

www.earthmicrobiome.org

@gilbertjacksa



earth microbiome project

Argonne National Laboratory Institute for
Genomic and Systems Biology

Monday, August 20th, 2012

Time: 1:30pm to 1:45pm

**Functional equivalence
and evolutionary
convergence in complex
communities of microbial
symbionts**

Session: Microbial symbiosis
Speaker: Torsten Thomas
(University of New South Wales)

Wednesday, August 22nd

Time: 8:30am - 2:00pm
**Extraction of microbial
DNA & RNA in
environmental samples
(workshop)**

Speaker: Janet Jansson
(Lawrence Berkeley National Laboratory)

Thursday, August 23rd, 2012

Time: 10:00am - 12:00pm
**From the HMP to the EMP:
deriving insights from
large-scale sequencing
projects**

Session: Bioinformatics in
microbial ecology
Speaker: Rob Knight
(University of Colorado)

Thursday, August 23rd, 2012

Time: 12:30pm - 1:15pm
**Bird's Eye View: Tackling
the pitfalls and unveiling
the promise of soil
metagenomics**

Keynote
Speaker: Janet Jansson
(Lawrence Berkeley National Laboratory)

Our Manifesto!

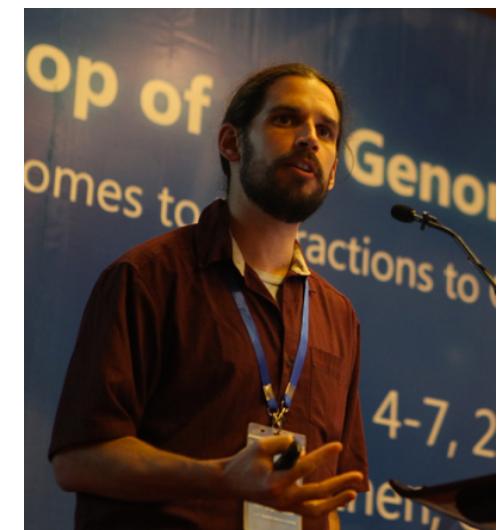
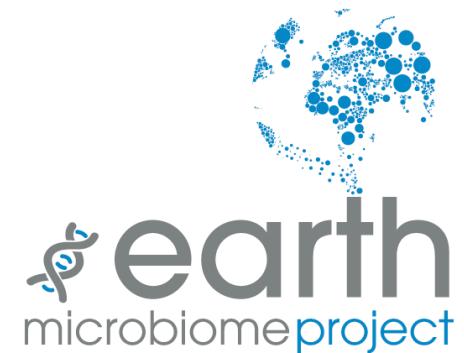


 **earth**
microbiome project

- A systematic characterization of global microbial diversity.
- Exploring:
 - the patterns of microbial diversity,
 - the processes that drive these patterns,
 - the association of different systems and scales.
- Crowd sourcing a consistently processed and analyzed dataset.
- Creating a framework for developing a predictive understanding of the emergent properties of microbial dynamics.
- Being developed for the community by the community.
- Immediate, free and open access data
- Providing a comparable environment in which any researcher can place their data to see it in a global context.

What have we been up to?

- Collaborators: 102
- 60,000 samples pledged
- 15,000 environmental samples being processed
- 7,137 completed for 16S rRNA analysis.
- Biomes Represented: 25
- Total 16S rRNA Sequences: 774,213,971
- Total OTUs at 97% identity: 279,001
- Public data analysis on github,
led by Greg Caporaso



Where on Earth are the EMP samples?

freshwater lake
marine habitat
canyon
rock
forest
pool
hot spring
rocky desert
tundra
coastal water
shrubland
permafrost
neritic zone
sea beach
taiga
lagoon
creek
Forest soil
grassland soil
cold temperature habitat
organism-associated habitat
fjord
grassland floor
estuary
pasture
dry stream
bog
river



G. Evelyn Hutchinson

Argonne Nation



Colorado
University of Colorado at Boulder

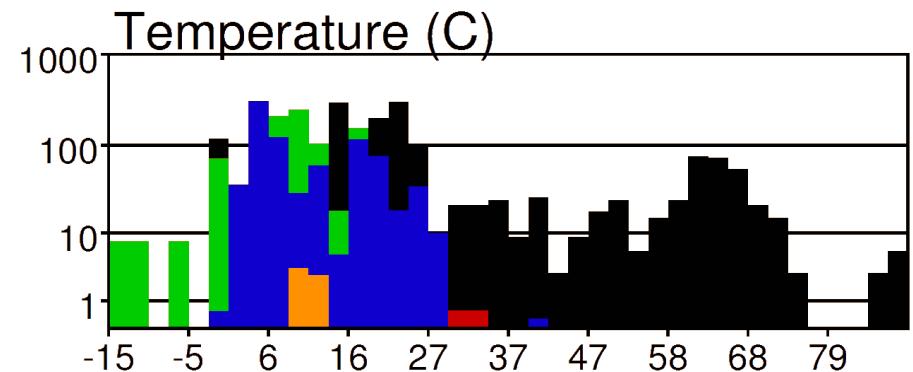
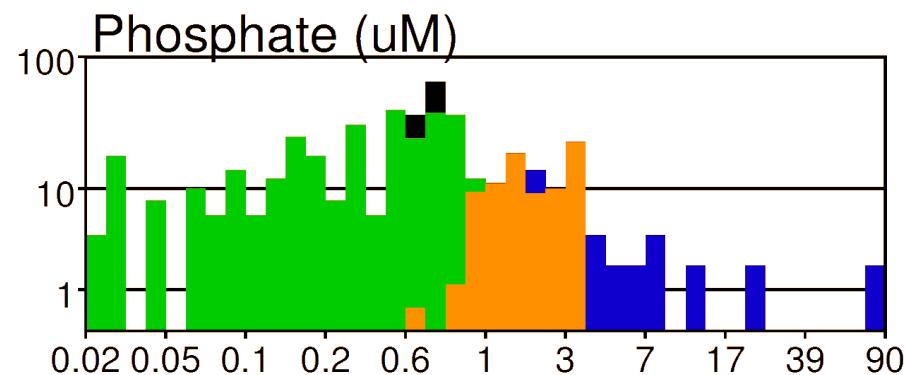
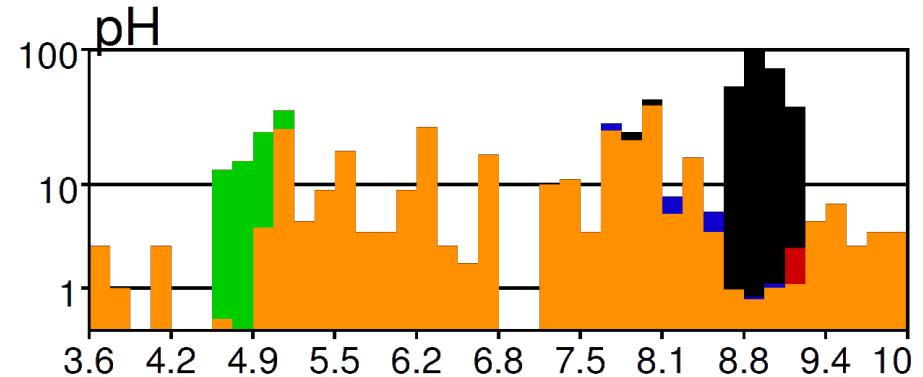
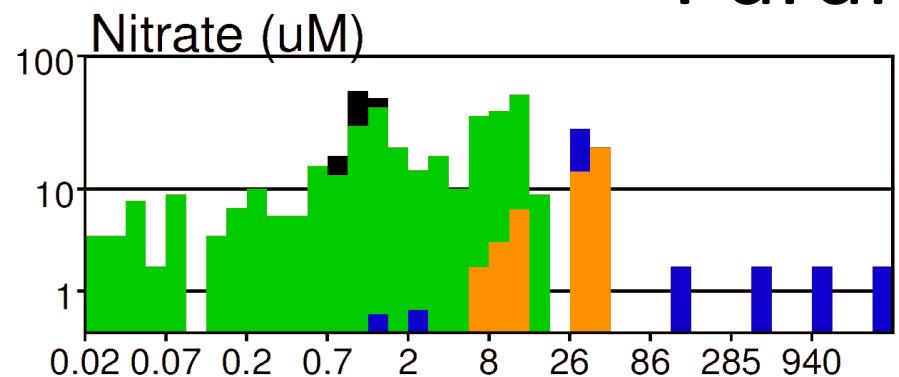
THE UNIVERSITY OF
CHICAGO



