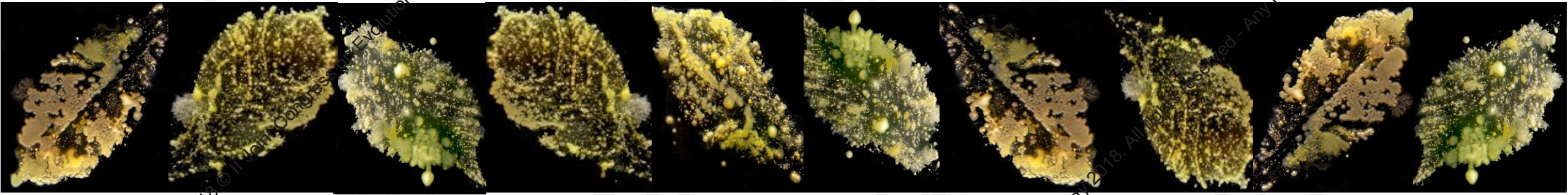


Nutrient and dose dependent microbiome-mediated protection against a plant pathogen

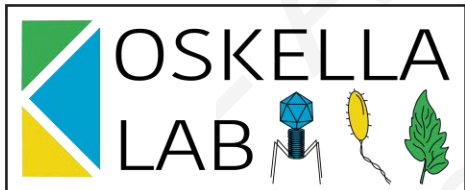


Britt Koskella

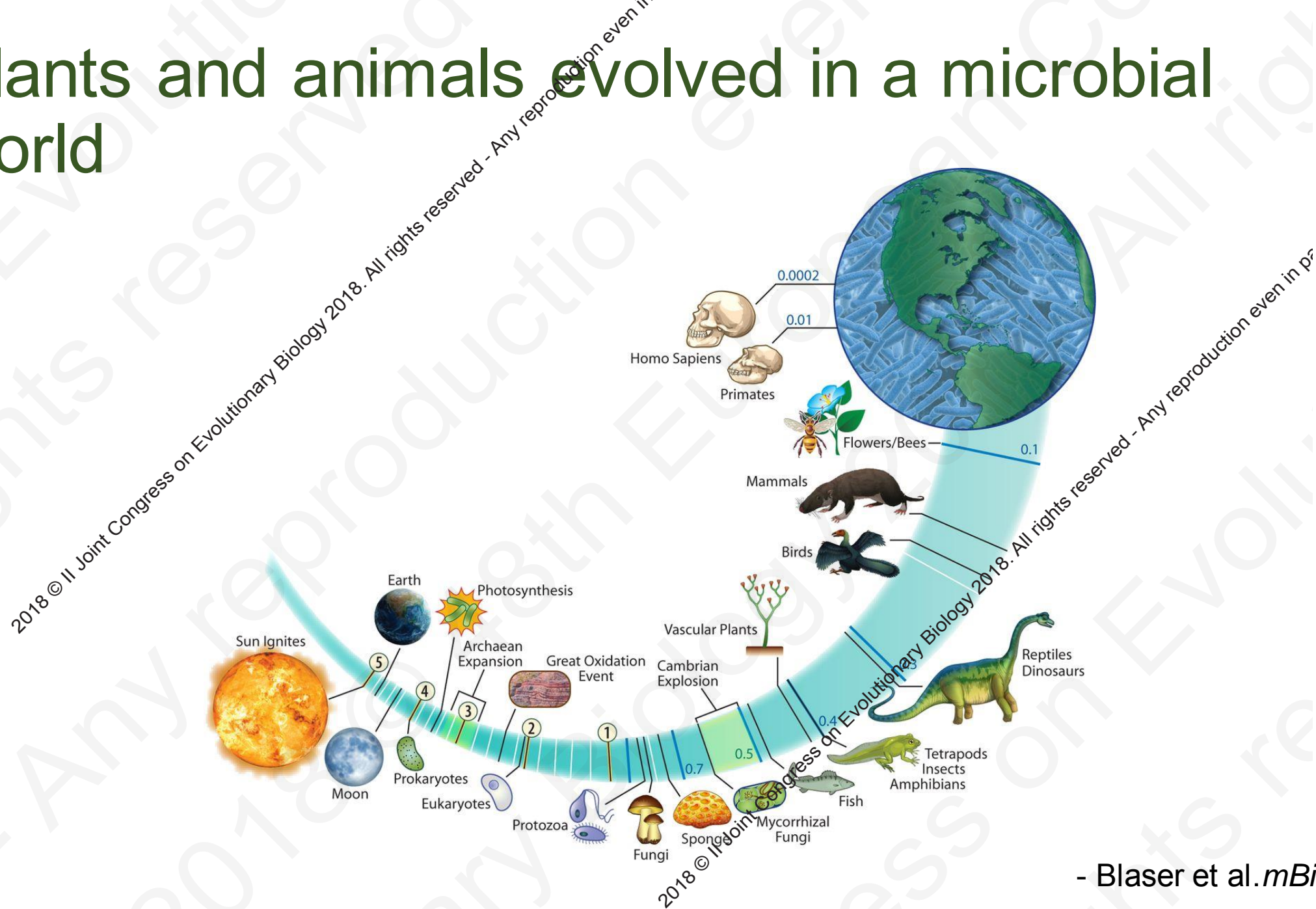
@bkoskella 

Assistant Professor, Integrative Biology

UC Berkeley

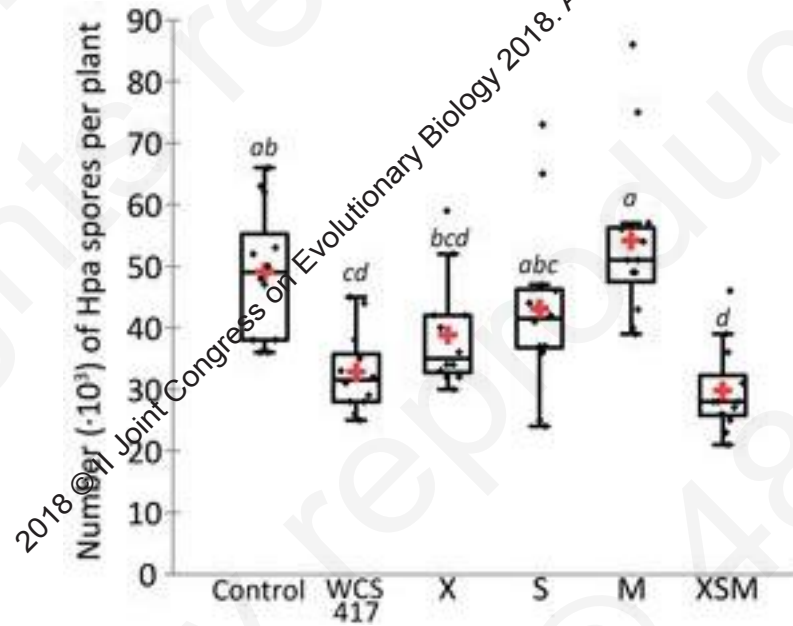


Plants and animals evolved in a microbial world



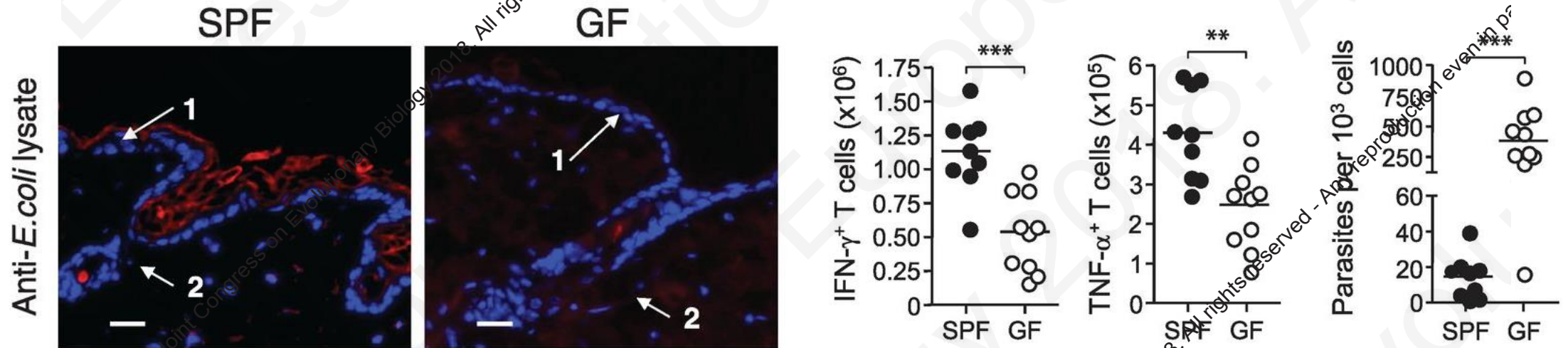
- Blaser et al. *mBio* 2016

Plants' and animals' immune systems evolved in a microbial world



