Metabolic interactions in microbial communities

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Program in Systems Biology
Microbiology and Physiological Systems
Cellular heterogeneity

Bacterial differentiation

Metabolite production
• ~ 1.7% of genome
• 2.5 megaDalton enzymatic machine
• 581 Da specialized metabolite
Coculture antibiotic assay
Coculture antibiotic assay

Pathogen
Coculture promotes antibiotic production

*Microbispora* sp. Monoculture

Coculture

*Microbispora* sp. Monoculture
Coculture to identify cell-cell signals

- Monoculture
- Coculture
- Monoculture

**Killing**
- Analyzed ~1,500 genomes
- Identified those with unusual biosynthetic gene clusters
- We selected 127 strains
- Performed > 5,000 pairwise cocultures

- Growth

- Biofilm

2017, *mSystems*, Grubbs and Bleich et al.
Coculture to identify cell-cell signals

Monoculture Coculture Monoculture

Killing

Growth

Biofilm

Influenced

Influencer

2017, mSystems, Grubbs and Bleich et al.
Cellular heterogeneity
Cellular heterogeneity

Gene1

YPet

PsdpA
PsboA
PtapA
Selected 18 genes of interest (physiology and metabolites)

Built 153 dual-labeled strains
**Intraspecies signaling**

- *B. cereus* Thiocillin
- *E. coli* Enterobactin
- DAPG
- *P. protegens*

**Interspecies signaling**

- 2011, PNAS, EA Shank et al.
- 2015, PNAS, R Bleich et al.
- 2015, JBact, M Powers et al.
- 2017, AEM, G Grandchamp et al.
Transparent Soil

2020, *eLife*, K Sharma et al. (Accepted)
Fungal hyphae
Shank Lab

We are recruiting!

Email me at Elizabeth.Shank@umassmed.edu

Collaborators

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