Argonne
NATIONAL LABORATORY



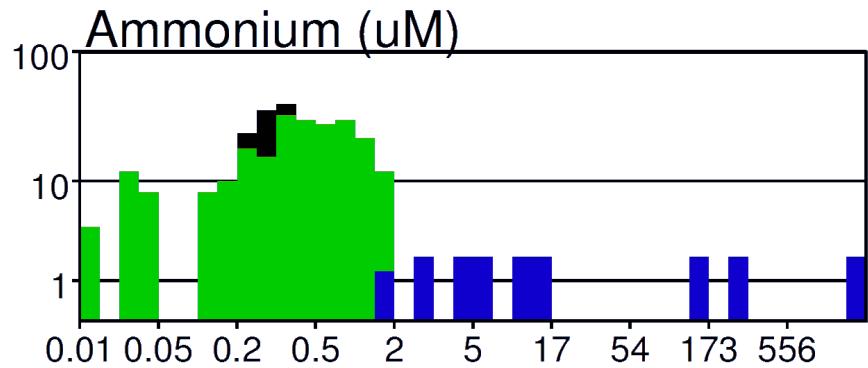
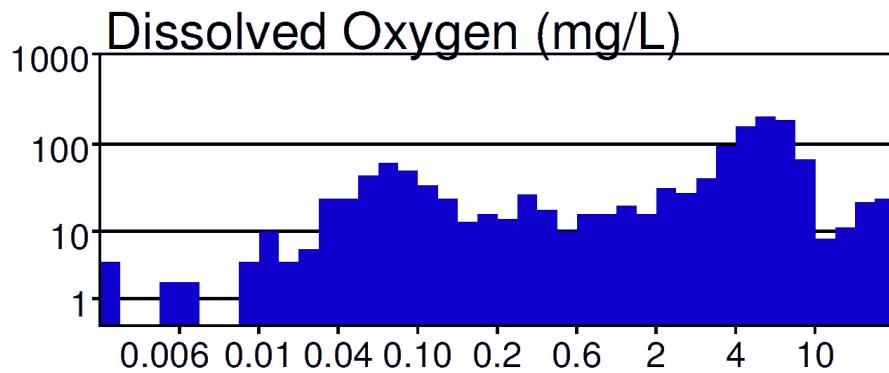
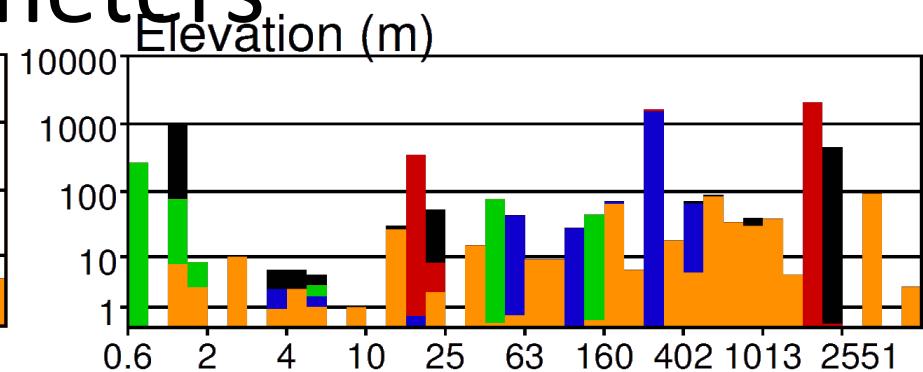
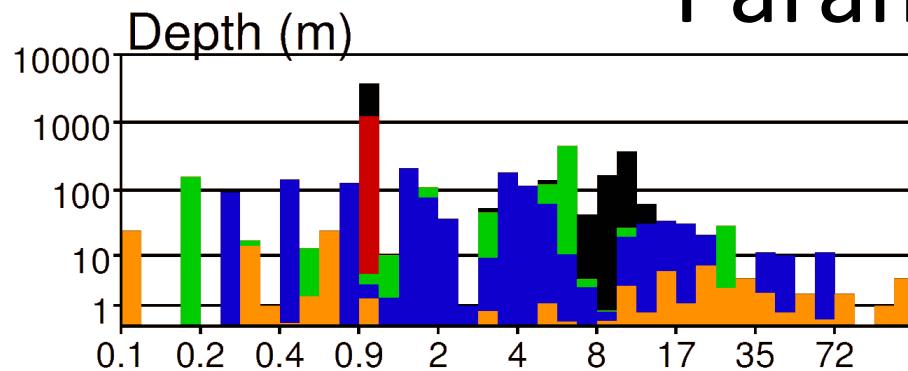
Coverage of Environmental Parameters