Colonization of the rhizosphere of Arabidopsis plants induced systemic resistance against downy mildew.

Plants' and animals' immune systems evolved in a microbial world



Protective immunity to a cutaneous pathogen in mice is dependent on the skin microbiota, which tune function of local T cells.

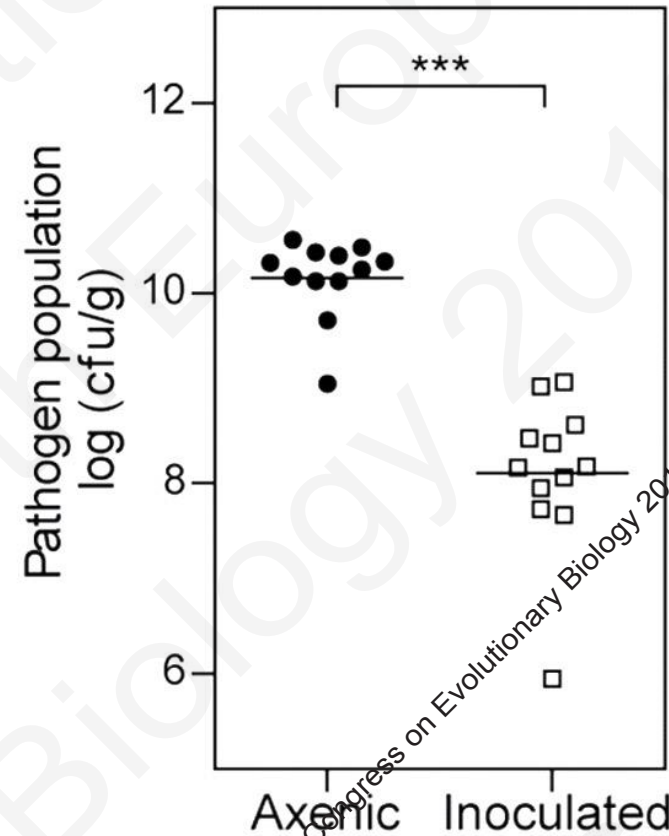
Host-associated microbes can directly impact pathogen colonization and growth

19 dpi

Axenic
plants + Pst

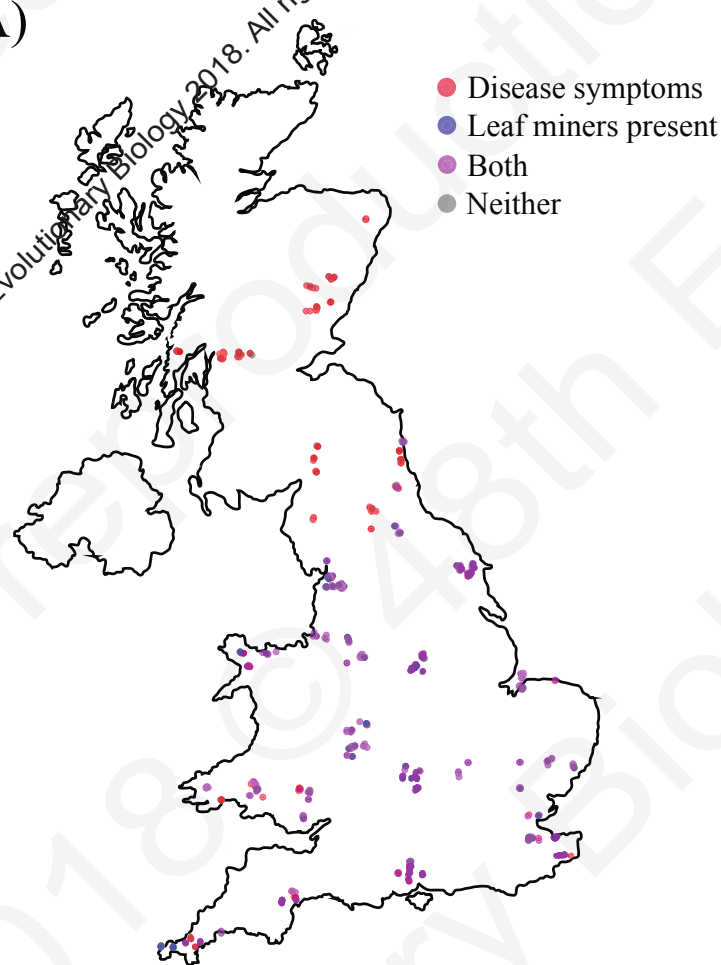


Sphingomonas
leaf-inoculated
plants + Pst



Horse chestnut tree bark microbiome is associated with bleeding canker disease

A)



