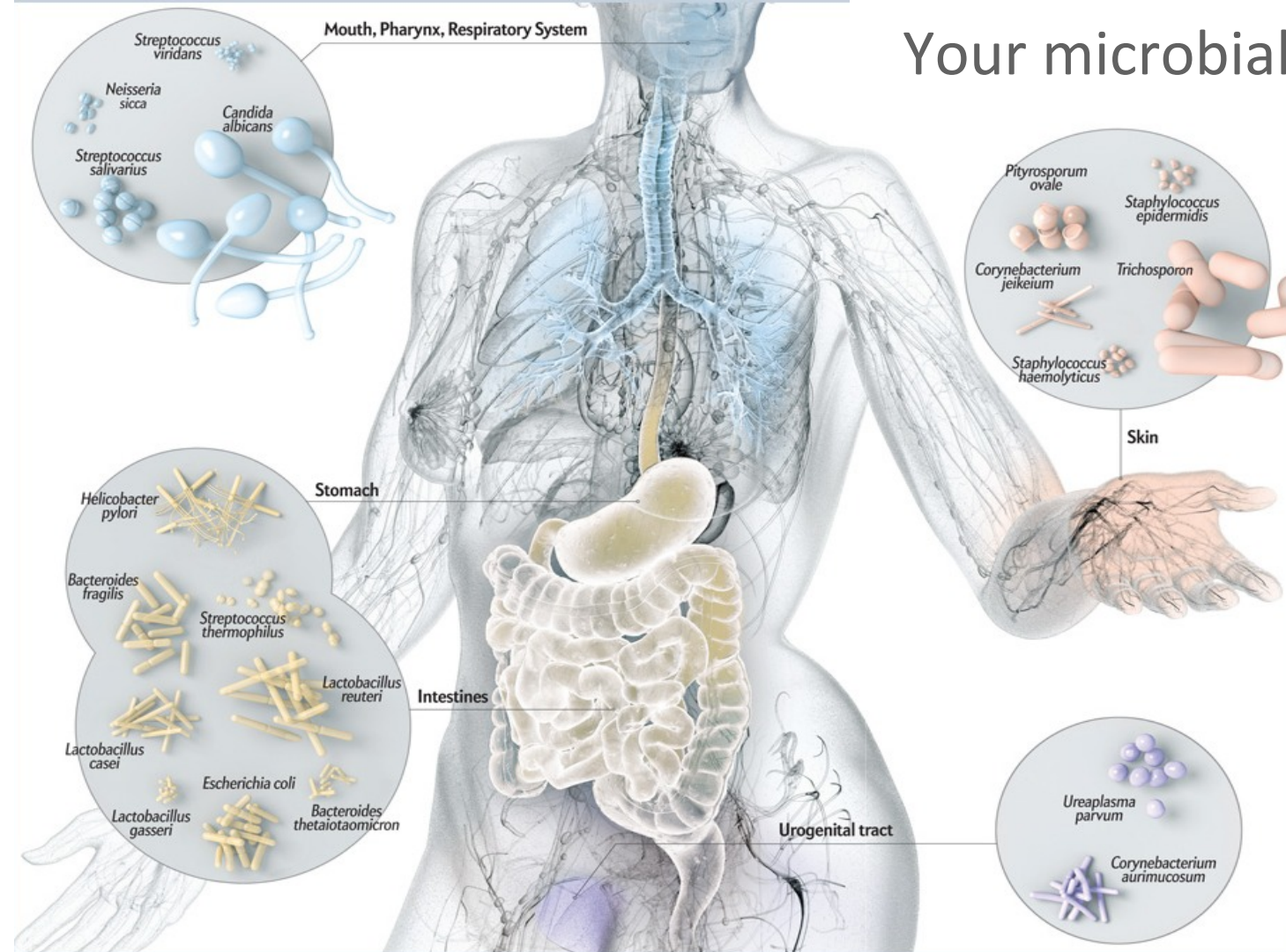


The Microbiome of the Built Environment

Jack A Gilbert

@gilbertjacka

Your microbial body!



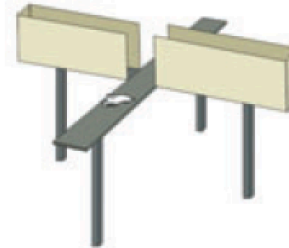
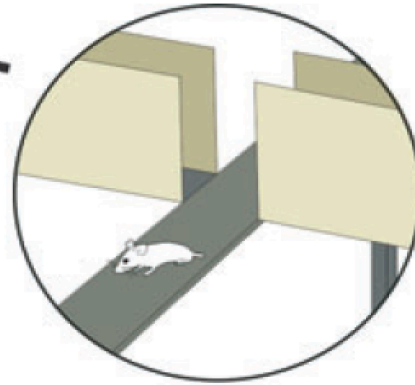
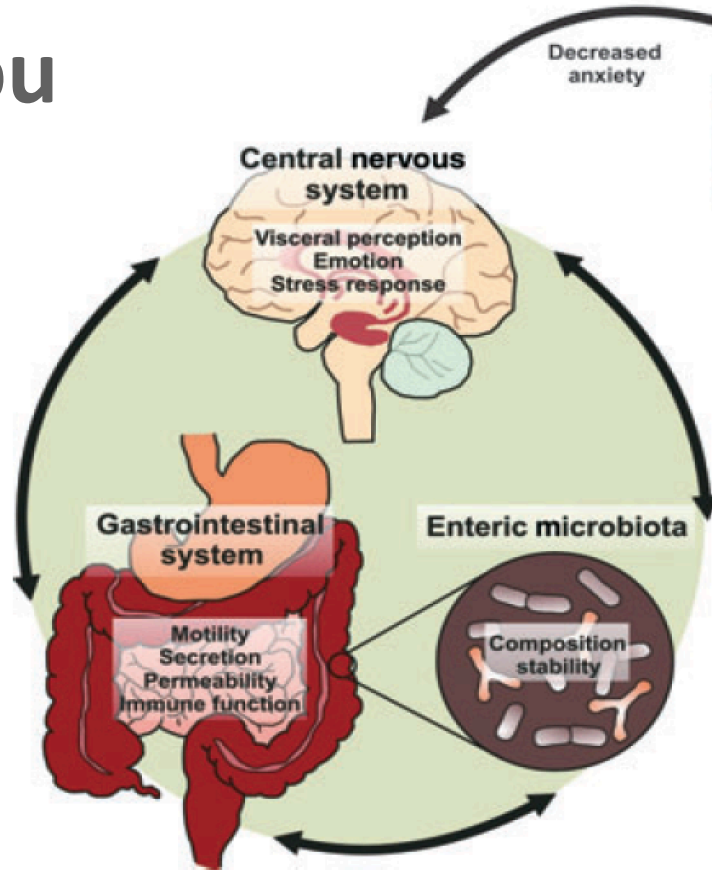
We need microbes



Bacteria and viruses are needed to help the body and brain develop in a 'normal' way.

