A Plant-Responsive Bacterial Signaling System Senses an Ethanolamine Derivative

Contacts: **Bruna Coutinho, coutinho@uw.edu**
E. P. Greenberg (206) 616-2881, epgreen@uw.edu
Dale Pelletier, pelletierda@ornl.gov (865)576-2857

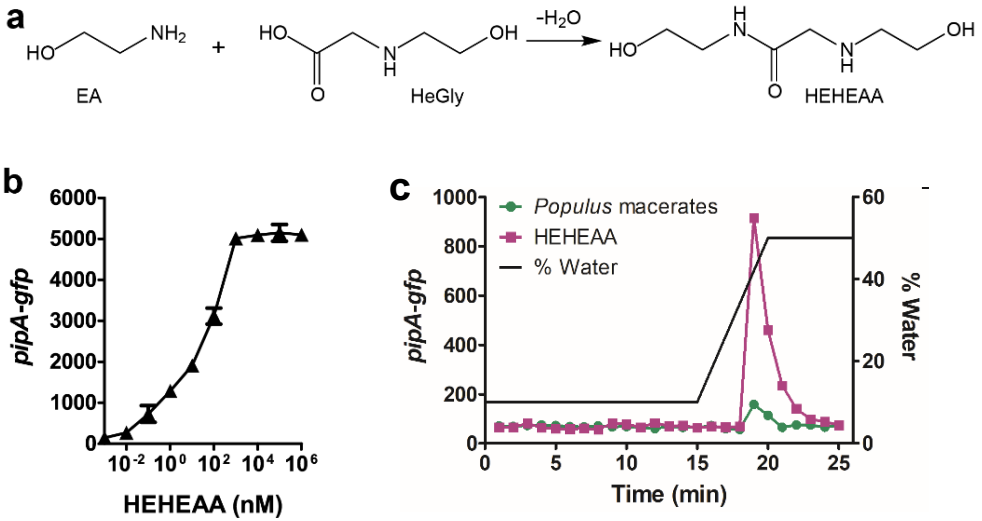
Funding Source: DOE Office of Biological and Environmental Research, Genomic Science Program

Background

- Many plant-associated bacteria, including those isolated from roots of *Populus*, possess regulatory proteins (e.g., PipR) that respond to unknown plant signals to control genes involved in plant-bacteria interactions.
- The *Populus* root endophyte *Pseudomonas* sp. GM79, uses a specific ABC-transporter to import a plant signal to the cytoplasm where it activates PipR and upregulates the expression of a peptidase-encoding gene (*pipA*).

Science

- We identified *N*-(2-hydroxyethyl)-2-(2-hydroxyethylamino) acetamide (HEHEAA) as the compound that binds to the ABC transporter and serves as a potent (pM) PipR-dependent inducer.
- Bioassay-active material in *Populus* leaf macerates co-elutes with HEHEAA by HPLC fractionation, suggesting HEHEAA is present in plant macerates.
- HEHEAA forms spontaneously from ethanolamine (EA), a component of plant phospholipids.



Picomolar amounts of HEHEAA, a compound spontaneously formed from EA, activate PipR and induce *pipA* expression in *Pseudomonas* sp. GM79. a) HEHEAA formation from EA and *N*-(2-hydroxyethyl)glycine (HeGly), another EA derivative. b) Activation of the *pipA* promoter in the *Pseudomonas* GM79 (pPpipA -gfp) bioassay by HEHEAA. c) Bioassay activity of HPLC-fractionated leaf macerates and synthetic HEHEAA. The black line indicates the water gradient.

Significance

- Identification of a GM79 PipR activator sets the stage for understanding interkingdom signaling and for identifying plant-derived signals for other PipR receptors, which are present in dozens of bacterial species associated with economically important plants.

U.S. DEPARTMENT OF ENERGY | Office of Science

Coutinho *et al.* 2018 manuscript accepted in PNAS USA