B)



4.5

Disease severity

1.0
0.8
0.6
0.4
0.2
0.0



Jessica Metcalf

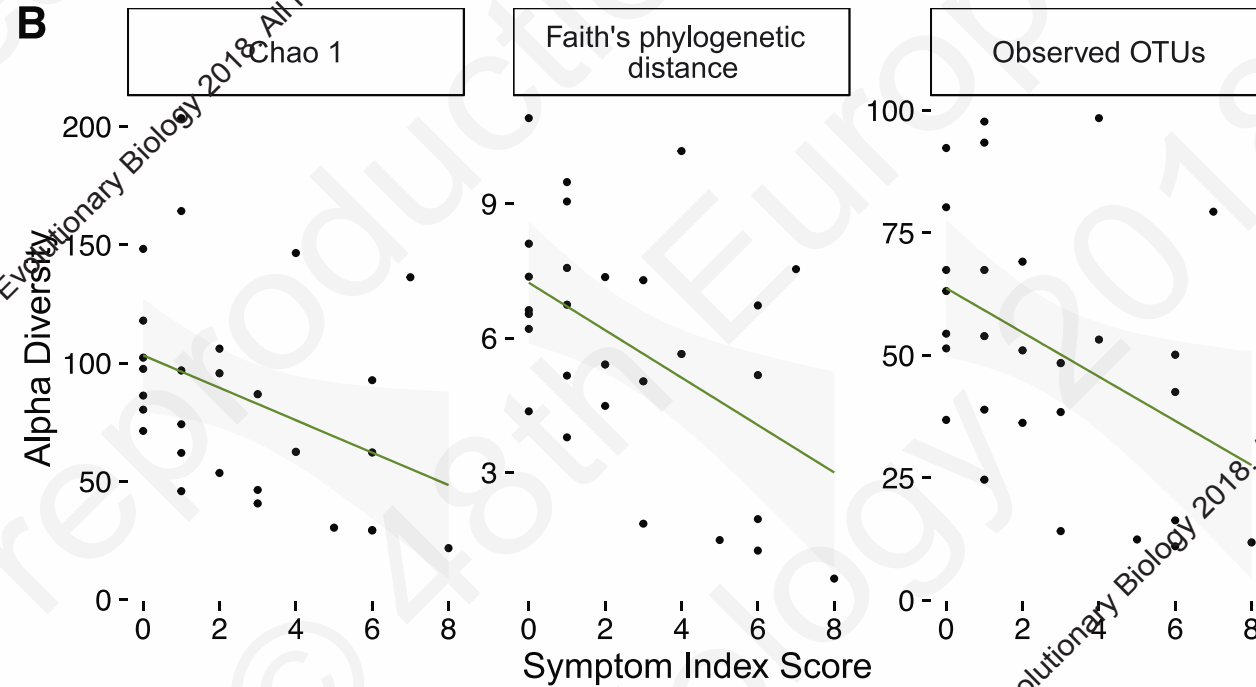
Tree diameter at breast height (cm, log scale)

- Koskella et al. *New Phytol* 2017

C)

D)

Horse chestnut tree bark microbiome is associated with bleeding canker disease



Decreasing diversity with disease status in asymptomatic tissues.



Jessica Metcalf

- Koskella et al. *New Phytol* 2017

Moving from correlation to causation using the tomato phyllosphere as a model system



Spray
Inoculation



Droplet Digital PCR



Maureen Berg

- Berg & Koskella *Curr Biol* 2018

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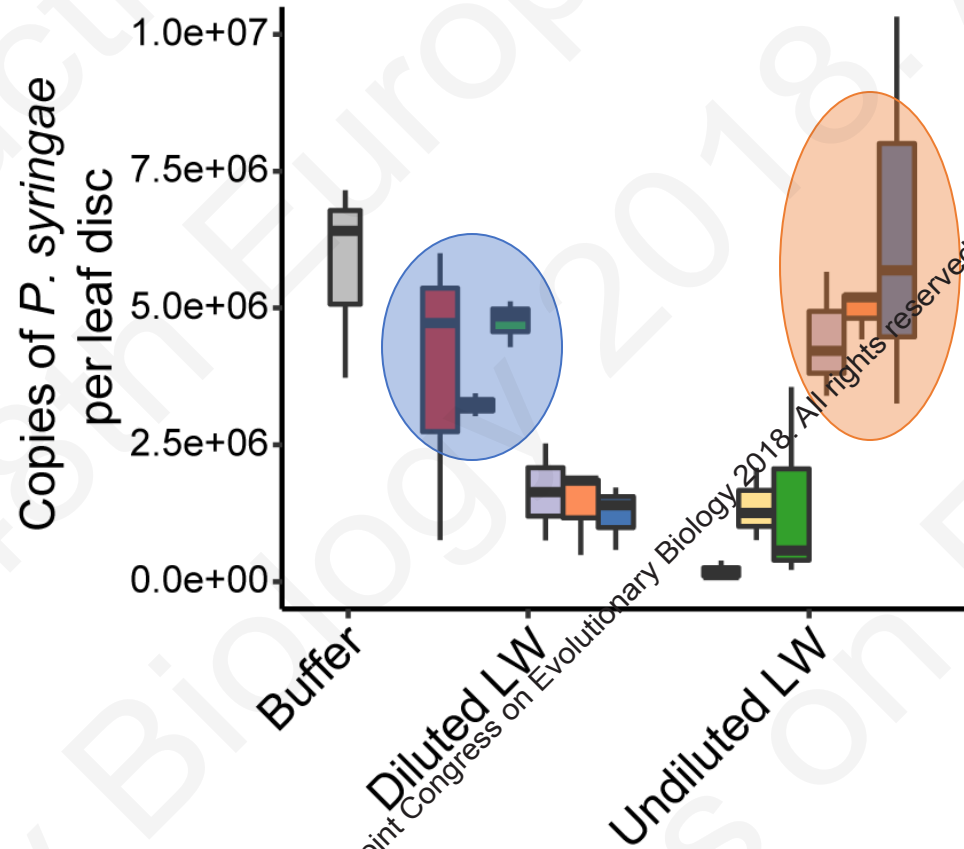
Moving from correlation to causation using the tomato phyllosphere as a model system



