“Nature has been perfecting enzymes for at least three billion years because they carry out the hundreds of thousands of chemical reactions in all organisms, and these reactions are needed by us all to survive and prosper. We could learn a lot by understanding that three-billion-year-old experiment.”

Noel’s laboratory explores how specialized enzymes and metabolic pathways allowed plants to adapt and spread across the planet and what these mechanisms can tell us about improving modern-day agriculture. His team discovered a family of plant proteins that plays a role in the production of seed oils, substances important for animal and human nutrition, biorenewable chemicals and biofuels.

Plant oils are composed primarily of triglycerides, formed by linking together three fatty acid molecules, and are stored mostly in seeds, where they are used for energy during germination. Seeds are crucial sources of oils for nutrition, flavoring and industrial applications, such as the production of soap, cosmetics and biofuels. With growing concerns about global climate change and petroleum security, producing biofuels for use in transportation and energy generation is a burgeoning industry.

Scoring a rare scientific hat trick, Noel’s lab identified three related proteins in thale cress plants (*Arabidopsis thaliana*) that regulate the metabolism of fatty acids, chemical components of all cell membranes and vegetable oils. They dubbed these fatty-acid-binding proteins FAP1, FAP2 and FAP3. They found that the proteins bind fatty acids, including the major plant omega-3 fatty acid, an important nutritional component found in certain seeds.

This work has major implications for modulating the fatty acid profiles of plants, which is important to sustainable production of food, biorenewable chemicals and fuels. Because very high-energy molecules such as fatty acids are created in the plant by solar energy, these types of molecules may ultimately provide the most efficient sources for biorenewable products.

The findings of Noel’s lab may lead to the development of improved crops yielding higher qualities and quantities of oils, helping to address growing demands for food and fuel and the consequent environmental pressures on the world’s ecosystems. The discovery may also help bioengineers focused on creating new enzymes for industrial uses by revealing how nature evolves proteins into chemical machines known as enzymes.

For more information, please visit www.salk.edu/faculty/noel