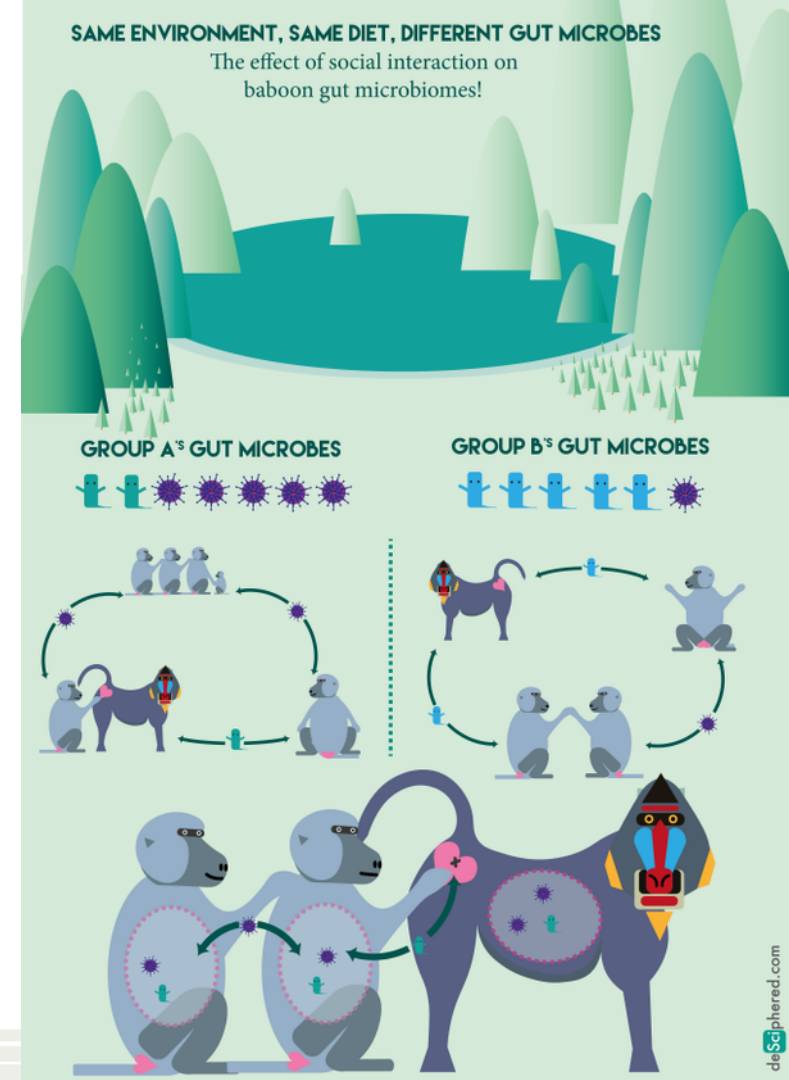


Bacteria can make you anxious



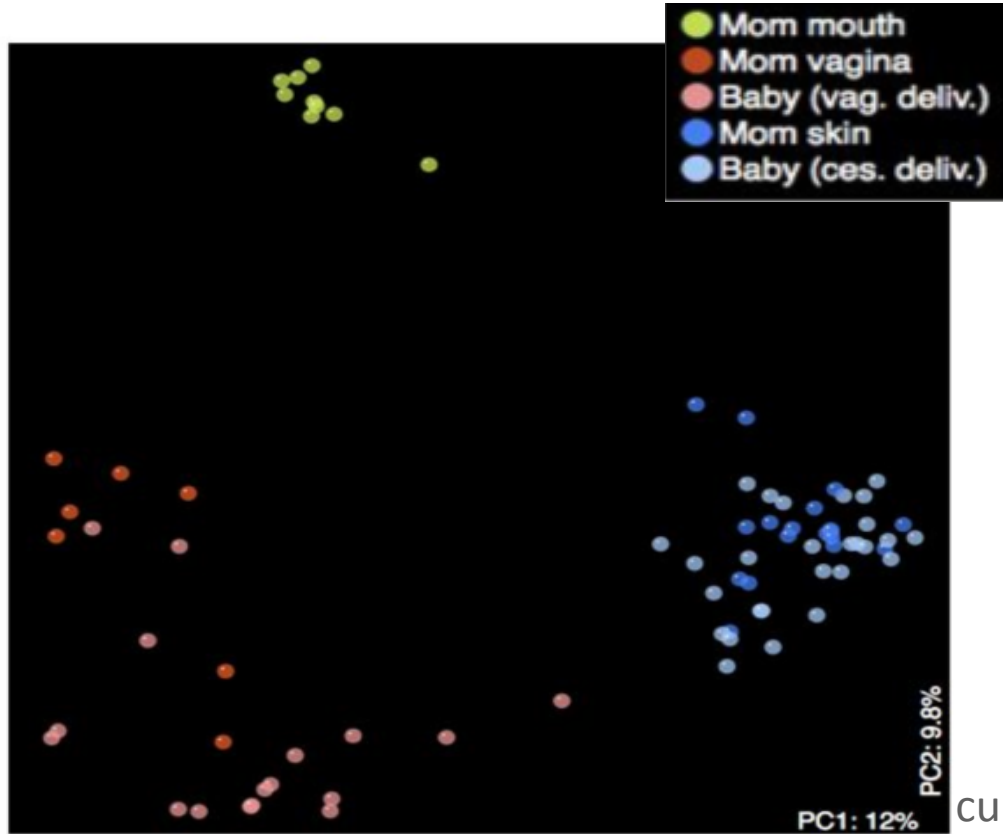
Swapping bacteria from one mouse to another can alter anxiety!

Human behavior may have evolved to share beneficial bacteria!



Tung et al., 2015 eLIFE
Gilbert, 2015, eLIFE

Where do microbes come from?



Your microbial starter-culture is dictated by your birth and upbringing



Where do microbes come from?



Even breast milk has its own microbiome which mother evolved to suit babies growing gut!



Far from the whole story!

Amish live on family run
farms and have no asthma.
Hutterites live on communal
farms and have elevated
asthma





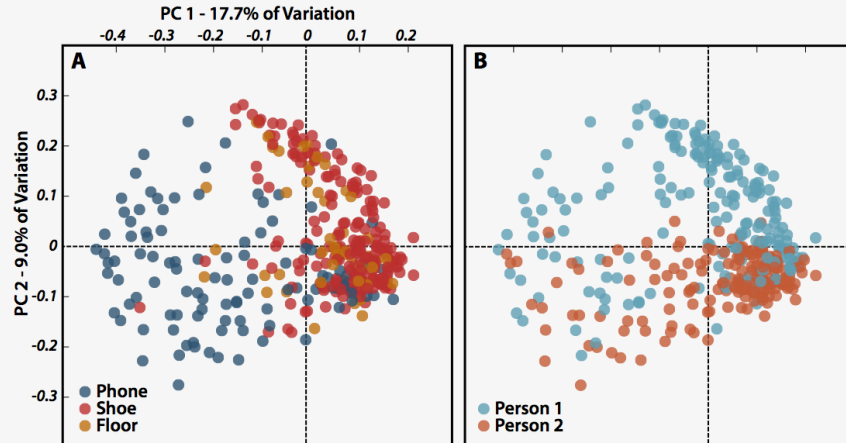
Forensic Insights From the Shoe and Phone Microbiomes

Lax et al. 2015. Forensic analysis of the microbiome of phones and shoes. **Microbiome**. 3:21
doi:10.1186/s40168-015-0082-9

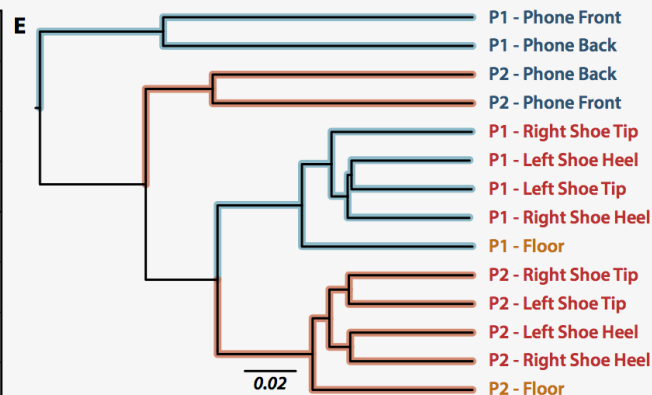
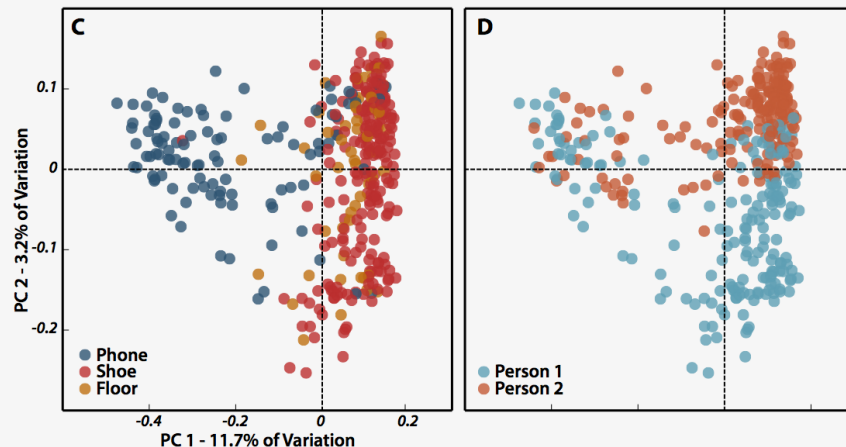
	<u>Person 1</u>	<u>Person 2</u>	<u>Total</u>
Shoe	Left Heel	26	23
	Right Heel	29	27
	Left Toe	28	25
	Right Toe	27	26
Phone	Front	25	27
	Back	27	25
	Floor	28	25
			53