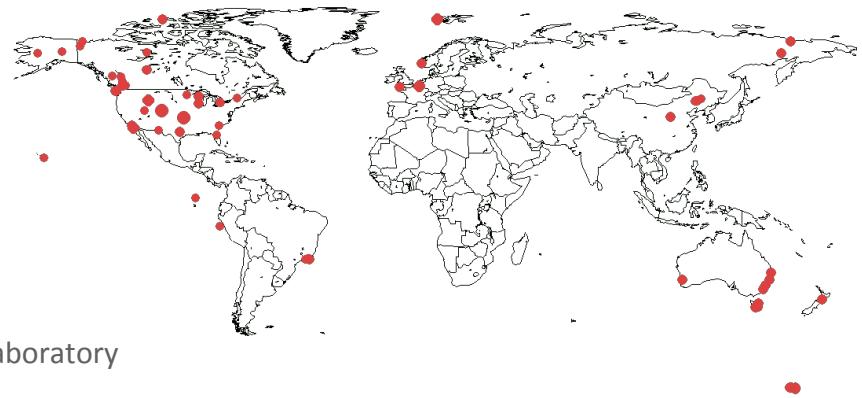
■ Fresh Water ■ Animal Associated
■ Sea Water ■ Soil ■ Other



Coverage of Environmental Parameters

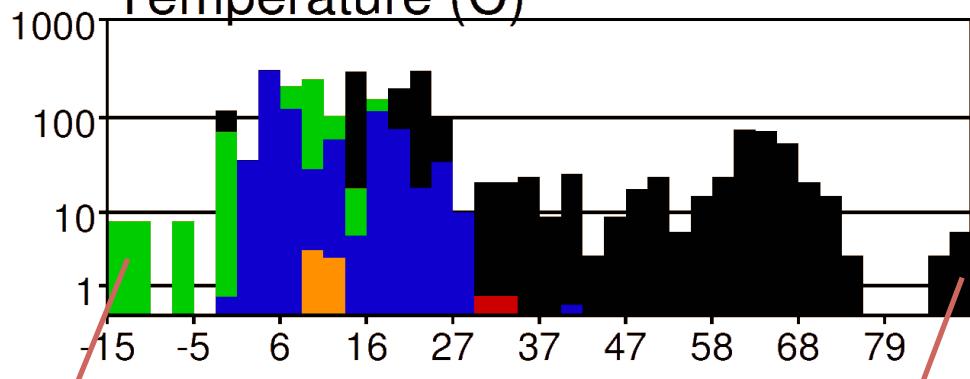


■ Fresh Water ■ Animal Associated
■ Sea Water ■ Soil ■ Other



Coverage of Environmental Parameters

Temperature (C)



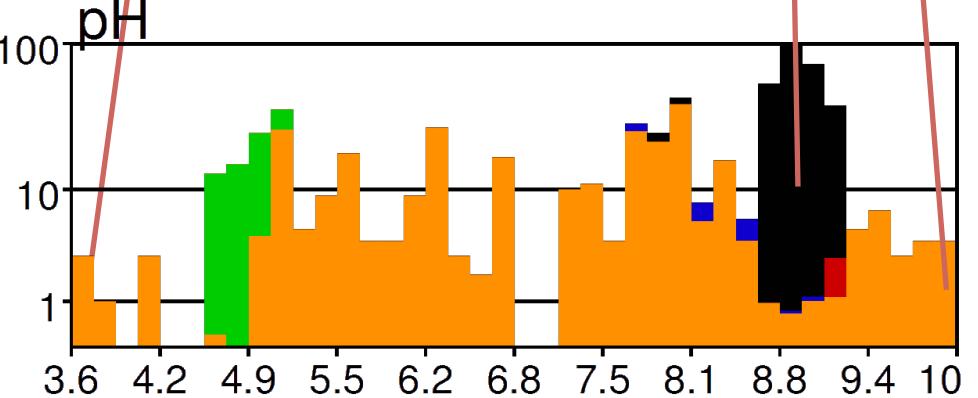
-15°C Ocean Water
Catlin Arctic Survey

89°C Microbial Mat
Yellowstone Hot Springs

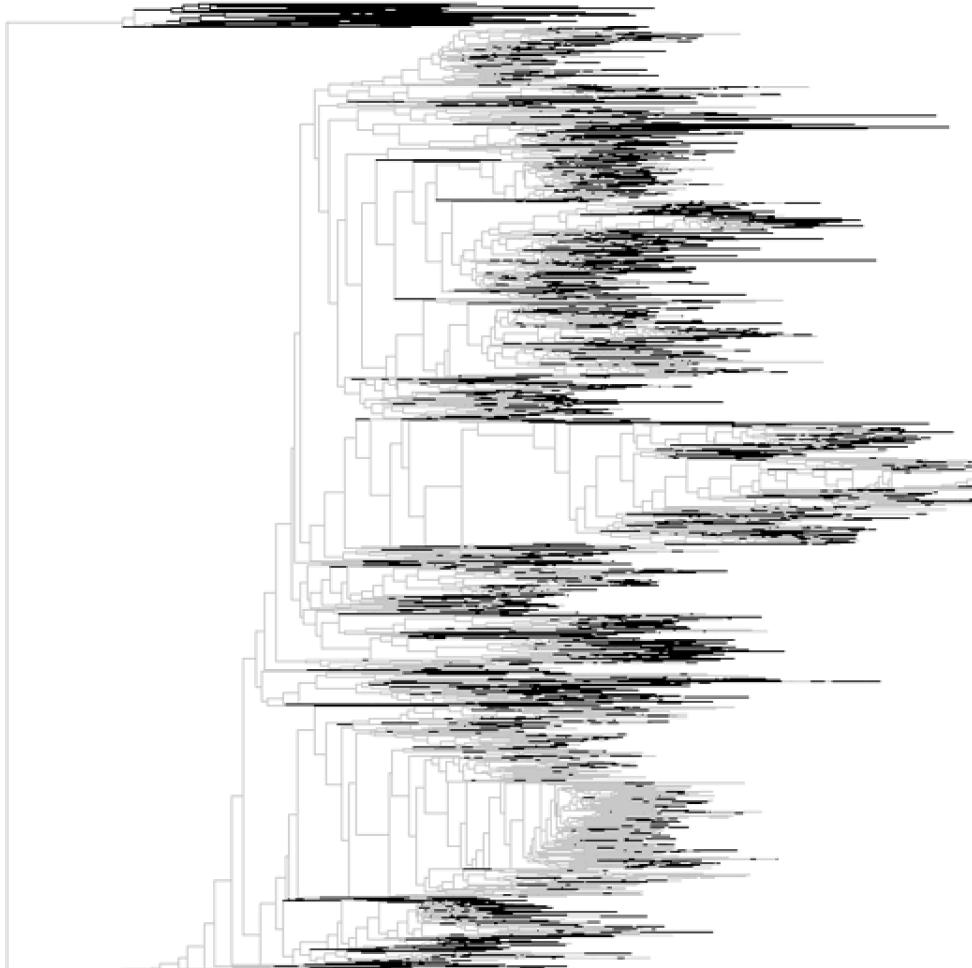
pH 3.6 Surface Soil
Temperate Pine Forest

