



National Microbiome Initiative: Opportunities for Research and Policy

September 29 , 2016

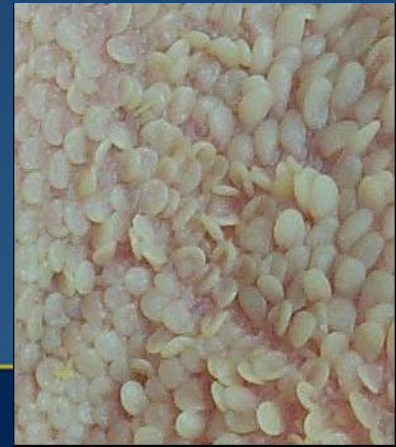
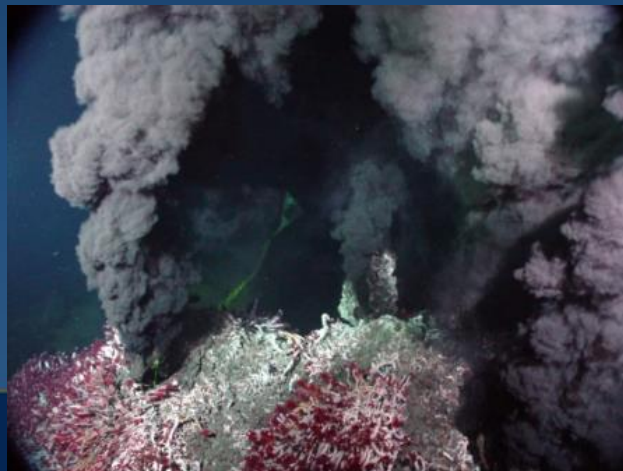
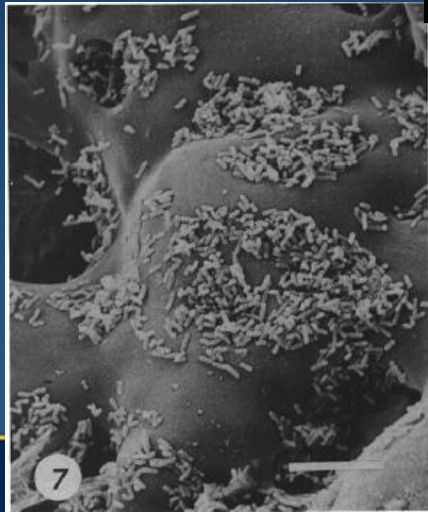
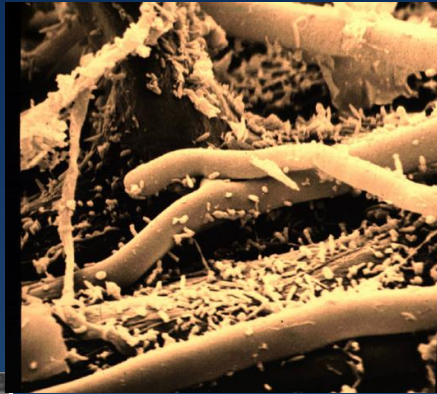
Jo Handelsman
Associate Director for Science
White House
Office of Science and Technology Policy

**Microbiome – the collection of
microorganisms associated with a particular
habitat**



Microbiome – the collection of microorganisms associated with a particular habitat

VIRTUALLY EVERY HABITAT ON EARTH



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Topics

- ❖ Origins of the National Microbiome Initiative
- ❖ Goals of the Initiative
- ❖ Commitments
- ❖ Challenges and Policy



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Obama Administration Priorities

❖ Applications needed for President's priorities

Precision medicine

Energy

Agriculture

Climate change

❖ Economic growth

Private-sector investments in the microbiome
have surged



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Fact finding

OSTP

- ❖ Convened 12 Federal departments and agencies
- ❖ Convened several groups of scientists
- ❖ Issued request for information in Federal Register



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Cross-cutting Themes Emerged

Common questions across biological systems

- ❖ What is a healthy microbiome?
- ❖ What is the nature of a robustness?