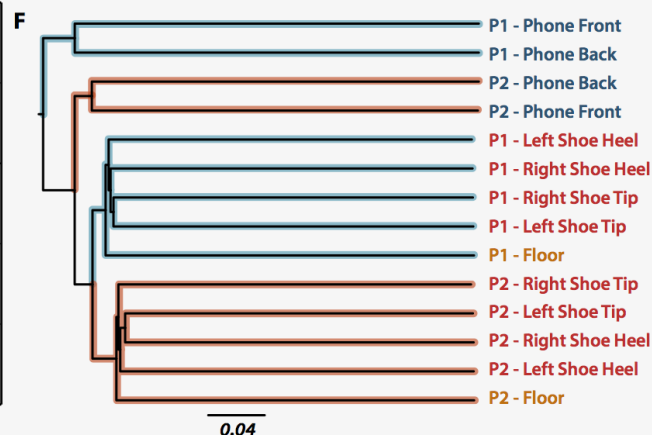
Weighted UniFrac



Unweighted UniFrac



Weighted
UniFrac

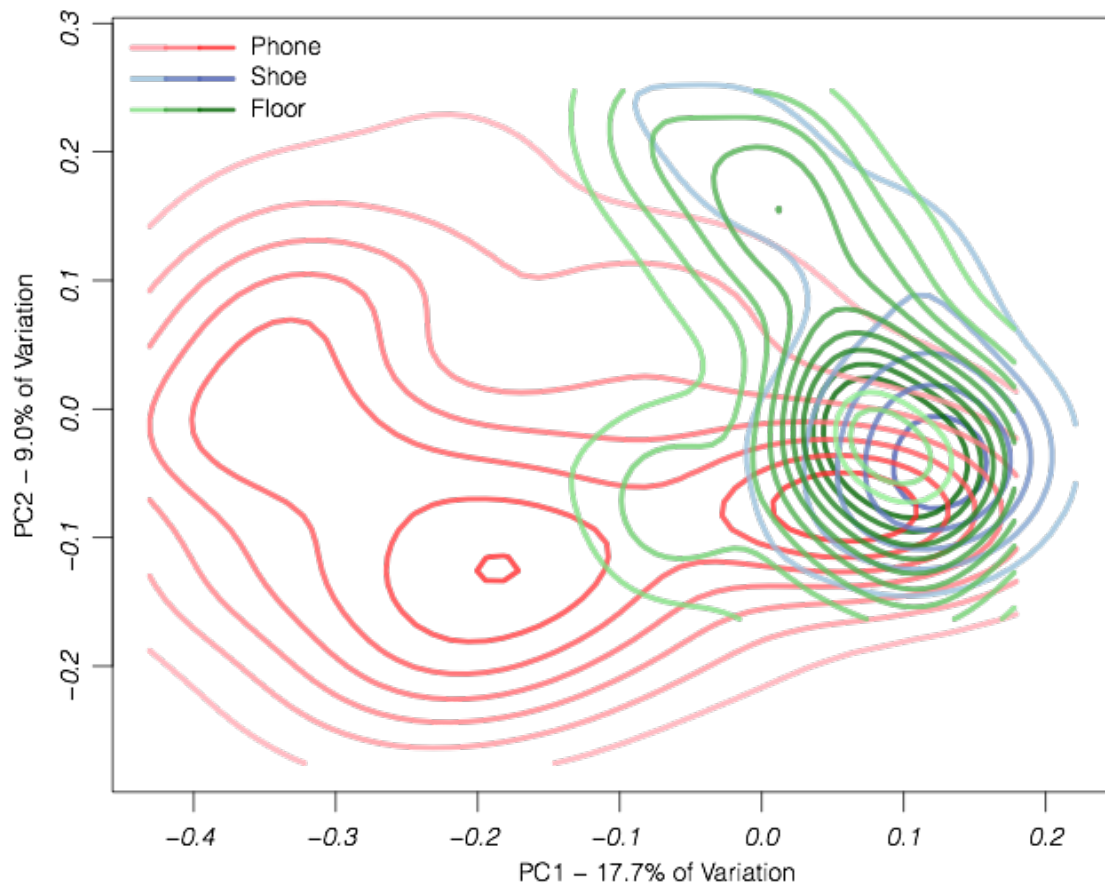


Unweighted
UniFrac

Shoes and floor couldn't be easily distinguished, but phones were very different



Density plot

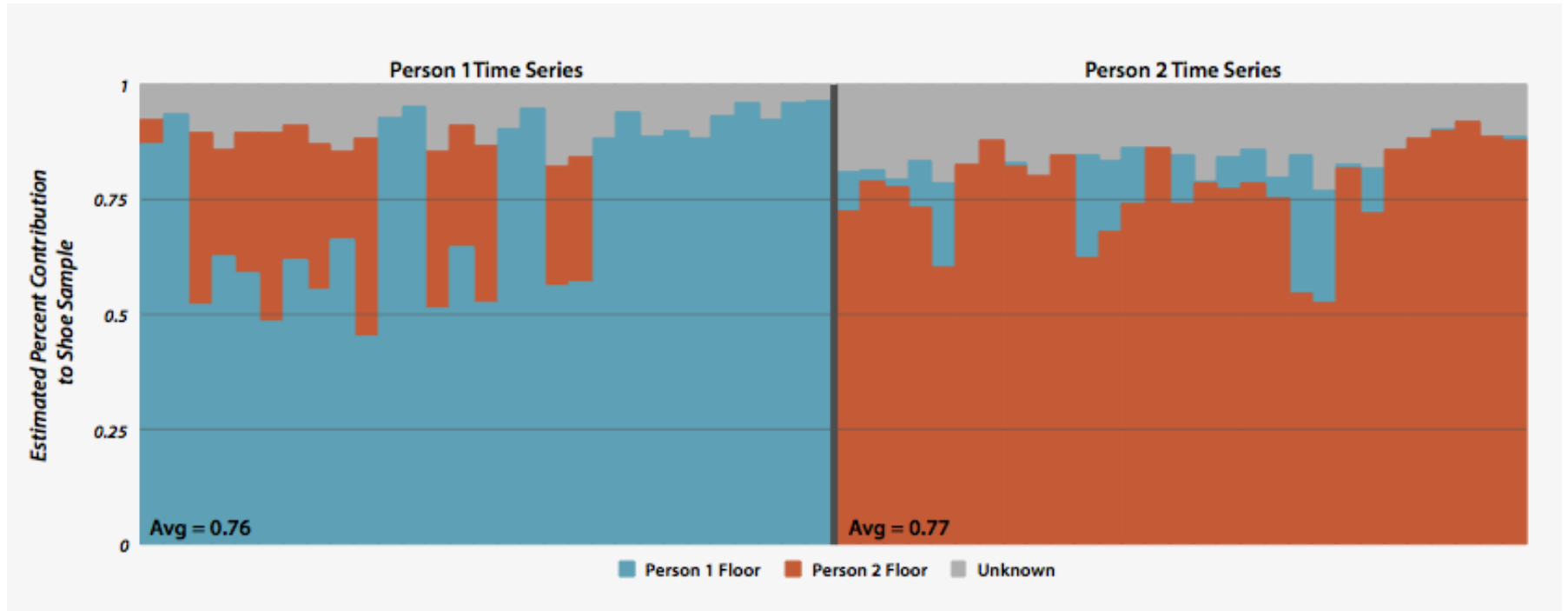


Random Forest Supervised Learning Results

Sample Subset	Predicted Category	N	Estimated Error \pm SD	Baseline Error	Ratio
All Phone Samples	Person	104	0.037 ± 0.062	0.500	13.63
All Shoe Samples	Person	211	0.010 ± 0.020	0.479	50.26
Person 1 Phone Samples	Front/Back	52	0.417 ± 0.206	0.481	1.15
Person 2 Phone Samples	Front/Back	52	0.268 ± 0.180	0.481	1.79
Person 1 Shoe Samples	Shoe Surface	110	0.705 ± 0.125	0.736	1.05
Person 2 Shoe Samples	Shoe Surface	101	0.796 ± 0.090	0.732	0.92

- Can detect a person based on their phone microbiome
- Can detect a person based on their shoe microbiome
- But where a sample is taken on the shoe or phone makes no difference.

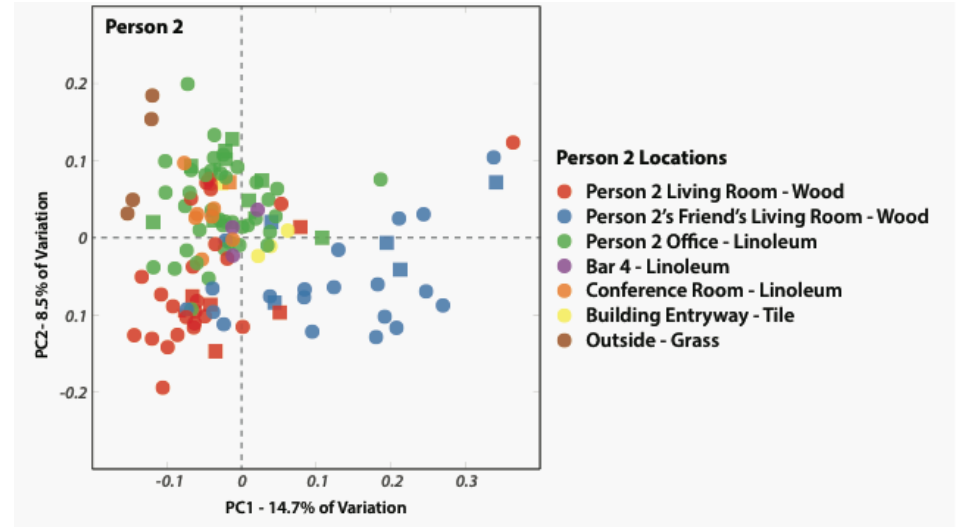
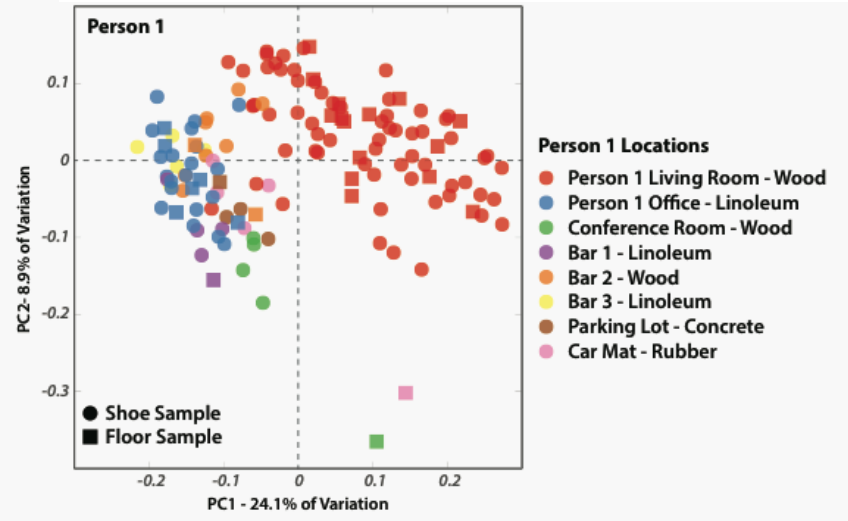




The source of bacteria found on the shoe soles is person dependent.