Spray
Inoculation



Droplet Digital PCR



Maureen Berg

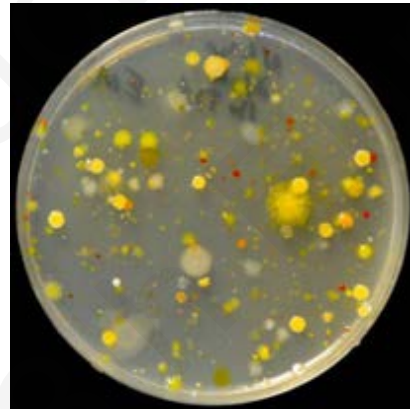
- Berg & Koskella *Curr Biol* 2018

Moving from correlation to causation using the tomato phyllosphere as a model system

Spray
Inoculation



Droplet Digital PCR



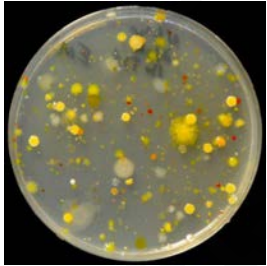
12 member constructed community



Maureen Berg

- Berg & Koskella *Curr Biol* 2018

Protective effect of phyllosphere is dose dependent - more is *not* better

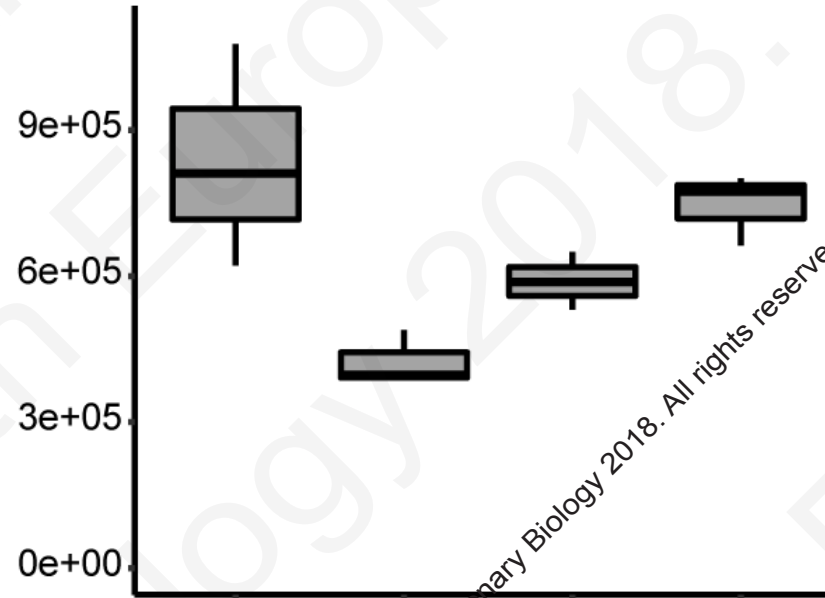


Spray
Inoculation



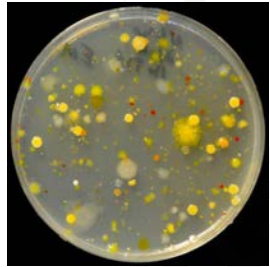
Droplet Digital PCR

Copies of *P. syringae*
per leaf disc



Maureen Berg

Protective effect of phyllosphere depends (non-linearly) on community composition

