# Researchers identify an important gene for a healthy, nutritious plant

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Dartmouth biologists have found a gene required for both efficient photosynthesis and for iron metabolism, processes necessary for producing a healthy plant and a nutritious food source. This research is part of a larger effort to learn how plants take up essential nutrients from the environment as they grow.

The research paper, published with colleagues from Colorado State University and the University of South Carolina, appeared in the early online edition of the *Proceedings of the National Academy of Science* during the week of July 21.

"There's a lot of attention today on global food shortages," says Mary Lou Guerinot, the principal investigator on the study and one of the authors of the paper. "We've found a gene that is key for proper chloroplast function. This finding might some day help scientists develop plants that grow better and can serve as more nutritious food."

During photosynthesis, chloroplasts are the subcellular compartment used by plant cells to convert light energy to sugars, fueling the plant. This process in the chloroplasts requires iron, and up to 90 percent of the iron in leaf cells is located in chloroplasts. In this study, Guerinot and her colleagues provide molecular evidence that FRO7, a gene in the FRO family, is involved in chloroplast iron acquisition and is required for efficient photosynthesis. The FRO family is a group of proteins that transfers electrons from ferric iron (Fe3+) to reduce it to another kind of iron (Fe2+). This same lab showed that this process (reduction of iron)

was essential for plants to take up iron into the roots from the soil in a study published in 1999 in Nature.

"We have now shown that an analogous process is required for proper chloroplast function," says Guerinot. "Moreover, without FRO7, plants sown in iron deficient soil died as young seedlings. Our findings are of particular interest because how iron gets into chloroplasts has not been well understood despite the significance of iron in chloroplasts."

Guerinot explains that one-third of the soil worldwide is iron deficient, so it is important to understand how plants acquire iron, allocate iron to different parts of the plant and within the cell, and survive under iron limiting conditions. This is not only critical to improve plant growth and crop yields but also to improve human nutrition. According to the World Health Organization, iron deficiency is the most prevalent nutritional disorder in the world today and most people get their iron from eating plants.

"Enriching crops with mineral and vitamin nutrients will provide sustainable solutions to malnutrition," she says.

The work was funded by the National Science Foundation. The title of the paper is, "Chloroplast Fe(III) chelate reductase activity is essential for seedling viability under iron limiting conditions." Co-authors on this paper include Dartmouth graduate student Jeeyon Jeong, with Erin Connolly and Loubna Kerkeb at the University of South Carolina, and Marinus Pilon and Chris Cohu at Colorado State University.

Provided by Dartmouth College