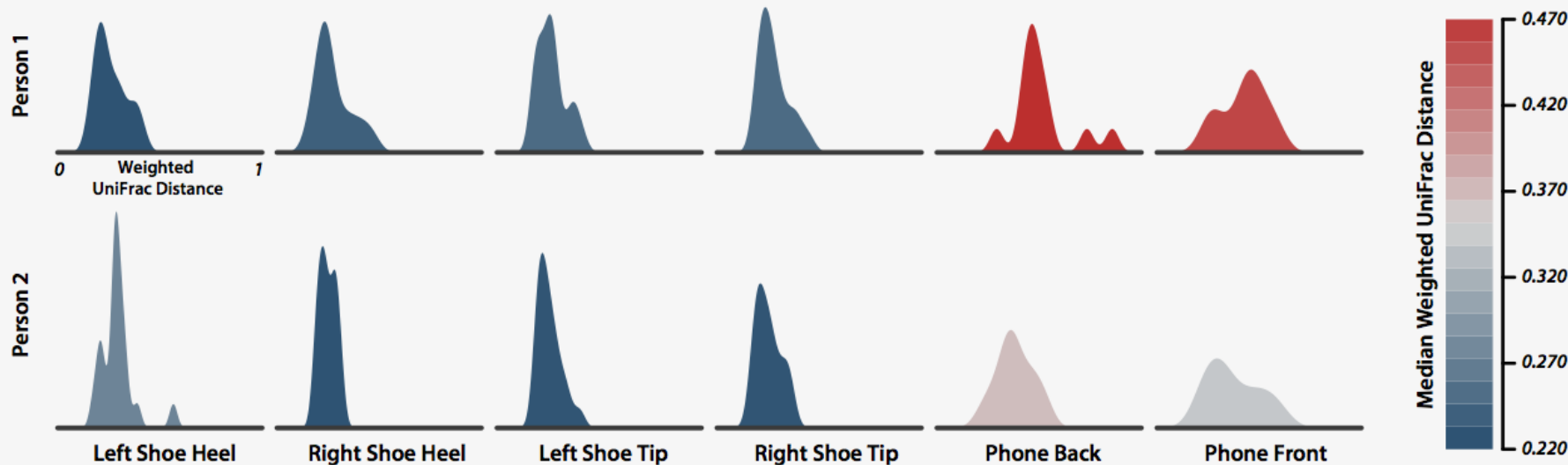
Similarity in Shoe and Floor Communities



Where you are in the city influences your shoe microbiome directly.



Stability of Community Structure

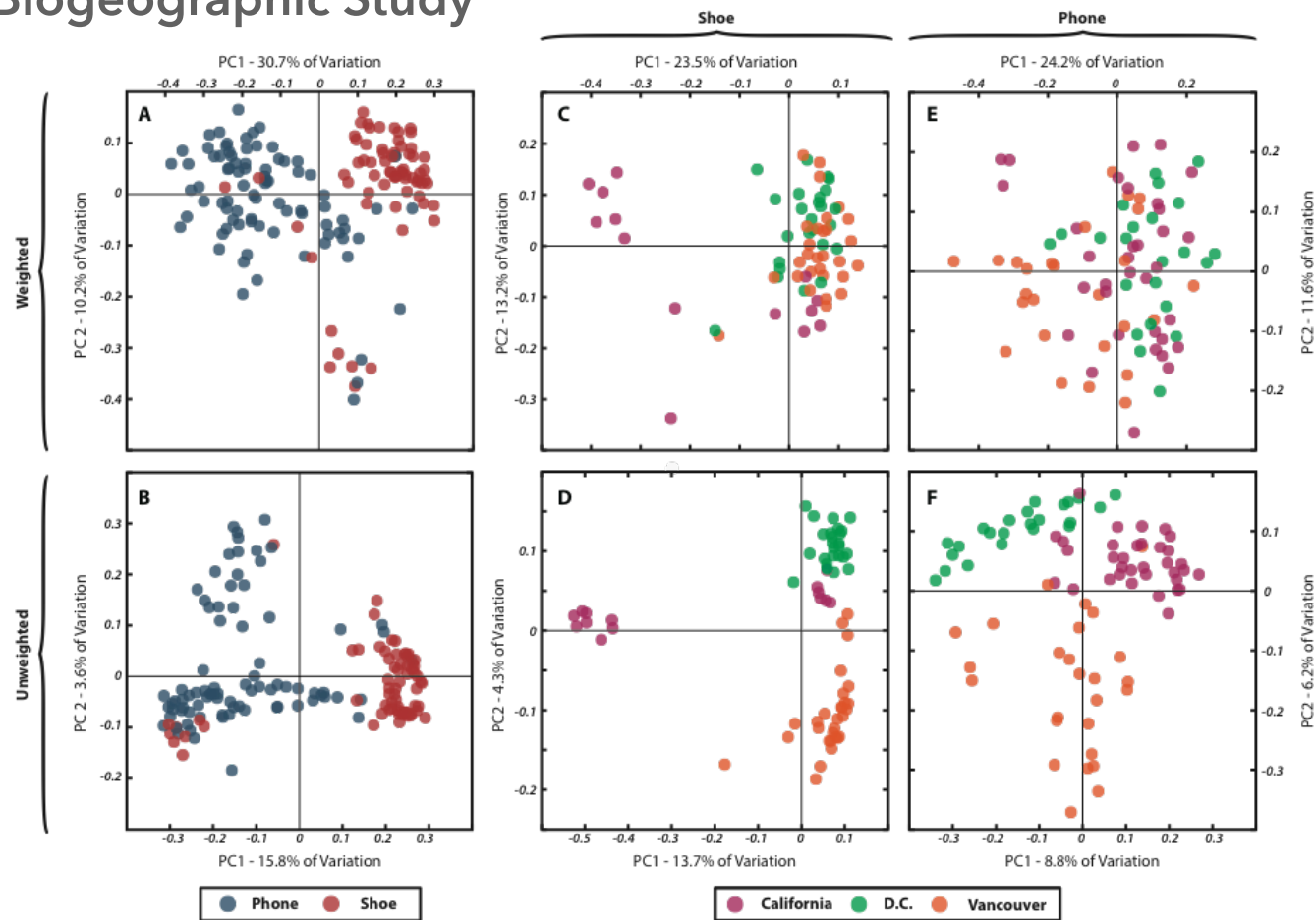


Interestingly – despite the locality dependent interaction, shoes are very stable.

Phones are very instable – because hands are instable.



Biogeographic Study



Which conference
we sampled from
influenced the
microbial
composition but
not the structure.

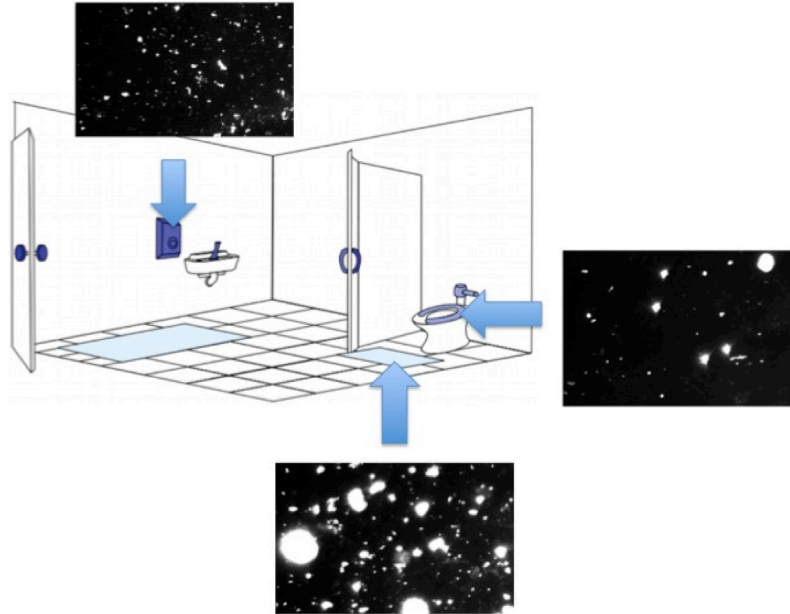


Restroom Microbiome Project

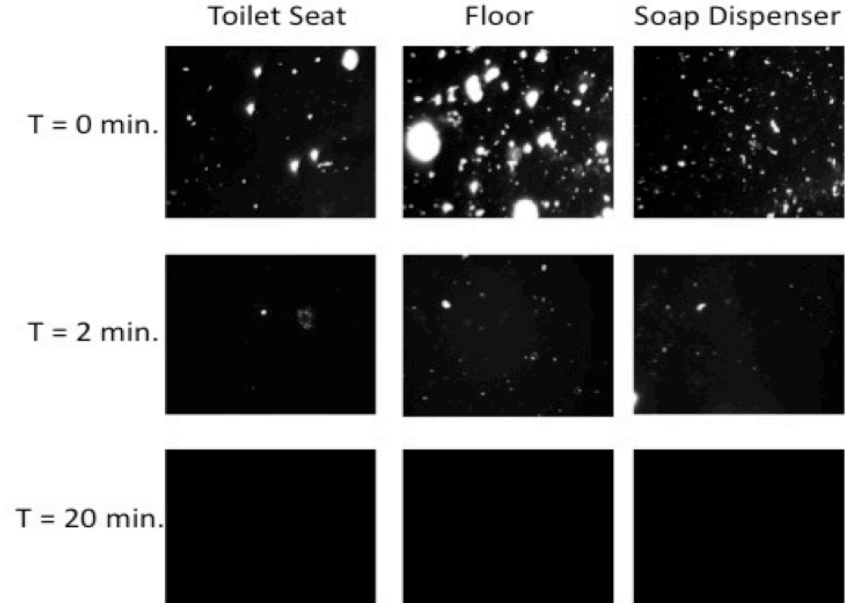


Restroom Microbiome Project - Sterilizing Surfaces

A.



