# A new chloroplast role for making biofuels

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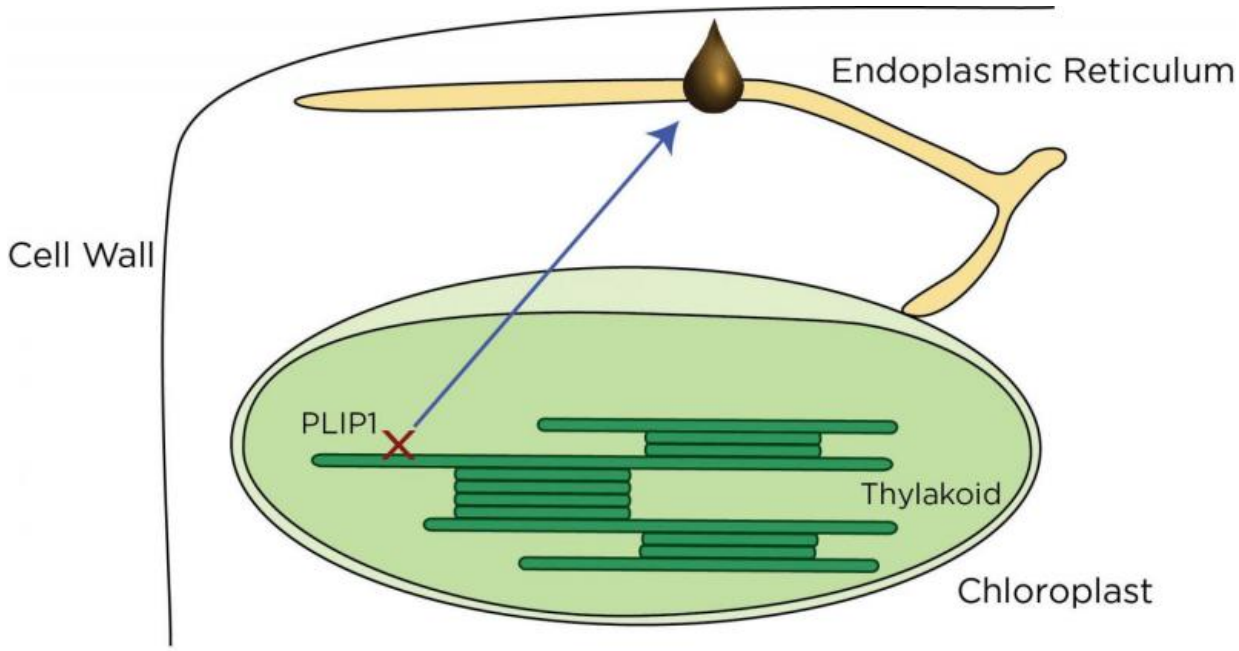


PLIP1 degrades internal chloroplast membranes surrounding the thylakoids. The left-over lipid products are transported to the endoplasmic reticulum, where they eventually turn into seed oil. Credit: MSU

Michigan State University researchers are experimenting with harvesting seed oil to make biofuels that could someday power our jets and cars.

In a recent study published in the journal *The Plant Cell*, the researchers show that the chloroplast, where plant photosynthesis occurs, also participates in new ways to provide seed oil precursors.

Seed oil, more commonly called vegetable oil, is made out of lipids, which are small molecules found in fats, oils, waxes and membranes that make up the boundaries of all living cell components. They also store a lot of energy.

The scientists identified a new enzyme, named PLIP1, or Plastid Lipade 1, that interacts with lipids inside the chloroplast.

"The enzyme breaks down lipids that make up the chloroplast's internal membranes, the thylakoids, to be precise. The use and recycling of lipids keeps chloroplast membranes adjusted to developmental or environmental changes," said Kun Wang, a graduate student in the department of biochemistry and molecular biology and researcher at the MSU-DOE Plant Research Laboratory.

Leftover lipid products are then transported to the endoplasmic reticulum, a massive cellular factory, where they become building blocks for seed oil.

Previously, it was thought that seed oil production is largely based in the endoplasmic reticulum.

"Now, we are finding that the chloroplast is responsible for 10% of seed oil precursors. That might seem like a low number. However, seed oil comes from many sources, and the main one is responsible for 20 to 40 percent of final product. So, 10 percent is significant," Wang said.

Wang wants to increase the level of PLIP1 in biofuel-targeted plants, so they produce more seed oil.

"One advantage with PLIP1 is that it is found in most land plants, which makes it easy to experiment on different species," Wang said.

Initial testing has unexpectedly led to a smaller plant with more oil per seed but fewer seeds, and higher defense activity.

"It seems oil production and plant defense functions don't coexist well. We have a few ideas to bypass this limitation, and we've already filled out a patent application to try a new strategy to increase seed oil yield, using PLIP1," Wang said.

Provided by Michigan State University

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