pH 10.0 Surface Soil
Antarctica Desert

pH 9 Microbial Mat
Yellowstone Hot Springs



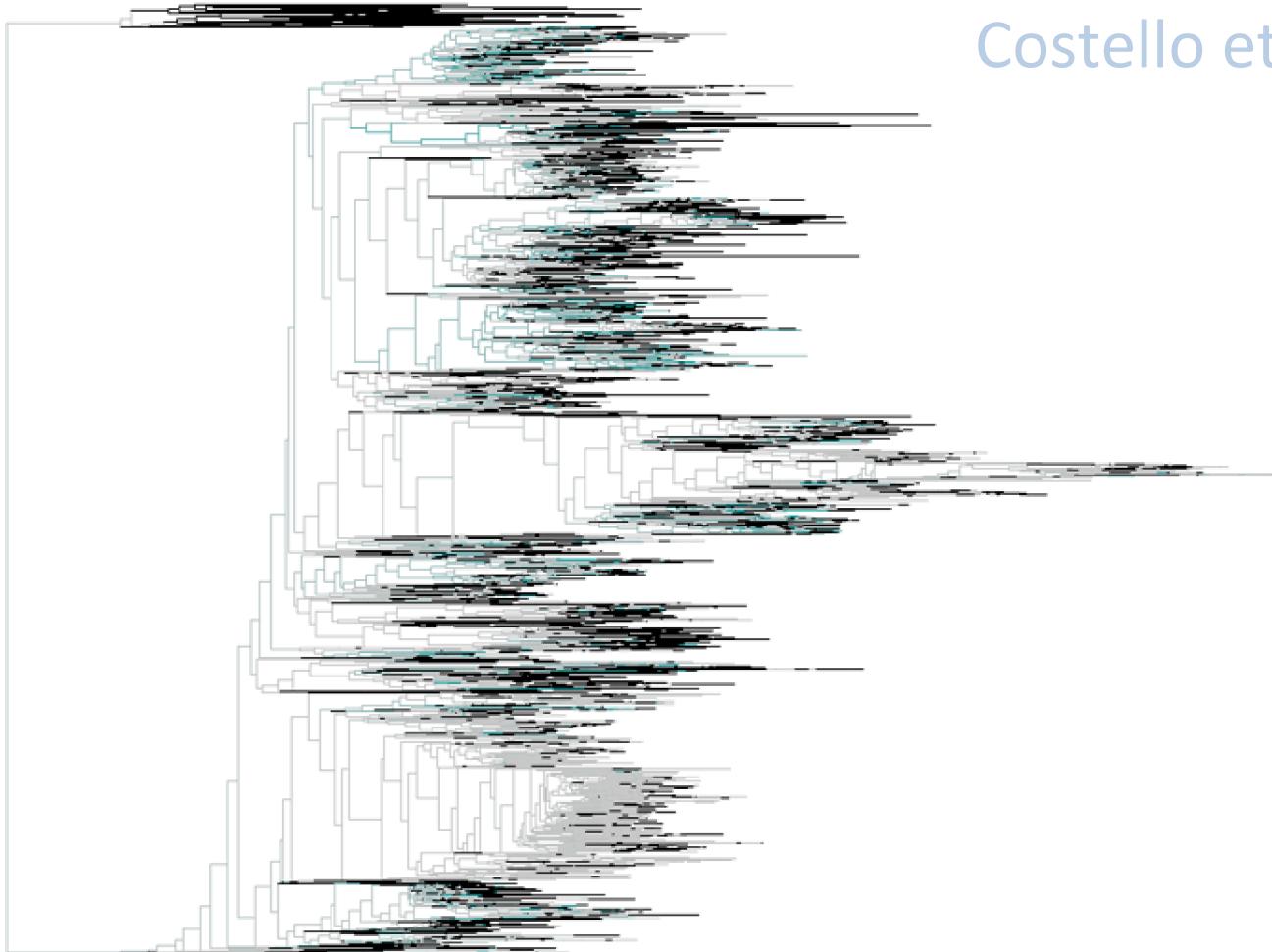
So what has the EMP told us about the tree of life?



Update of Greengenes tree (Daniel McDonald, Julia Goodrich, Todd DeSantis, Eric Nawrocki, Morgan Price, Phil Hugenholtz; visualization with TopiaryExplorer by Meg Pirrung, Ryan Kennedy, Daniel McDonald, Antonio Gonzalez)