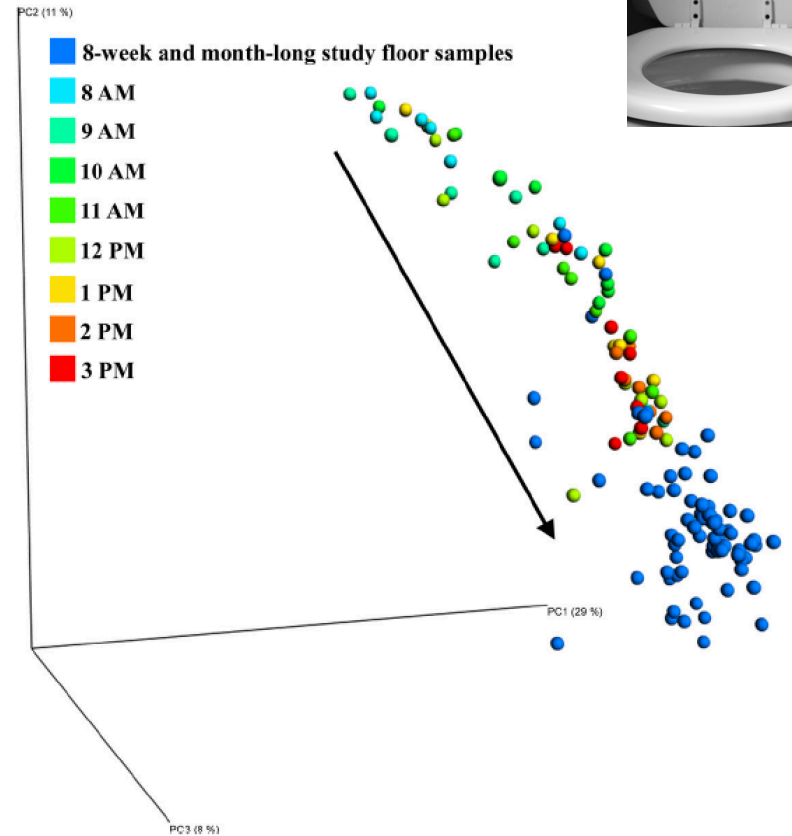
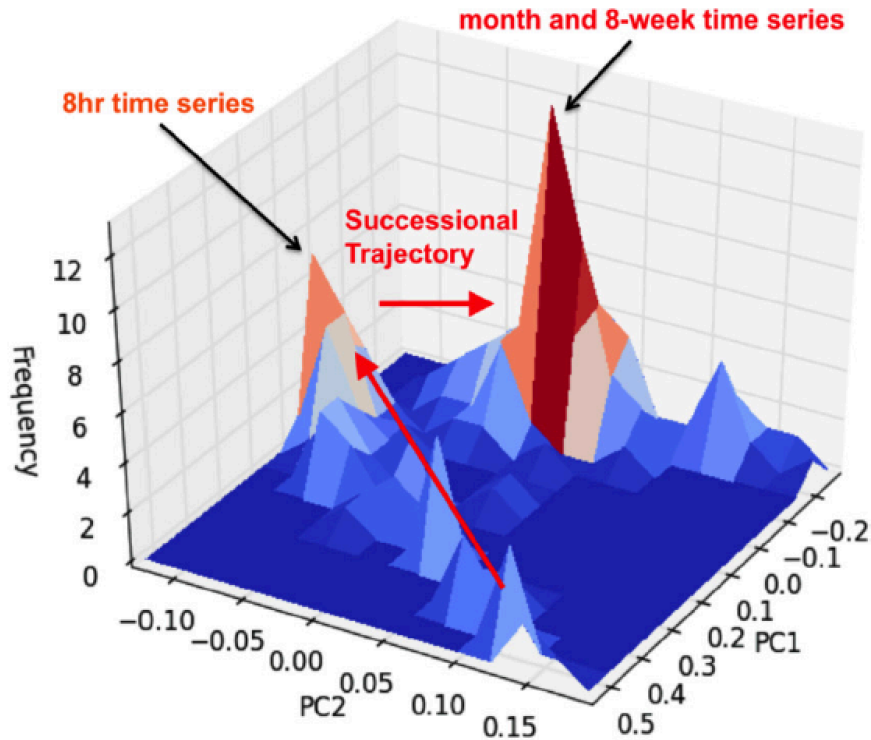
B.



Gibbons et al. 2015. Ecological succession and viability of human-associated microbiota on restroom surfaces. **Applied and Environmental Microbiology**. 81(2), 765-773.

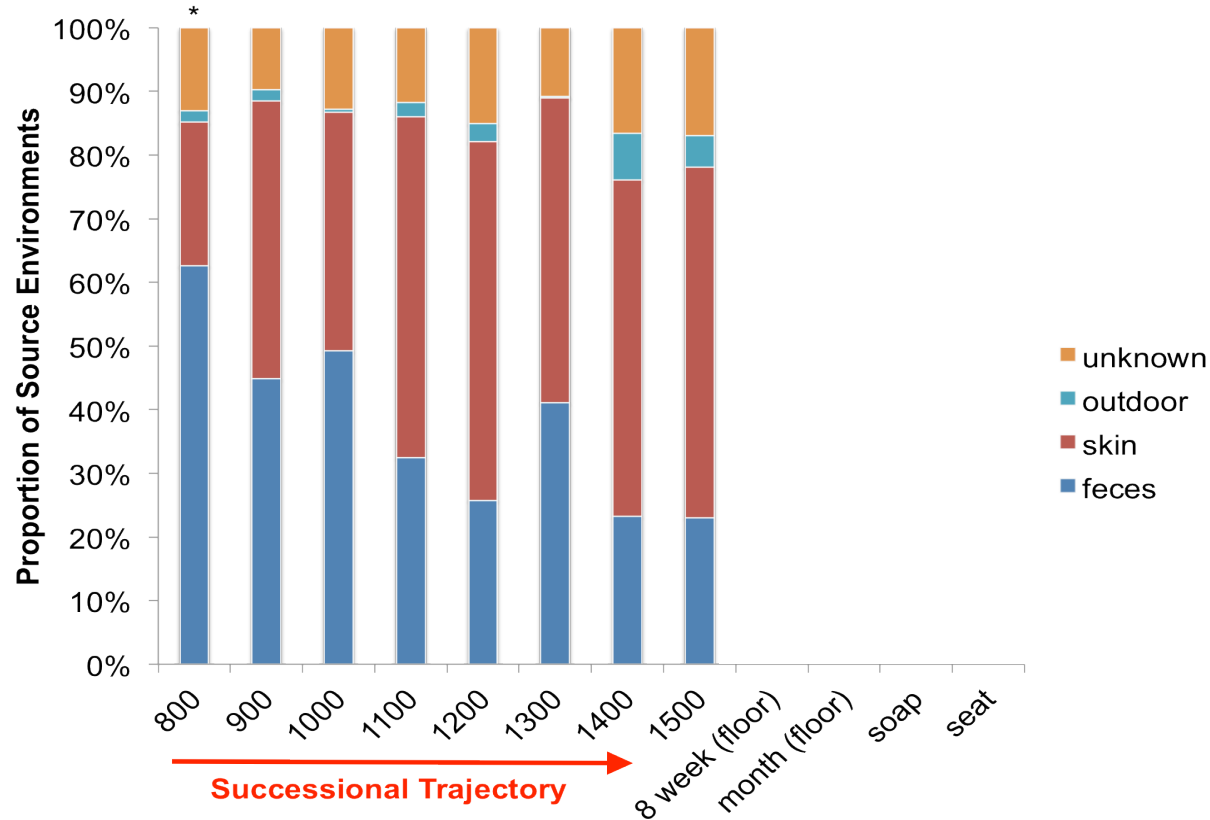


Succession after sterilization!