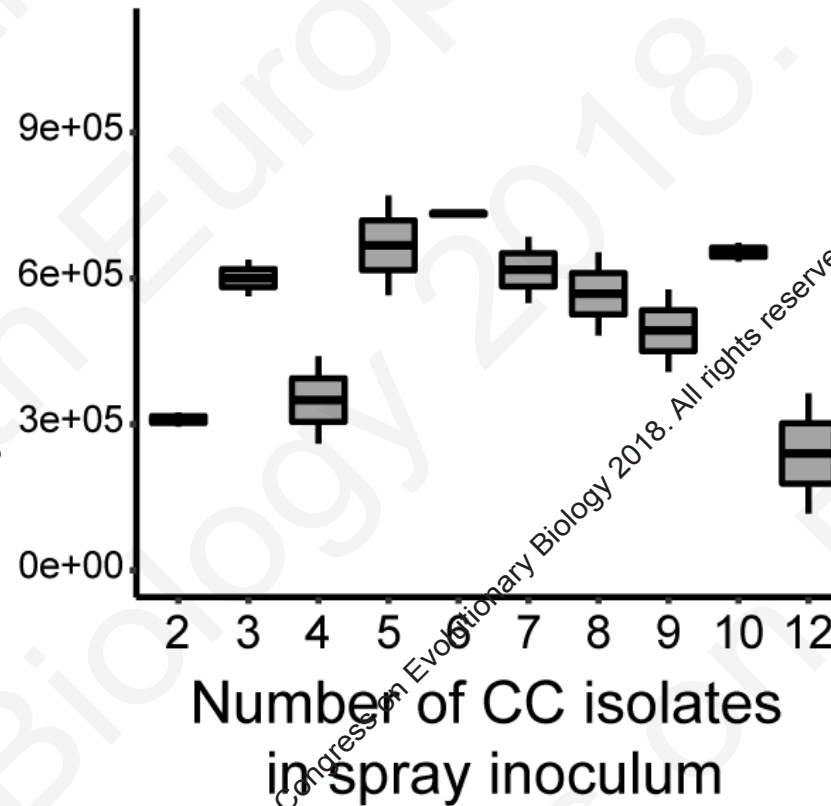


Spray
Inoculation



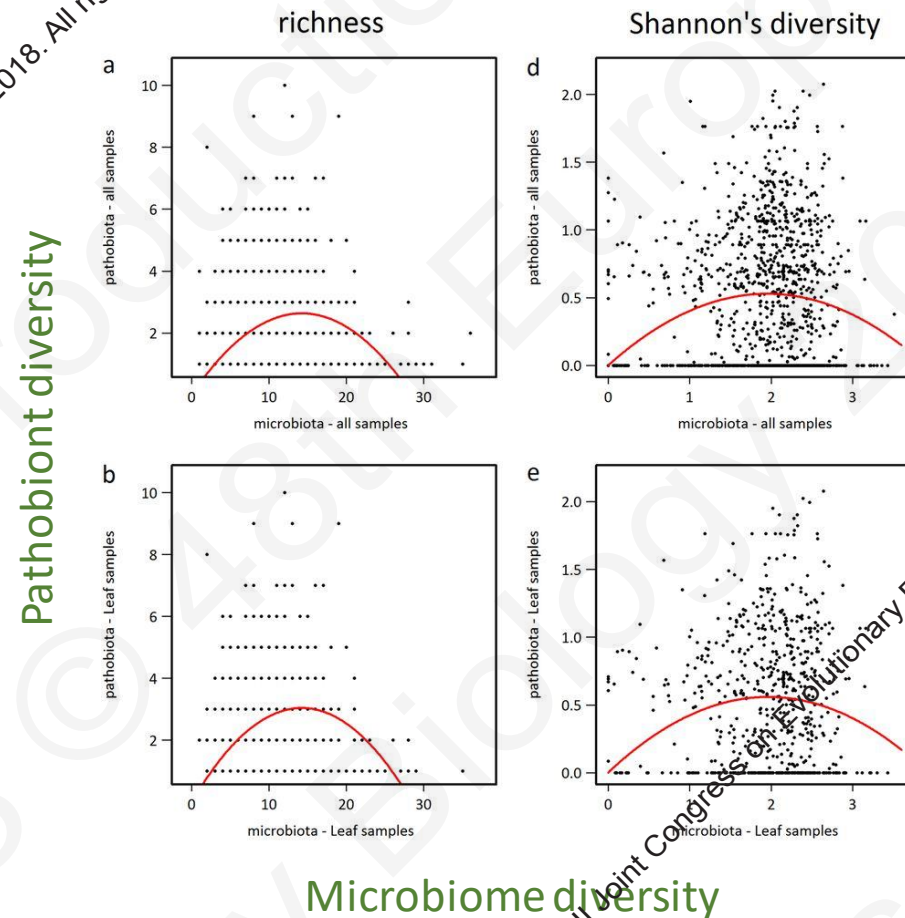
Droplet Digital PCR

Copies of *P. syringae*
per leaf disc

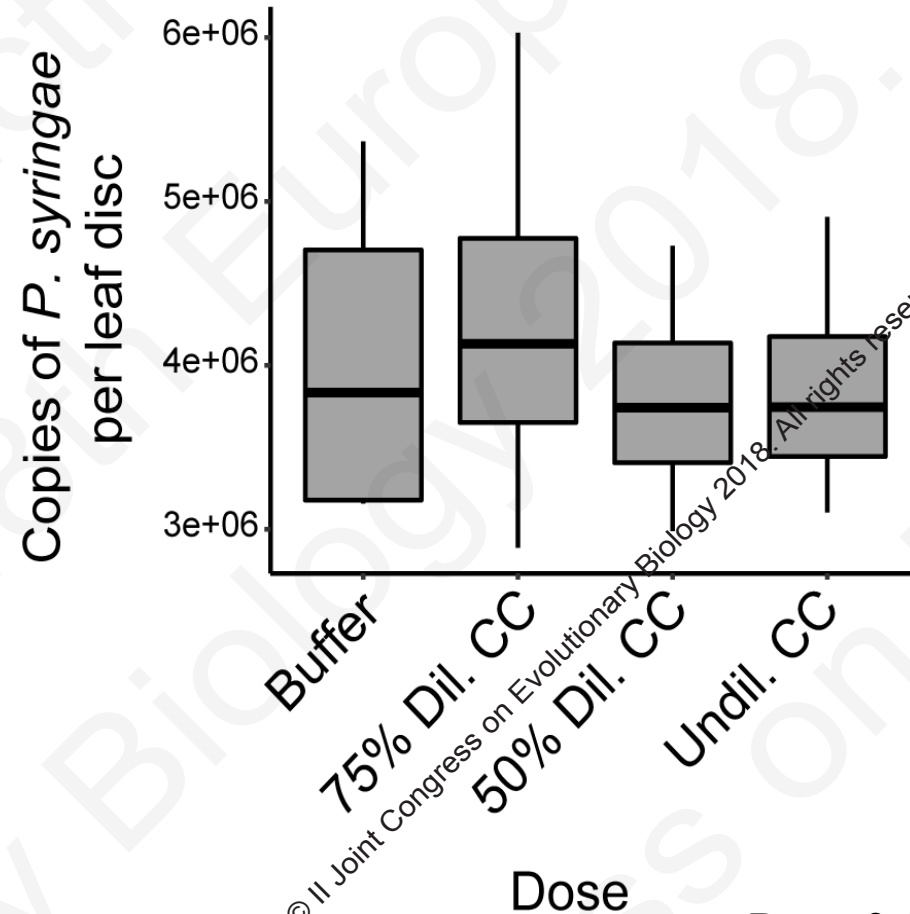
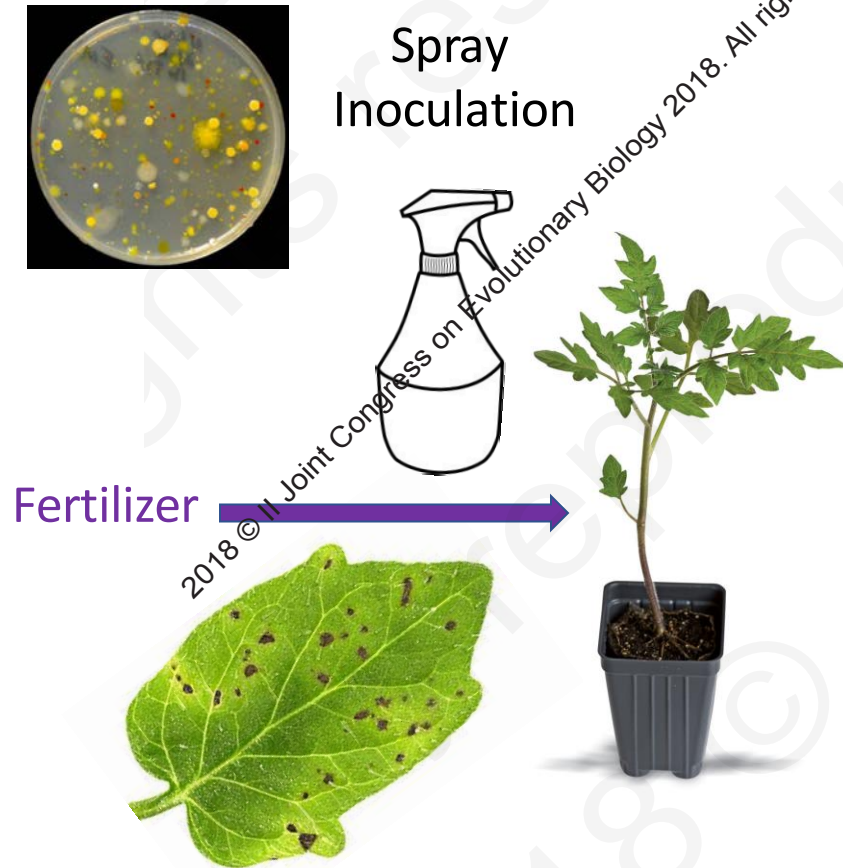


