Phylogenomic Discovery and Engineering of Nitrogen Fixation into the Bioenergy Woody Crop Poplar

Jean-Michel Ané,1 Pamela Soltis,2,3 Douglas Soltis,2,3 Robert Guralnick,2,3 Ryan Folk,2,3 Sushmita Roy,1 and Matias Kirst2* (mkirst@ufl.edu)

1University of Wisconsin, Madison; 2University of Florida, Gainesville; 3Florida Museum of Natural History, Gainesville

URL: http://nit_fix.org; Twitter: @nit_fix

Nitrogen (N) availability is critical for high biomass productivity of bioenergy crops. Despite the abundance of N\(_2\) in the atmosphere, plants cannot access it. Instead, plants must absorb available N in the soil, provided through intensive and costly fertilization. Some species acquired the capability to obtain N through a mutualistic relationship with bacteria and archaea, but this capability is absent from most bioenergy crops. Our overall goal is to discover the underlying genome novelties that evolved this mutualistic relationship using a comparative phylogenetic framework to contrast related species that possess and lack this ability. Genomic novelties will be evaluated for their effect on root nodule development in Medicago (nodulating) and poplar hairy root organ cultures (non-nodulating). Next will engineer nodule development in poplar plants and test the impact of these structures on N-fixation, whole-plant development and biomass productivity and composition.

This project is funded by the Biosystems Design Program from the Biological and Environmental Research (BER) Office of Science at the U.S. Department of Energy (grant #DE-SC0018247).