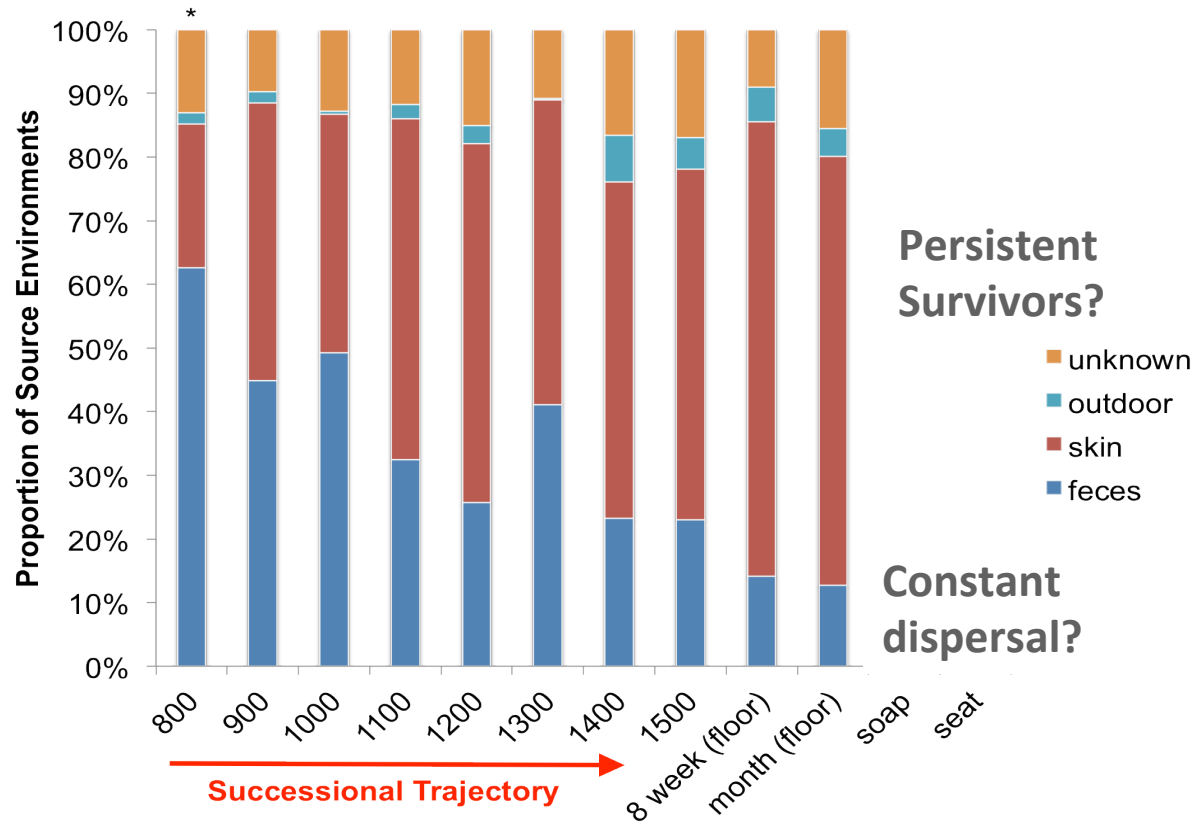


Despite daily cleaning, the floors return to same successional stable state.

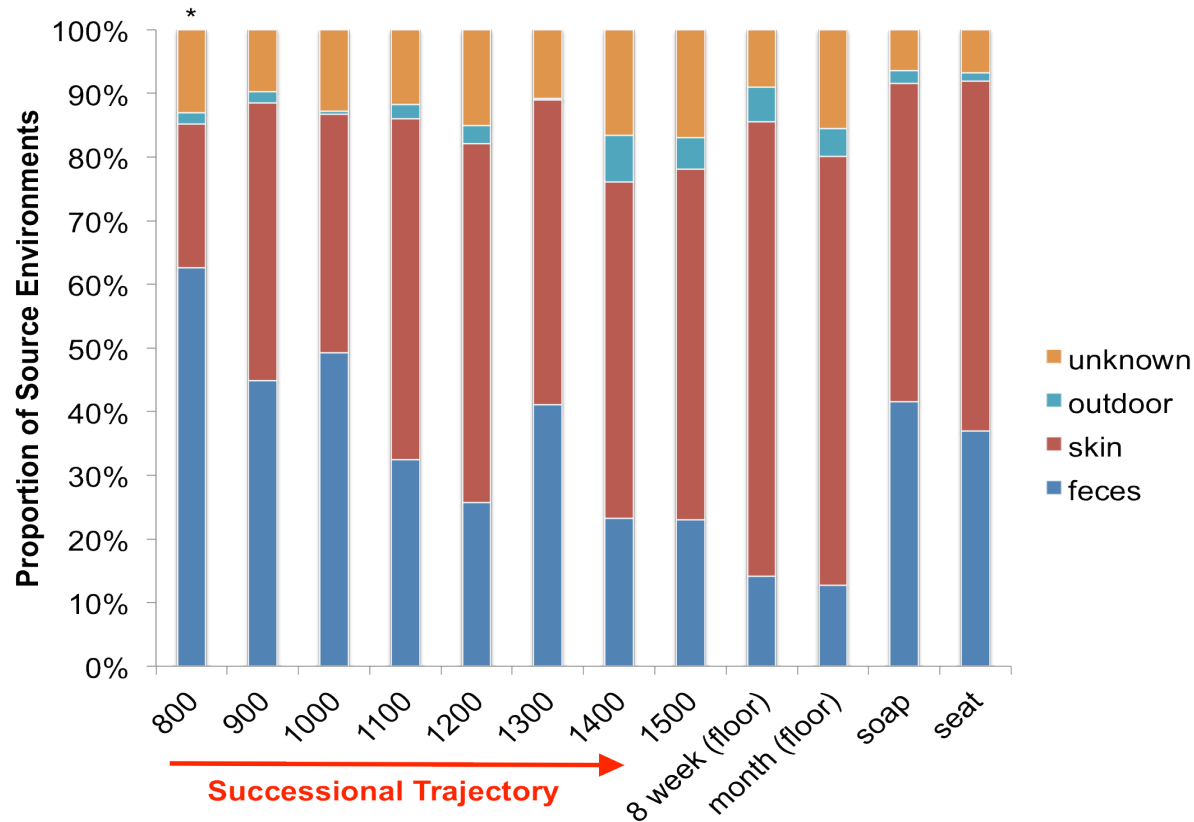
Restroom Microbiome Project - Succession influenced by Source

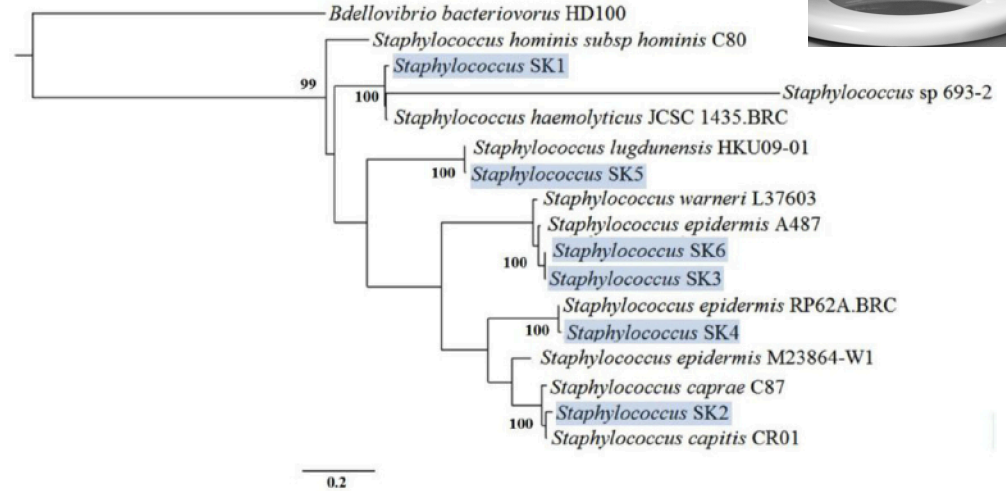
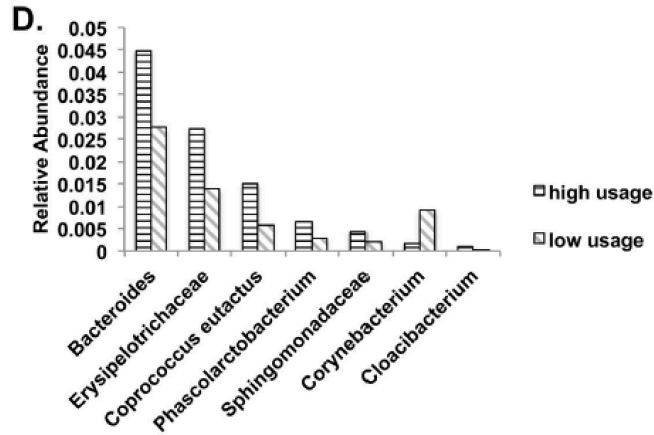
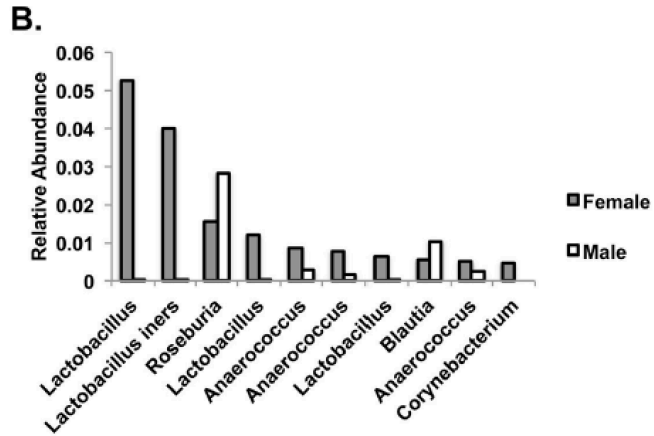


Restroom Microbiome Project - Succession influenced by Source



Restroom Microbiome Project - Succession influenced by Source





Male and female bathrooms are microbiological dissimilar, and contain bacteria pertinent to the gender!