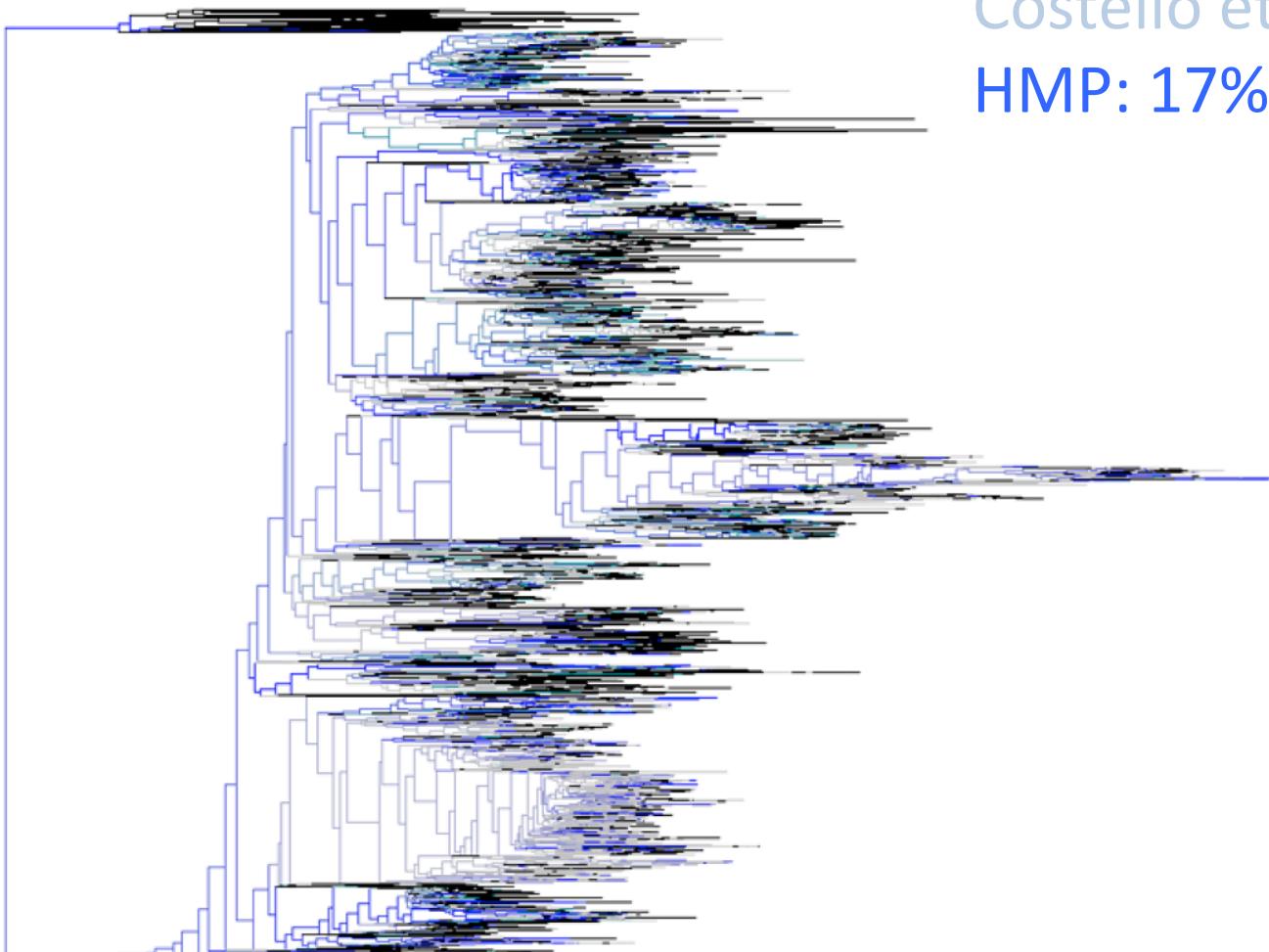
408,135 chimaera-checked, quality-filtered sequences

So what has the EMP told us about the tree of life?