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Matches natural patterns from *Arabidopsis thaliana*



Repeat experiments at your own risk... (and reward)

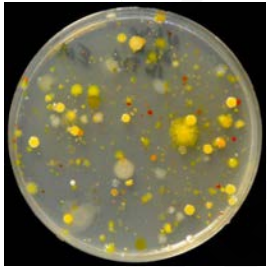


Maureen Berg

Droplet Digital PCR

- Berg & Koskella *Curr Biol* 2018

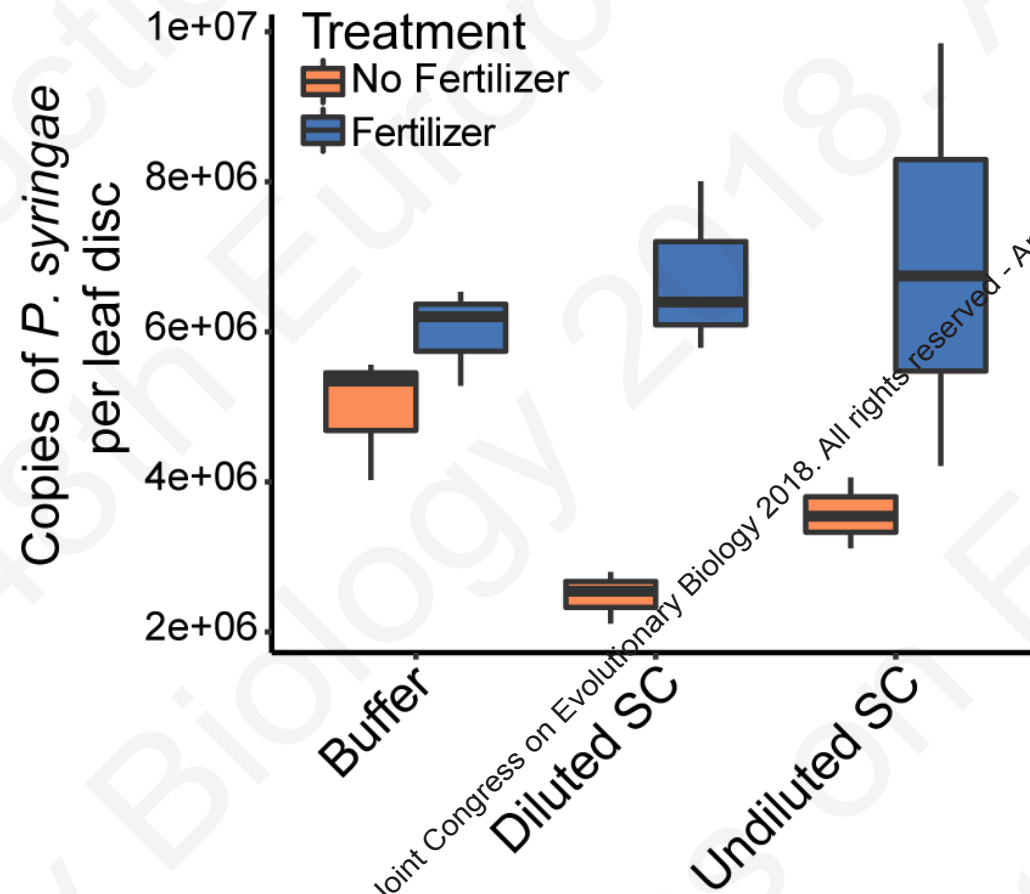
Protective effect of the phyllosphere depends on host nutrient environment



Spray
Inoculation



Droplet Digital PCR



Maureen Berg

Many questions remain, including....

Does microbiome-mediated protection *reduce* selection for host genetic resistance?

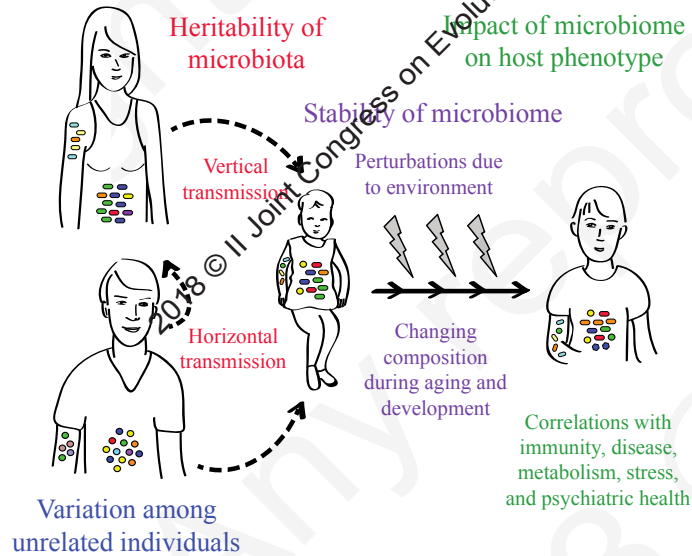


Biotypes that protective symbionts have higher, rather than lower, levels of intrinsic resistance.

