

# Divergent Evolution of Extreme Production of Variant Plant Monounsaturated Fatty Acids

## Background/Objective

- Novel monounsaturations broadens the functional uses of fatty acids in vegetable oils for oleochemical applications.
- Identifying new sources of unusual monounsaturated fatty acid-rich oils can be useful for discovering “new” fatty acid modification enzymes, understanding the structural basis of novel enzyme activities, and sourcing genes for oil functionality improvement.

## Approach

- Bioprosped for new sources of fatty acid modification enzymes and associated genes.

## Results

- Identified plant species that are “extreme” producers of petroselinic acid, a novel monounsaturated fatty acid.
- Identified a variant fatty acid desaturase, elucidated its 3D structure, and designed enzymes that produce new monounsaturated fatty acids.
- Identified genes from extreme producer to engineer new plant oil and microbial fatty acid compositions.

## Significance/Impacts

We used this information to develop enzymes that produce non-naturally occurring monounsaturated fatty acids and sourced genes from these species to engineer “new” plant oil and microbial fatty acid compositions for enhanced bioproduct value.

Gan, L., Park, K., Chai, J., Updike, E.M., Kim, H., Voshall, A., Behera, S., Yu, X., Cai, Y., Zhang, C., Wilson, M.A., Mower, J.P., Moriyama, E.N., Zhang, C., Kaewsuwan, S., Liu, Q., Shanklin, J., Cahoon, E.B. July 22, 2022. "Divergent Evolution of Extreme Production of Variant Plant Monounsaturated Fatty Acids." *PNAS*. DOI: 10.1073/pnas.2201160119

