New plant databases and models could lead to more nutritious foods

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(Phys.org)—Creating virtual plants could solve real problems, such as reducing vitamin deficiencies in humans, according to University of Florida researchers.

They are developing databases and computer models to show how and where B vitamins are made in plants, knowledge scientists believe they can use to guide plant breeding projects, such as increasing plants' vitamin contents, leading to more nutritious foods.

The research is detailed in the current issue of the Journal of Experimental Botany as part of the Darwin Review series.

Vitamin B deficiencies are common the world over, including the U.S., and lack of B vitamins in the diet can cause serious health problems, such as cardiovascular disease and birth defects. These problems most often occur when one crop becomes a major dietary staple.

Common sources of B vitamins—which include thiamin, riboflavin, niacin and folate—are whole, unprocessed foods such as whole grains, green leafy vegetables and legumes.

The databases being developed are the foundation for models, or computer simulations, of the way B vitamins are created in plants. When complete, researchers can use the models to test ways to increase vitamin B in the system before experimenting on plants, said lead researcher Andrew Hanson, perhaps increasing the speed at which improvednutrient crops can be produced.

Hanson, an eminent scholar in UF's horticultural sciences department, part of the Institute of Food and Agricultural Sciences, said the models could also allow researchers to speed up the creation of plants for use in biofuel and bioplastic production.

"B vitamin pathways are involved in everything," Hanson said. "You can't make biofuels or polymer constituents without the involvement of the cofactors that come from B vitamins."

Dean DellaPenna, a biochemistry and molecular biology professor at Michigan State University and an authority on plant micronutrient biosynthesis, said the research will help guide scientists as they work to improve crop varieties.

"Understanding the pathways leading to B vitamin synthesis in plants will give researchers knowledge, a map of sorts, for balancing the B vitamin content of major crops," DellaPenna said. "This is especially important for developing countries where people depend on a single crop for the majority of their calories."

The models show both what is and isn't known about the creation of B vitamins.

Hanson said his team has begun filling in missing parts of the models, which are publicly available at pubseed.theseed.org/seedviewer … gi?page=PlantGateway , and hopes others will contribute as well.

"These models define targets for discovery of B vitamin genes that are missing, and other mysteries that need to be addressed with the tools of comparative genomics, genetics, biochemistry, analytical chemistry and metabolic modeling," he said.

The models are part of the SEED database, which contains detailed information on the genes in thousands of sequenced genomes. A genome is the full set of genetic information of an organism.

The research focuses on corn, a major food source for people and animals, as well as a biofuel source, and Arabidopsis, a small-genome plant often used to better understand other plants.

Study authors also include Svetlana Gerdes of Argonne National Laboratory in Argonne, Ill.; Valérie de Crécy-Lagard and Claudia Lerma-Ortiz in UF's department of microbiology and cell science; Océane Frelin in UF's horticultural sciences department; and Christopher S. Henry and Samuel M.D. Seaver with the Argonne National Laboratory and the Computation Institute at the University of Chicago.

Project members who helped conceive the study include Jesse Gregory, a UF professor in food science and human nutrition, and Don McCarty, a UF professor in horticultural sciences.

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