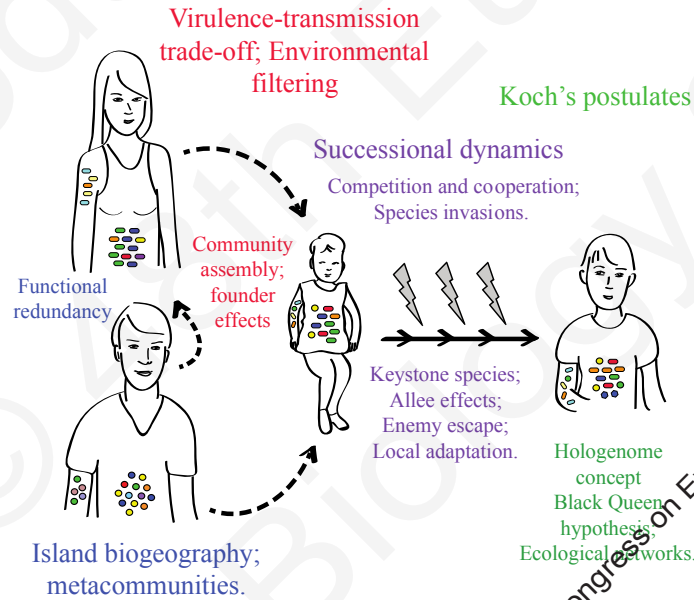
The microbiome beyond the horizon of ecological and evolutionary theory

Britt Koskella^{1*}, Lindsay J. Hall² and C. Jessica E. Metcalf³

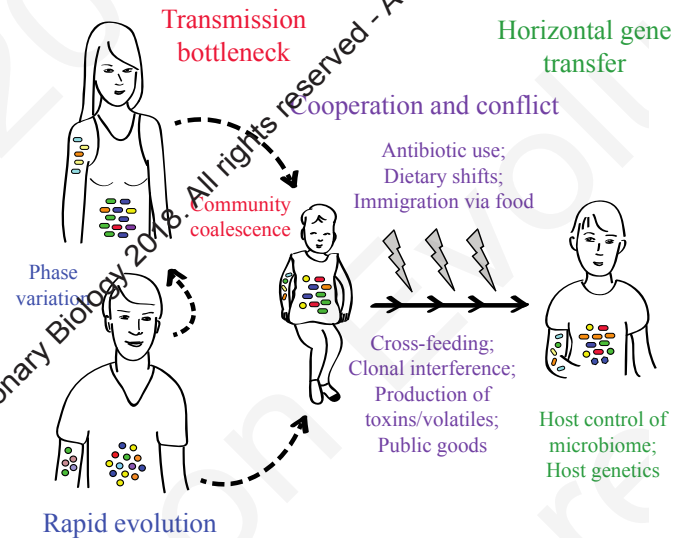
A) Observed patterns to be explained



B) Application of current theories and approaches



C) Important/unique properties of the microbiome



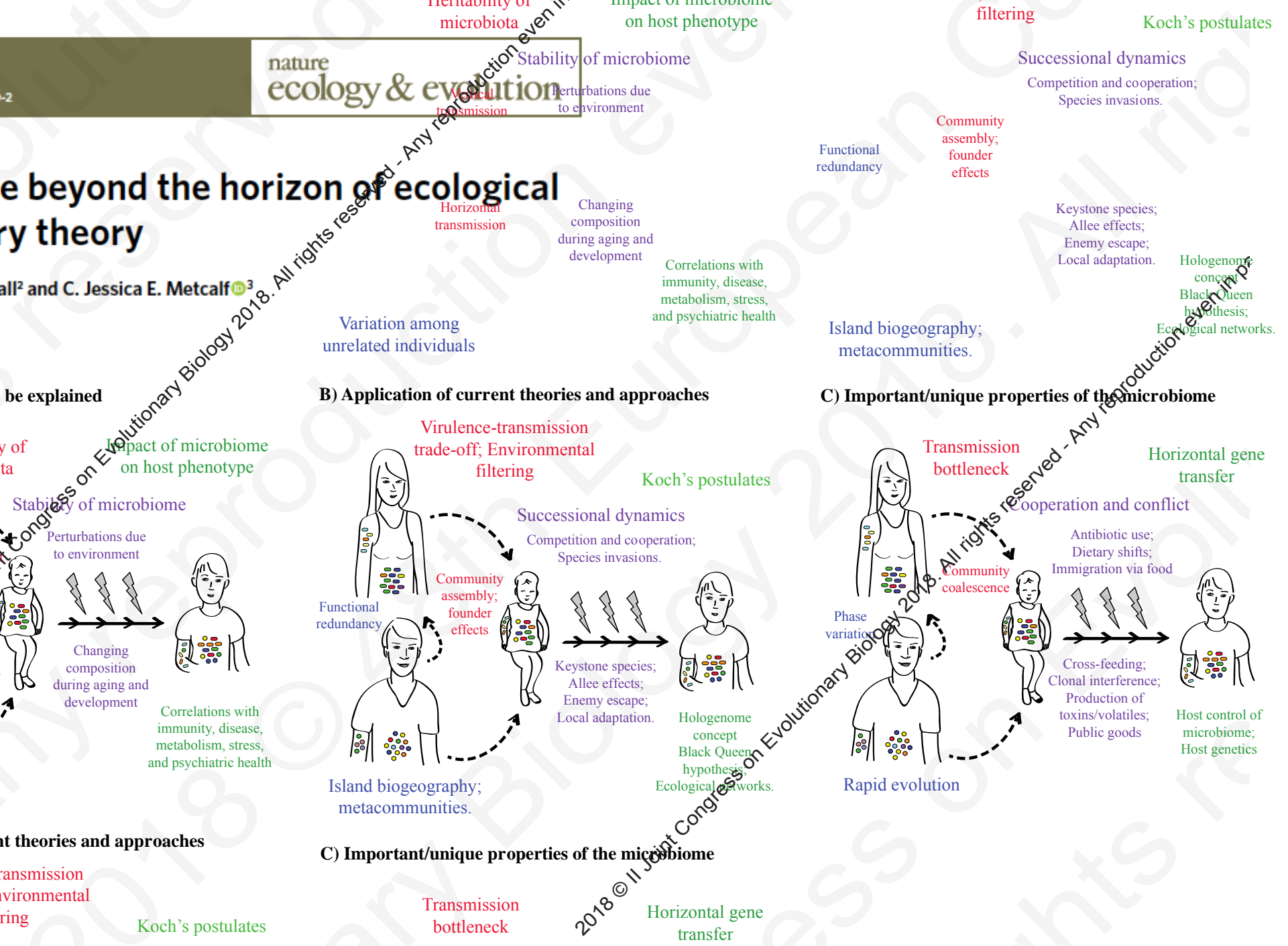
B) Application of current theories and approaches

Virulence-transmission trade-off; Environmental filtering
Koch's postulates
Successional dynamics

C) Important/unique properties of the microbiome

Transmission bottleneck
Horizontal gene transfer
Cooperation and conflict

Heritability of microbiota
Impact of microbiome on host phenotype
Stability of microbiome
Perturbations due to environment
Horizontal transmission
Changing composition during aging and development
Correlations with immunity, disease, metabolism, stress, and psychiatric health
Functional redundancy
Community assembly; founder effects
Successional dynamics
Competition and cooperation; Species invasions.
Keystone species; Allee effects; Enemy escape; Local adaptation.
Hologenome concept
Black Queen hypothesis;
Ecological networks.
Island biogeography; metacommunities.