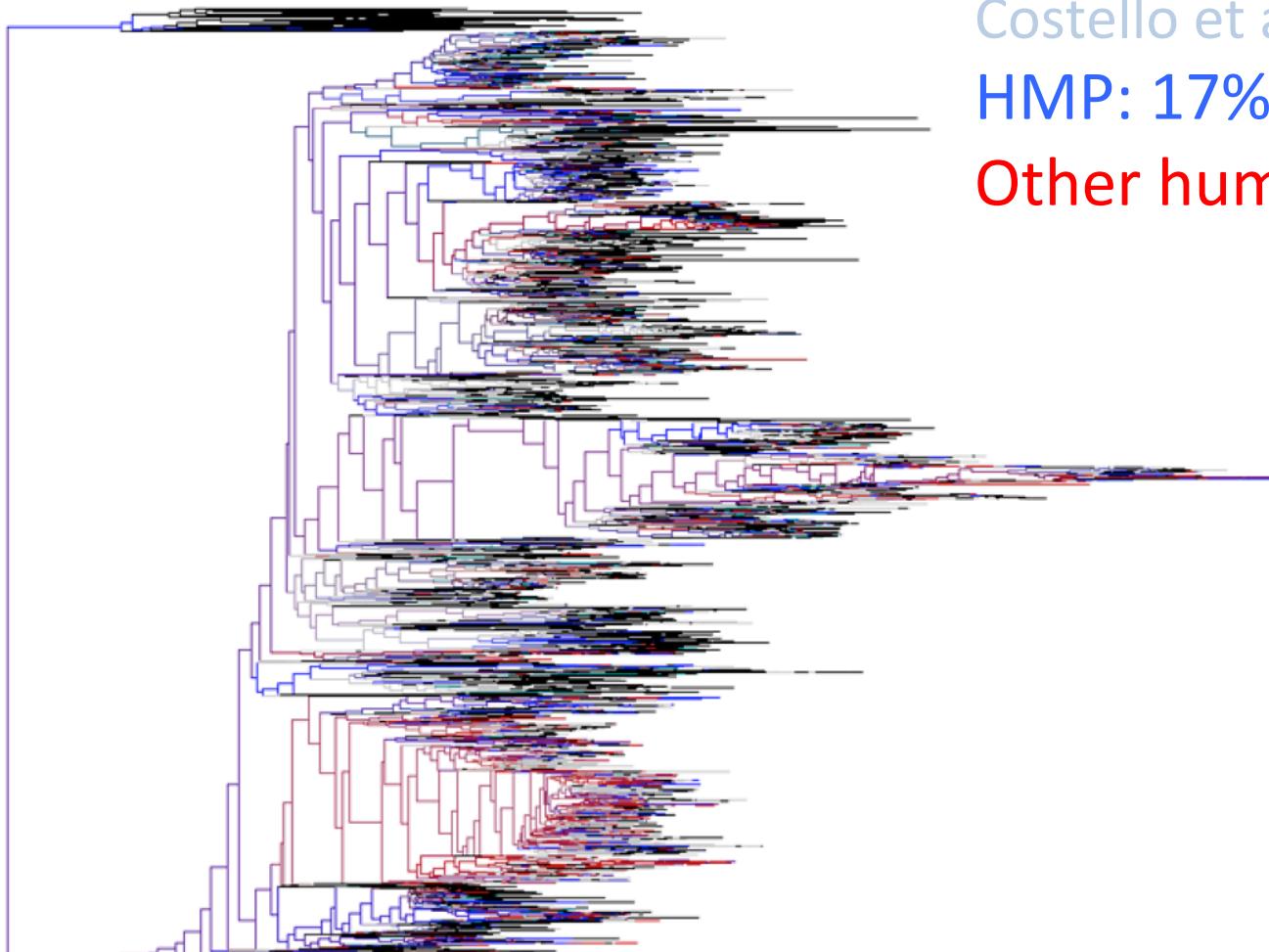
Costello et al. 2009: 14%

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HMP: 17%

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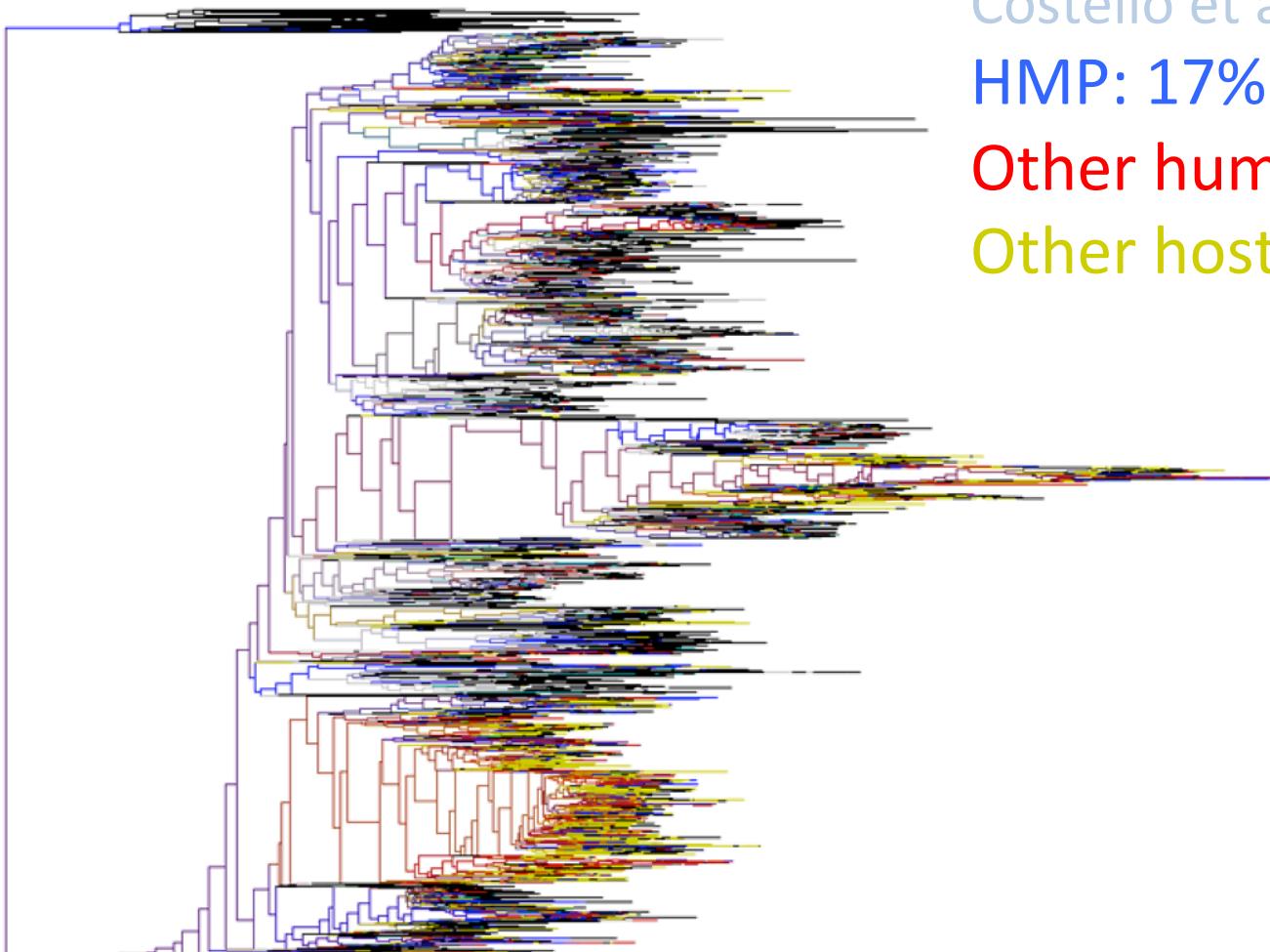


