Lipid droplets (LDs) are evolutionarily conserved organelles that not only function to store neutral lipids but participate in myriad other cellular functions, such as membrane biosynthesis and remodeling, stress responses, and protein turnover. While LDs are known to form at the endoplasmic reticulum (ER), the molecular mechanisms of LD biogenesis, maintenance, and breakdown are largely unknown, particularly in plants where few LD-related proteins have been identified and characterized.

To address this paucity of information, recent proteomics surveys of isolated LDs from *Arabidopsis thaliana* and protein-protein interaction studies with known plant LD proteins, including LDIP (LD-associated protein-interacting protein), were screened for new LD proteins. Using cell biology and genetic approaches, candidate proteins will be assessed in terms of their localization to LDs or other LD-associated intracellular compartments and whether alterations in their expression influences stored neutral lipid homeostasis and/or yields an aberrant LD phenotype. Additional planned research with promising candidate LD proteins will focus on mechanistic details underlying their function(s). Notably, preliminary results indicate that two selected candidate proteins, Early Response to Dehydration 7 (ERD7) and a protein of unknown function, localize to LDs. Additionally, mutant *erd7* plants and mutants of the v-ATPase subunit *De-etiolated 3 (det3)* appear to have a hyperaccumulation of leaf LDs, suggesting they serve roles in maintaining LD number. Overall, the proposed research will serve to improve our understanding of plant LDs by providing not only new insights to LD biology, but also potential avenues for future efforts aimed at increasing storage oil accumulation in bioenergy crops.