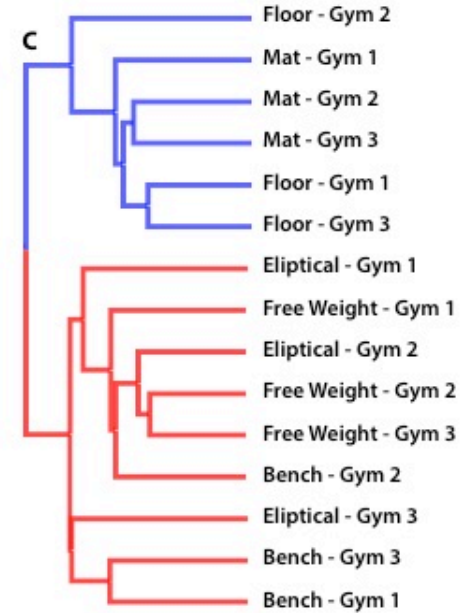
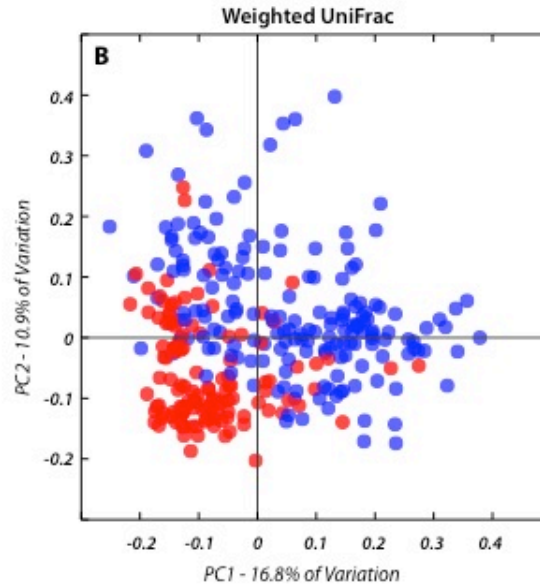
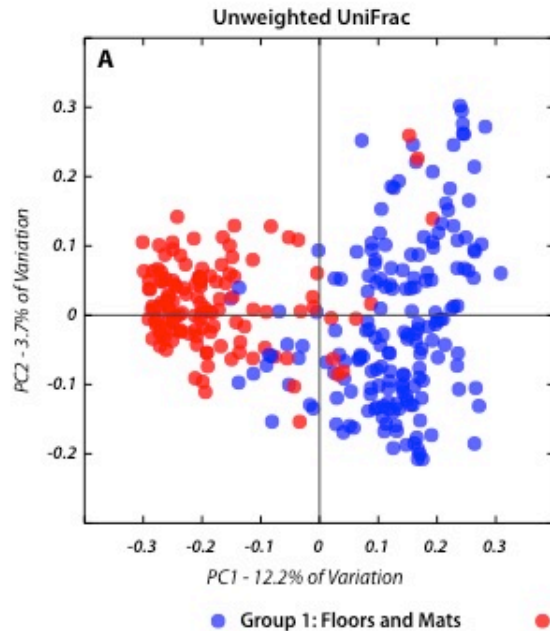
Even after exclusion of people, *Staphylococcus* strains with virulence markers are culturable.





Gym Microbiome Project

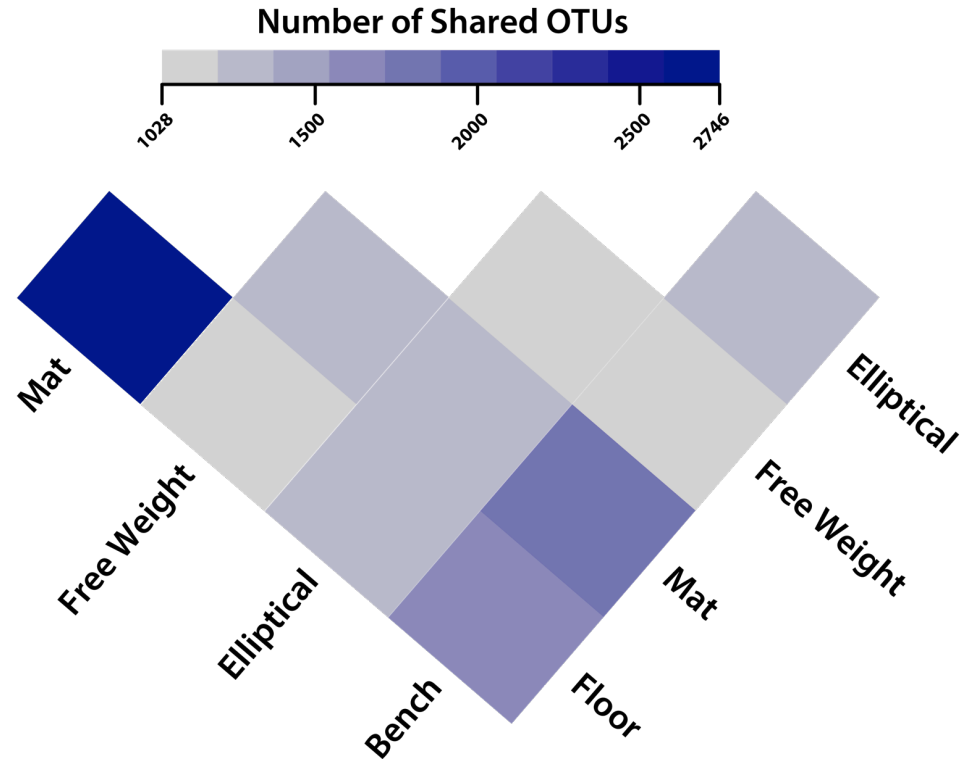
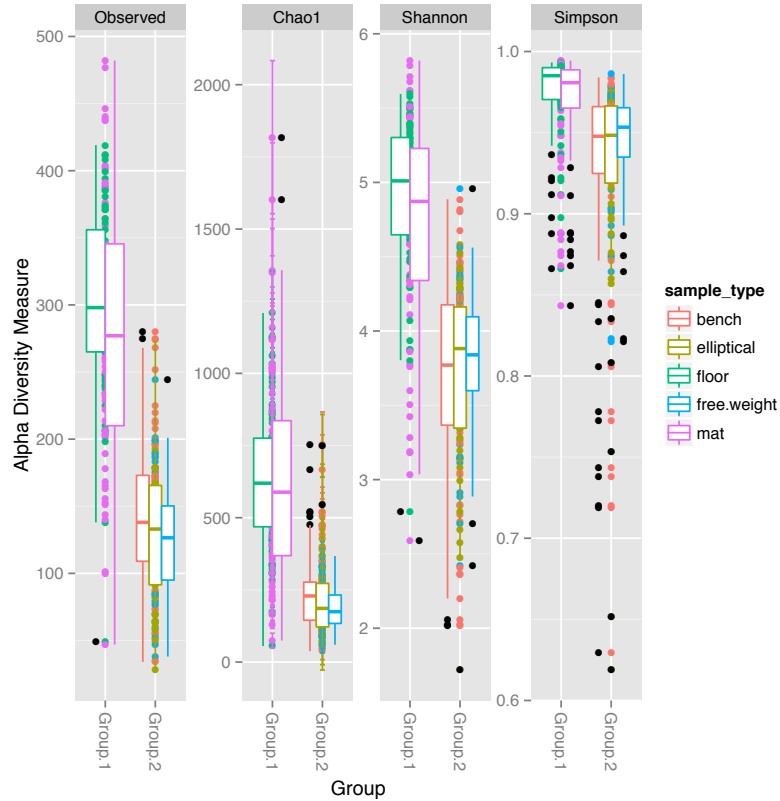
Gym Microbiome Project

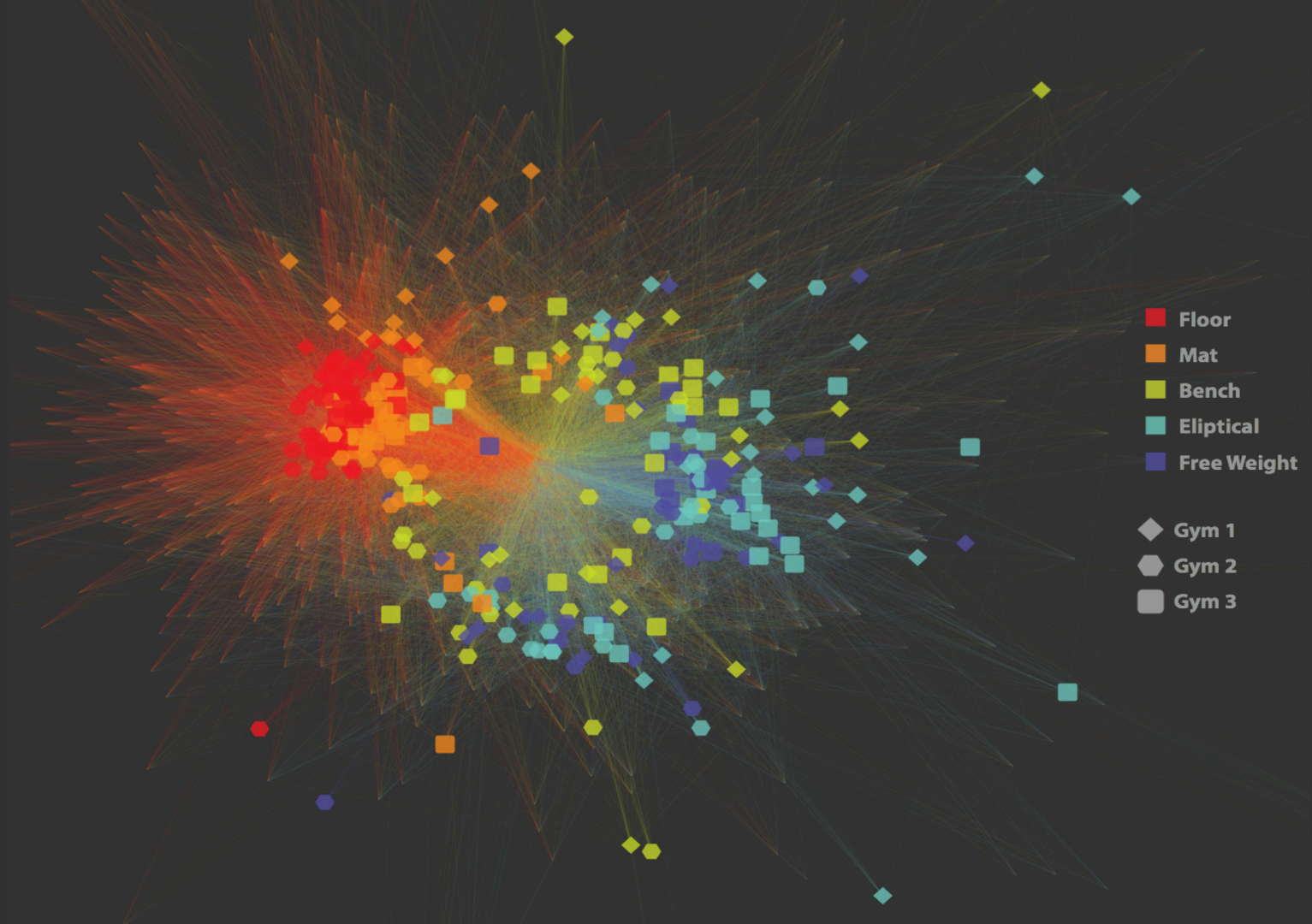


Surface interaction more
important than gym or
time of day!