Technology needed to

- ❖ Detect, measure, and model in multi-dimensions the chemical currency of microbial communities
- ❖ Develop computational tools to analyze vast datasets
- ❖ Model community behavior

Applications

- ❖ Alter microbiomes predictably and reliably

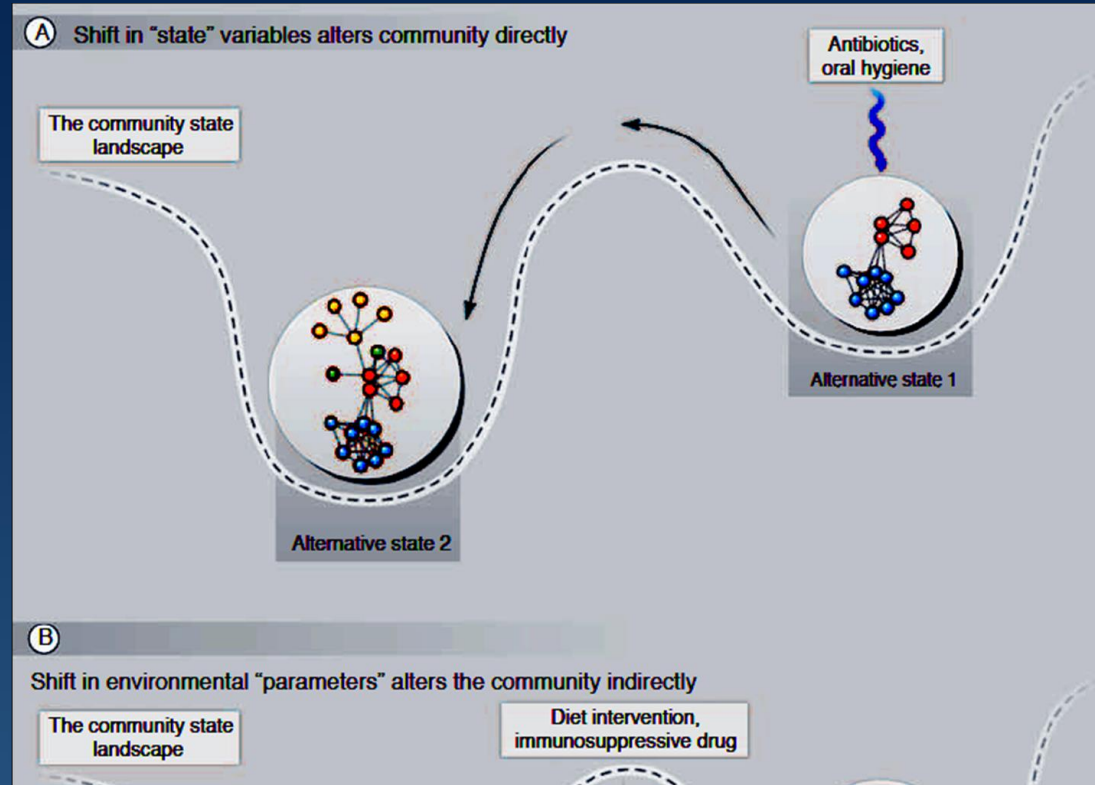
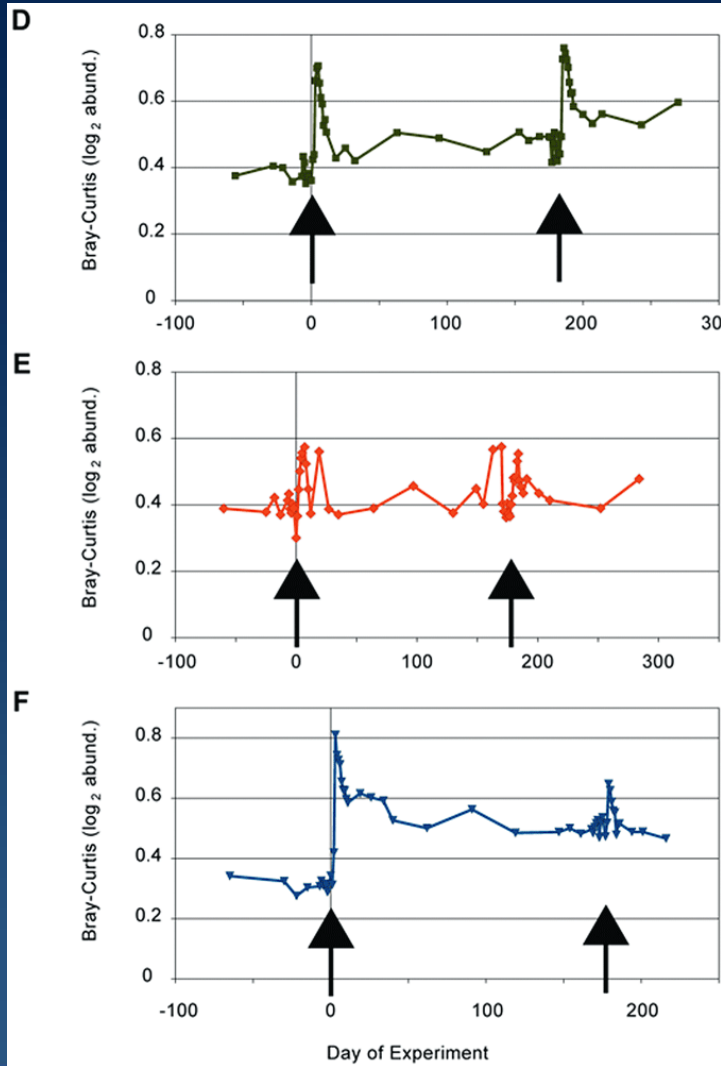