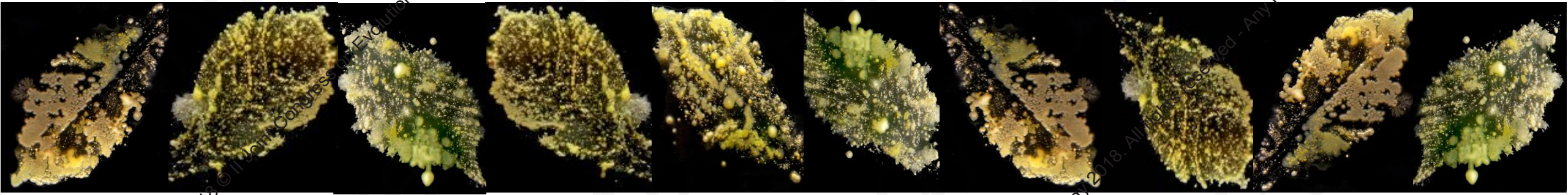
P-0179

Multi-generational passaging and
adaptation of the phyllosphere
microbiome on genetically distinct
hosts

Norma Morella



Nutrient and dose dependent microbiome-mediated protection against a plant pathogen

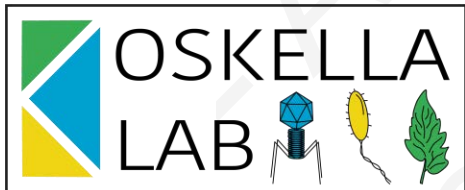


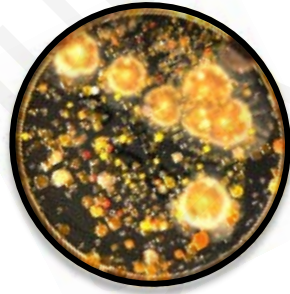
Britt Koskella

@bkoskella 

Assistant Professor, Integrative Biology

UC Berkeley





Glad you asked.....

Isolate Number	Top BLAST ID	Present in communities
3	Curtobacterium oceanosedimentum	full
14	Pseudomonas rhizosphaerae	full
19	Pseudomonas rhizosphaerae	full; 10
5	Pseudomonas coleopterorum	full; 9-10
20	Xanthomonas campestris	full; 8-10
11	Pseudomonas coleopterorum	full; 7-10
13	Pseudomonas psychrotolerans	full; 6-10
6	Curtobacterium oceanosedimentum/pusillum	full; 5-10
12	Pseudomonas coleopterorum	full; 4-10
17	Frigoribacterium faeni	full; 3-10
2	Bacillus megaterium	full; 2-10
7	Massilia aurea	full; 2-10

Table S2. Members of the constructed communities used in experiment 3, related to Figure 2B. All isolates were originally found on the leaves of tomato plants growing under natural field conditions. Bacterial isolates within the constructed community were identified using the full-length 16s rDNA gene sequence. The “full” community contains all 12 isolates; communities 2-10 represent the number of isolates included in the given community.



Maureen Berg

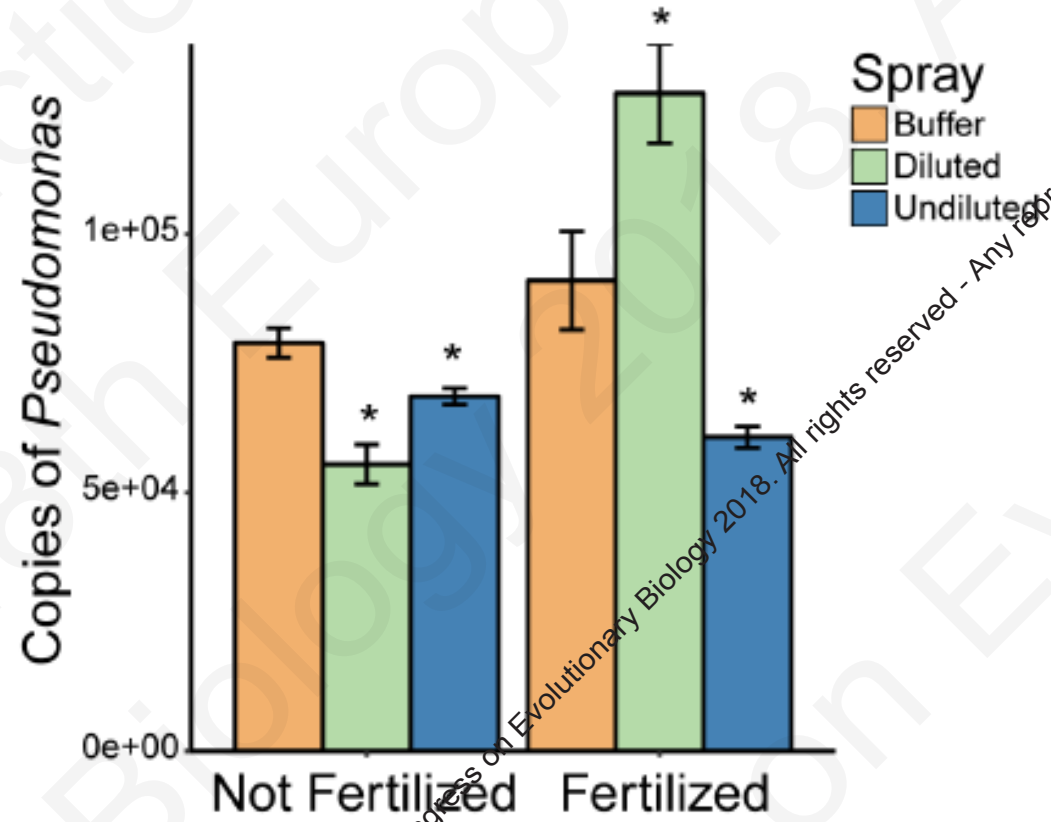
Glad you asked.....



Spray
Inoculation



Droplet Digital PCR



Maureen Berg