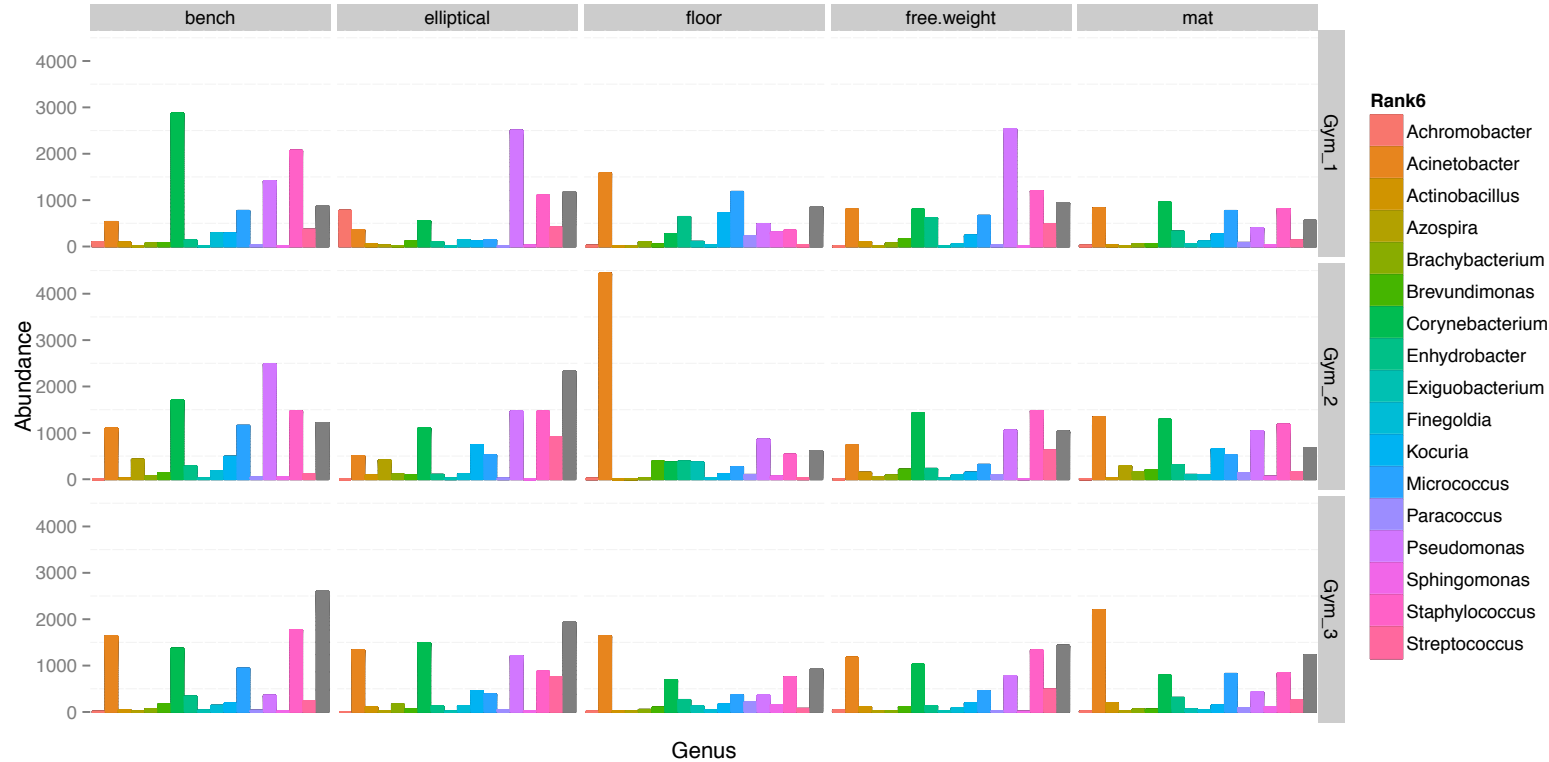
Gym Microbiome Project





Gym Microbiome Project

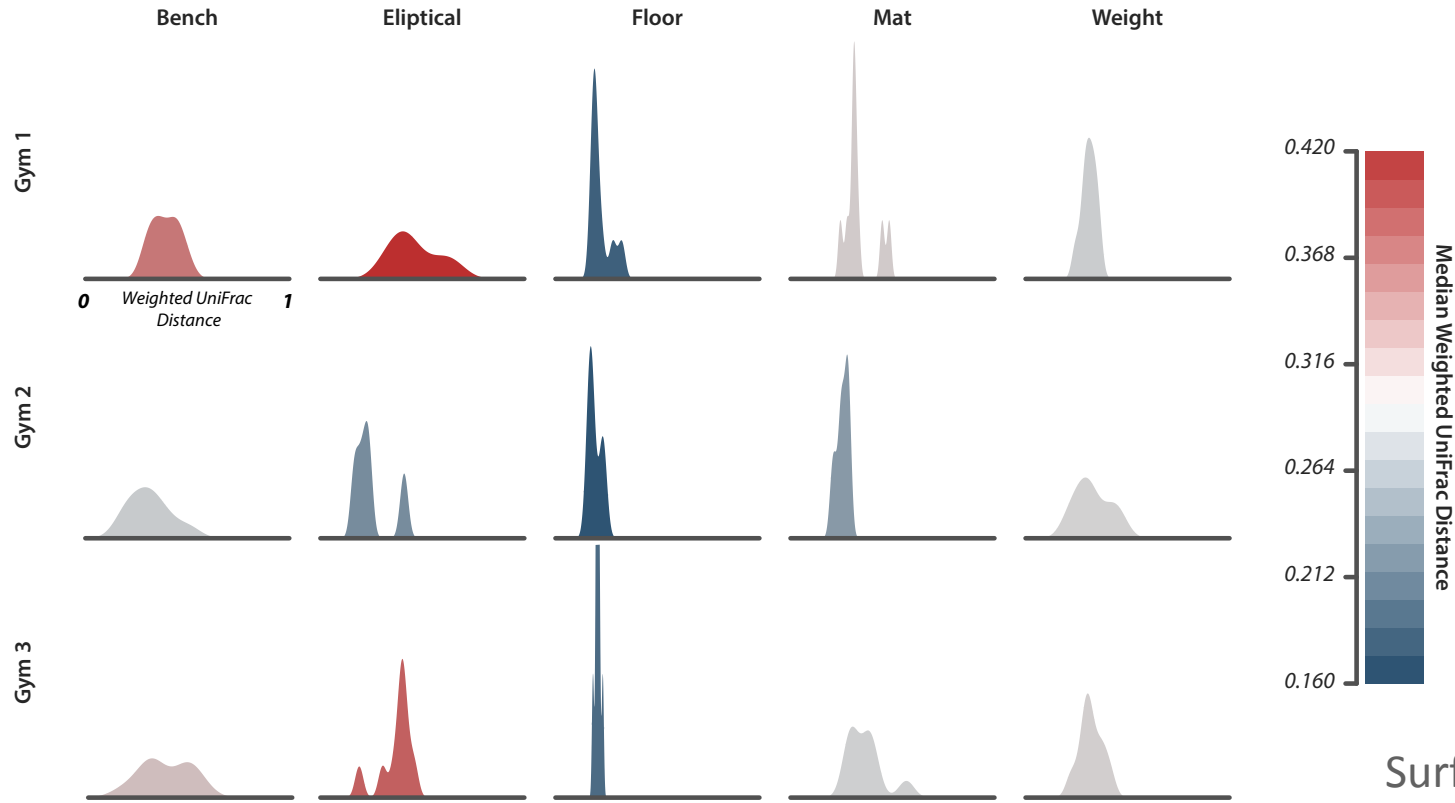
Wood et al. 2015. Athletic equipment microbiota are shaped by interactions with human skin. **Microbiome**. 3:25 doi:10.1186/s40168-015-0088-3



Many different
human associated
bacteria!



Gym Microbiome Project



Surfaces which interact with hands are very unstable



Putting microbes in your medical records



Monitoring your microbiome





www.americangut.org

For \$99 find out
who's living in
your gut!



>\$800,000

8450

56

Contributors

Weeks running

Launched Apr 8, 2013

Give



Monitoring your home or cities microbiome

