Microbial biogeography in light of traits

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Community variation

What are the patterns over space/time?
What underlies these patterns?
What do they mean for microbial functioning?
Microbial traits

- Cellulose degradation
- Organic phosphate utilization
- Bacteriophage host range
- Biofilm formation
- Nitrogen fixation
- Salinity preference

Simple → Complex
Are microbial traits conserved?

Web-of-life (Ford Doolittle)

Allison and Martiny 2008 *PNAS*
Whole genomes / metabolic traits

Adam Martiny et al. 2013 ISME J
Distribution data / response traits

Mike Goulden, UCI

Amend et al. 2016 ISME J
How deeply are traits conserved?
The depth of trait conservation

A hierarchy of trait conservation?

Martiny et al. 2015 *Science*
Trait conservation and biogeography

Traits
- pH
- Carbon substrate use

Phylum
- Genus

Taxonomic/gene resolution

Martiny et al. 2015 *Science*
Prochlorococcus and trait conservation

A. Martiny et al. 2009
Implications of phylogenetic trait hierarchy

- Biogeographic patterns observed will depend on genetic resolution.

- The genetic/taxonomic level of compositional variation provides a hypothesis about the traits under selection.
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