Parallels Among Microbiomes

Examples



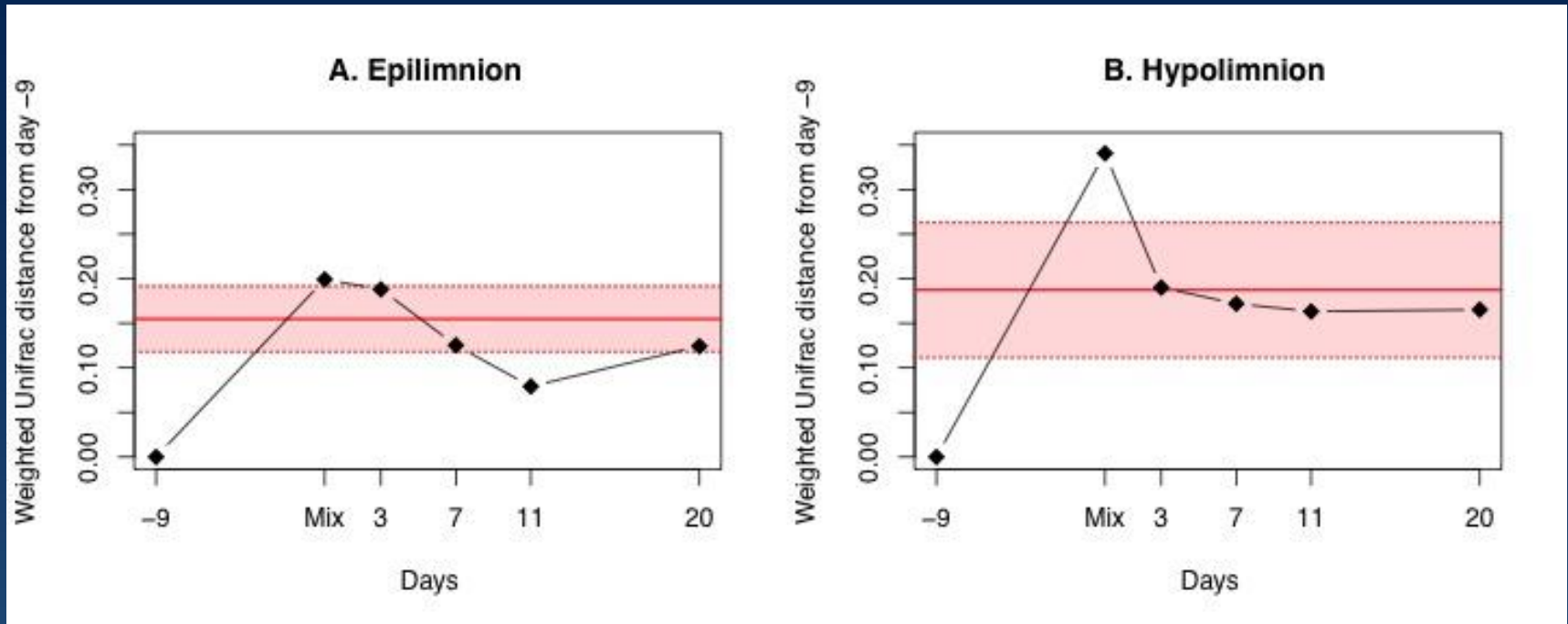
Gut Microbiome Behavior After Antibiotics



Relman, D. Nutr Rev. 2012 70:S2-S9.



