Determining traits from genes

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Through a two-step process, scientists demonstrated a way to predict how an organism will look and behave based on its genes, a feat impossible before this study. Credit: Nathan Johnson, PNNL Creative Services.

Advanced technologies allow scientists to decipher information about genes faster and more accurately than ever before. But bridging the gap between the genome and how it will be expressed has proven challenging. Scientists used a model grass to demonstrate, for the first time, a two-step process that links genes to internal properties of a plant and in turn links those internal properties to plant growth traits.

Advances in medicine, nutrition, and agriculture rely on the ability to study a set of genes inside an organism and predict how that organism will look or behave. These external traits have always been considered a complex interaction between biochemical and physiological properties

and the environment. The new process developed under this research bridges this gap between what scientists see on the inside and what everyone sees on the outside. This knowledge could help researchers develop plants that are more tolerant of changes in their environment and improve human disease diagnosis.

Staff at EMSL, the Environmental Molecular Sciences Laboratory, a U.S. Department of Energy Office of Science user facility, partnered with colleagues at Pacific Northwest National Laboratory and the Joint Genome Institute to study stiff grass (*Brachypodium distachyon*). Using EMSL's linear ion trap quadrupole Orbitrap mass spectrometer, they looked at biochemical and physiological properties as internal traits—the final internal expression of an organism's genes— focusing specifically on metabolites. They then compared these internal traits to external traits such as biomass accumulation, the amount of biomass allocated above and below ground, and drought tolerance. These traits are important for selecting or designing crops and for managing agricultural systems to meet increasing demands for food, animal feed, and energy production. The scientists discovered that a two-step process—comparing genes to internal traits and then comparing internal traits to external traits—could allow them to accurately predict external traits from genomic information. This study is the first in a series of investigations to examine gene diversity in stiff grass across different environmental conditions and determine how external traits can be predicted.

More information: Pubudu P. Handakumbura et al. Metabotyping as a Stopover in Genome-to-Phenome Mapping, *Scientific Reports* (2019). DOI: 10.1038/s41598-019-38483-0

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