Costello et al. 2009: 14%

HMP: 17%

Other humans: 19%

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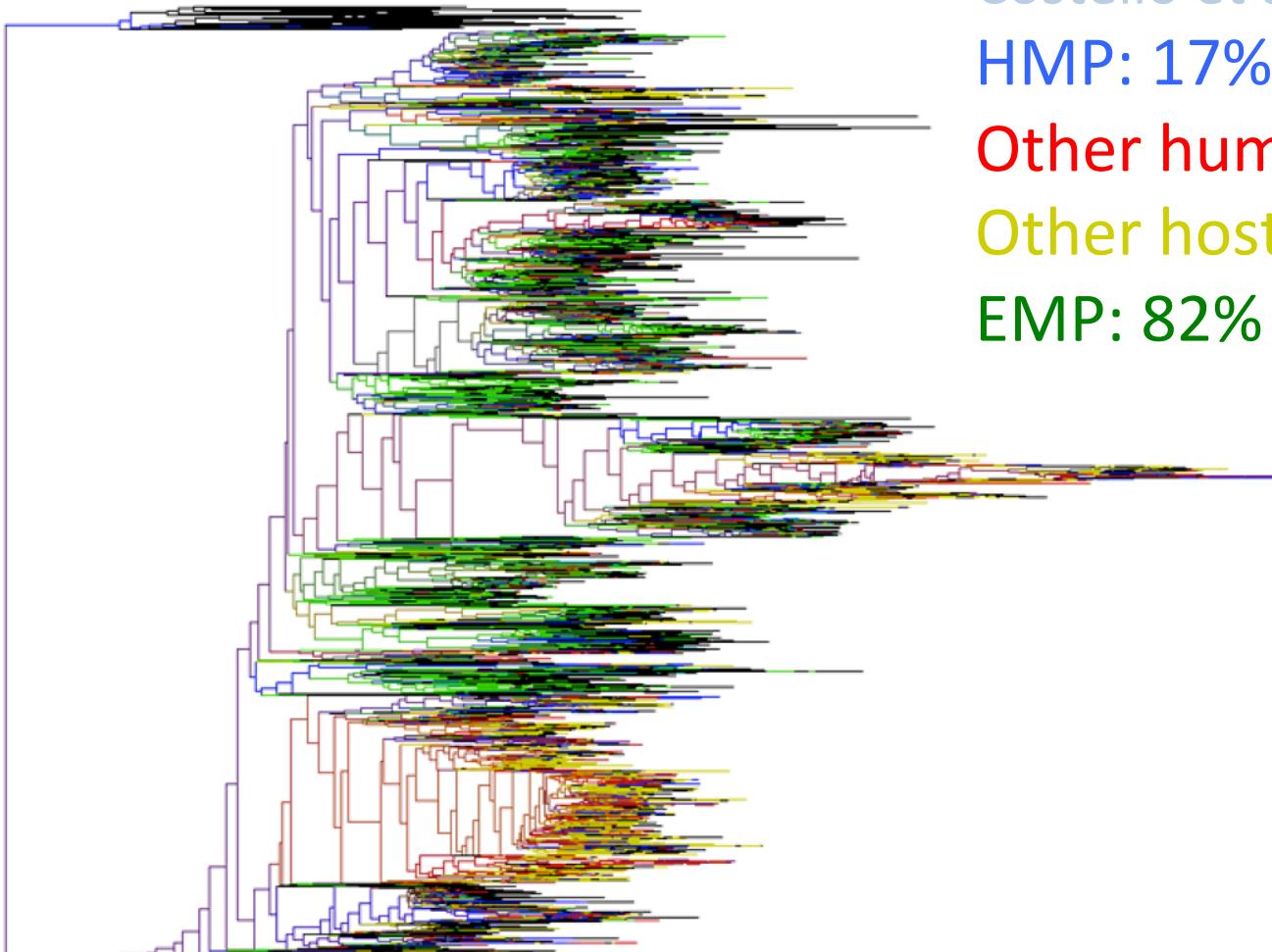
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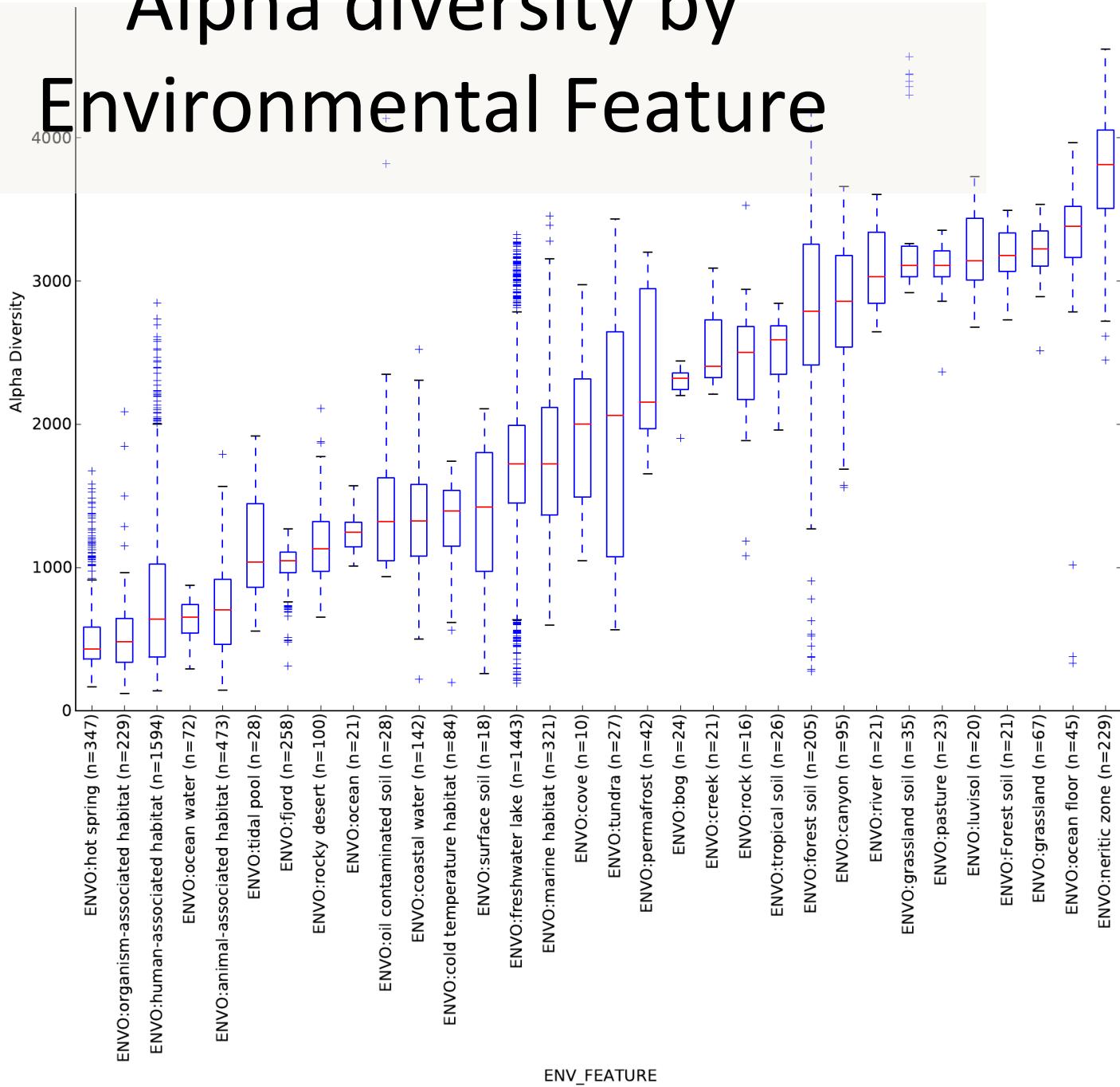
Other hosts: 27%