Lake Microbiome After Mixing Disturbance



Weighted UniFrac distances between each July time point and the day before the mixing manipulation began, day -9. **(a)** Epilimnion (0 m) UniFrac distances. **(b)** Hypolimnion (4 m) UniFrac distances. The red line is the overall mean UniFrac distance for all possible epilimnion or hypolimnion July pairs. The dotted lines and red shading show one standard deviation from the overall mean. Pyrosequencing data were used for this analysis.



To harness microbiomes, we need to

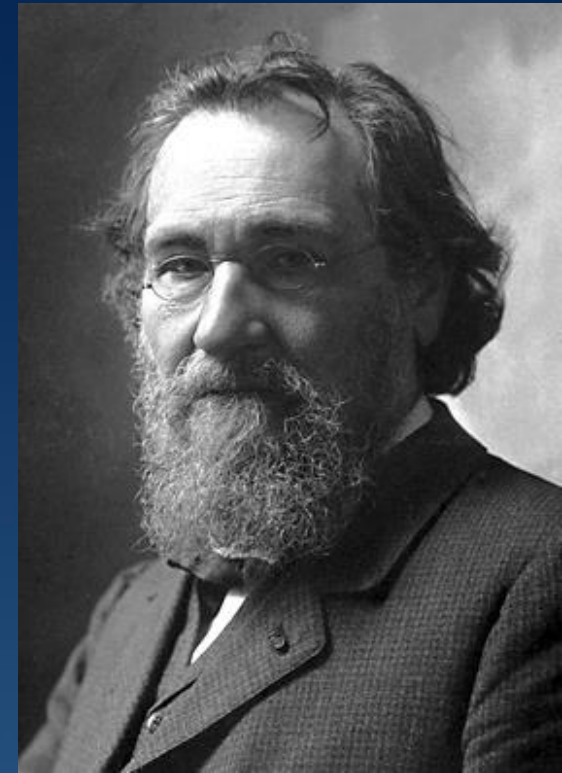
Alter microbiomes predictably and reliably

Understand robustness



Attempting to change microbiomes is not new

- ❖ Mechnikov consumed liters of yogurt containing *Lactobacillus* each day
- ❖ *Lactobacillus* disappeared from his microbiome upon cessation of yogurt consumption
- ❖ **Many microbiomes are resistant to and recover from change**



Ilya Ilyich Mechnikov
~1900



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Goals of the Initiative

- ❖ Interdisciplinary research on fundamental questions about diverse microbiomes.
- ❖ Platform technologies for probing and changing microbiomes and data access.
- ❖ New workforce through citizen science, public engagement, and educational opportunities.



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Commitments

- U.S. Government invested more than **\$900 million** over 2012-2014 in microbiome research

New Investments

- **\$120 million** of U.S. Government-supported research
- **\$400 million** in new commitments from non-Government groups



Community-Driven Research

- Collaborations between academic researchers and community groups
 - Ministries for Precision Health and University of Chicago
 - Problems defined by community (impact of sickle cell and PTSD from exposure to gun violence on the microbiome)
 - Scientific expertise and funding provided by researchers
- Encourage other collaborations between communities with particular health concerns and microbiome researchers
 - Effects of exposure of urban communities to toxins
 - Effects of exposure of rural communities to farm animals or pesticides
 - Effect of soil management practices on soil microbiome



Predicted Outcomes of The National Microbiome Initiative

- Unifying ecological principles
- Tools to probe microbiomes — microscopic and chemical profiles
- Tools to change microbiomes
- Products for humans, animals, agriculture, and environmental quality
- New model for research collaboration between communities and microbiome researchers



What universities can do....

- Organize interdisciplinary discussions about the microbiome
- Share research grant opportunities broadly (NSF, DOE, USDA)
- Provide campus support for microbiome group proposals
- Initiate inter-campus collaborations to generate diverse teams
- Solicit matching funds from industry for microbiome research
- Encourage and facilitate community-research collaborations to engage public in microbiome education and research



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@jo44

<https://www.whitehouse.gov/blog/2016/05/13/announcing-national-microbiome-initiative>

