New discovery will enhance yield and quality of cereal and bioenergy crops

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A team of scientists led by Thomas Brutnell, Ph.D., director of the Enterprise Rent-A-Car Institute for Renewable Fuels at the Donald Danforth Plant Science Center have developed a new way of identifying genes that are important for photosynthesis in maize, and in rice. Their research helps to prioritize candidate genes that can be used for crop improvement and revealed new pathways and information about how plants fix carbon. The findings, published in "Comparative analyses of C4 and C3 photosynthesis in developing leaves of maize and rice," on October 12, 2014 in *Nature Biotechnology*, also made public a mathematical model enabling access to datasets comparing C4 photosynthesis traits in plants like maize to C3 photosynthesis in plants like rice.

C4 crops including maize, sorghum, switchgrass and sugarcane are able to withstand drought, heat, nitrogen and carbon dioxide limitations better than C3 crops, such as rice, wheat, barley and oats, due to their ability to efficiently make use of carbon dioxide and water that make carbohydrates we eat and cell wall polysaccharides; the sugars that are important to producing next-generation biofuels.

"Our research focuses on understanding complex network interactions in grasses with a goal of engineering C4 traits into C3 grasses which can be translated into crops that impact the supply of food and fuel," said Brutnell. "The technologies that our team developed to identify regulatory genes that enhance photosynthesis in C4 crops can be extended to identify control points for other processes including nitrogen

and phosphate efficiency as well as a plant's response to environmental stresses like heat and drought."

The Danforth Center has expanded their portfolio over the years by studying model C4 grasses to improve the quality, yield and biomass of emerging bioenergy feedstocks such as miscanthus and switchgrass and that can be applied to improve food security and major cereal crops.

Todd Mockler, Ph.D., Geraldine and Robert Virgil Distinguished Investigator and Doug Bryant, Ph.D., director of the bioinformatics core facility have developed algorithms and technology to better understand important genes and genomes for a variety of significant crops using model plants. "The regulatory genes that impact photosynthesis are critically important for enhancing growth and yield and improving carbon capture in both food and bioenergy crops," said Mockler.

Provided by Donald Danforth Plant Science Center

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