty Acid Synthesis machinery, respectively, and have shown a direct impact on the production of TAG. Genetic crossing of WRI1 Over Expressing (OE) plant lines and BADC RNA Interference (RNAi) lines were used in model plant Arabidopsis thaliana to enhance TAG accumulation. Oil content analysis and quantitative reverse transcriptase polymerase chain reaction experiments are underway to determine the effectiveness of this approach in increasing oil production and altering expression of either genes. WRI1-OE / BADC RNAi plant lines will also be subjected to bioassays designed to measure their resistance to insect pests and high temperatures. This will provide valuable data on any vulnerabilities that high-oil engineering crop plants may create out in the field. In an attempt to preemptively address these foreseeable vulnerabilities, the high-oil plants will be further transformed to express the gene that could enhance the production of jasmonic acid, a major hormone that regulates plant immunity. The final outcome will be to create an ideal bioenergy crop with high oil that can defend better against biotic and abiotic stresses.