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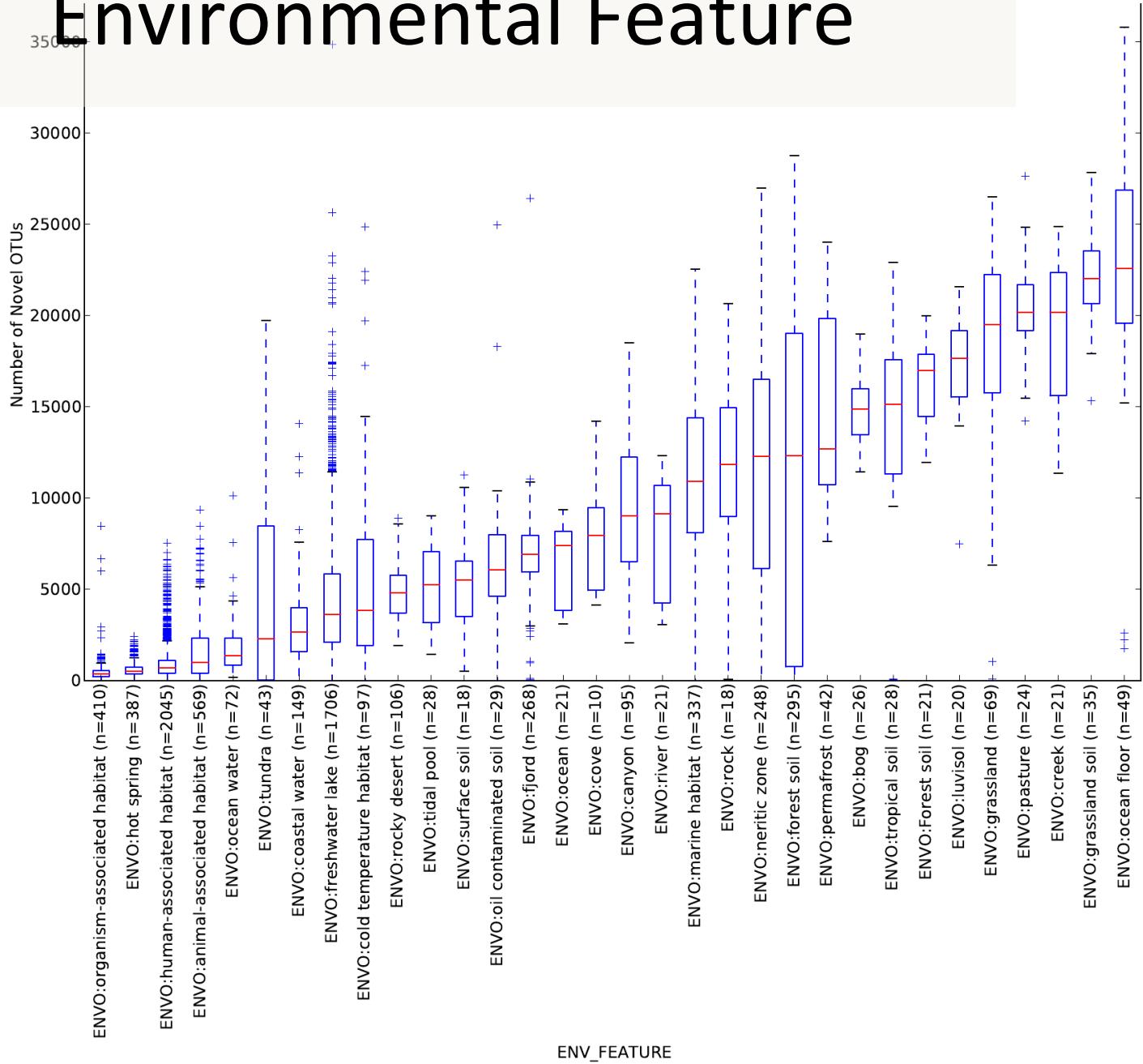


Costello et al. 2009: 14%
HMP: 17%
Other humans: 19%
Other hosts: 27%
EMP: 82%

Alpha diversity by Environmental Feature



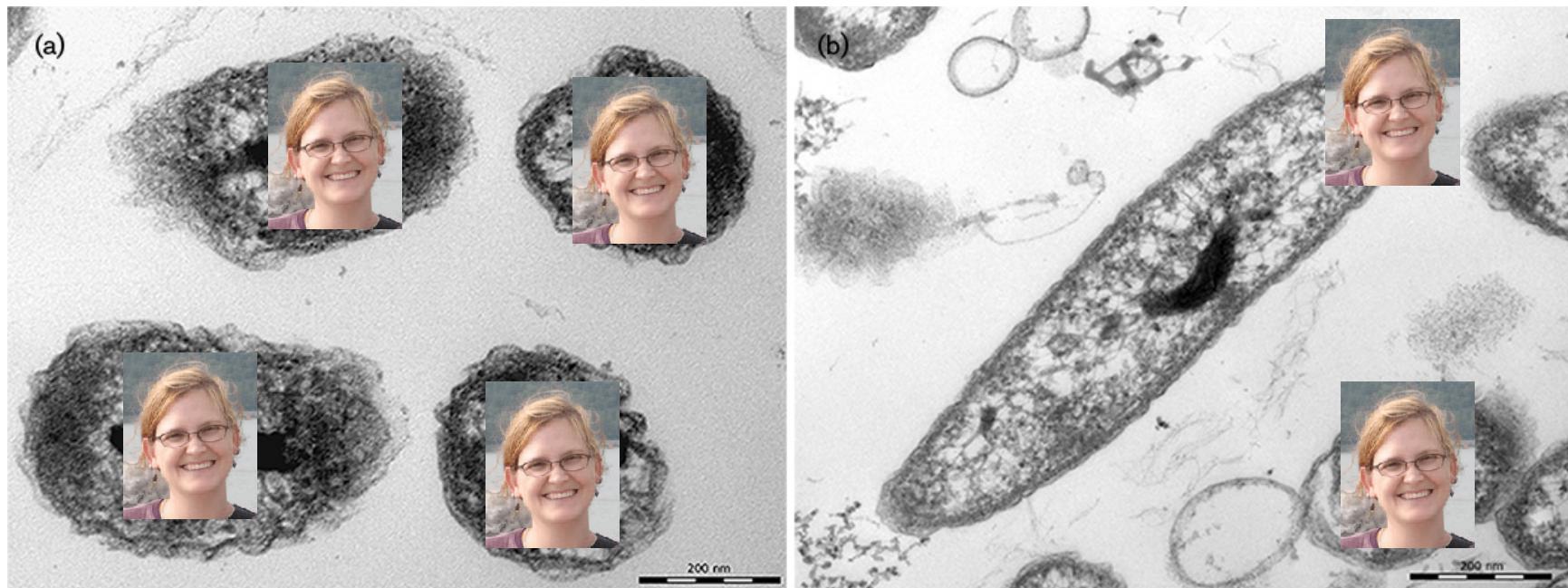
Novel diversity by Environmental Feature



What is the most prevalent microbe in *Limnohabitans spp.* the EMP?

Betaproteobacteria; Burkholderiales;
Comamonadaceae

Present in 39.1% of all EMP samples to date.
Found mostly in the global lakes samples.





Wanted by the FBI

Home • Most Wanted

Be part of the solution.

Protect your family, your local community, and the nation by helping the FBI catch wanted terrorists and fugitives. You can also help reunite missing persons of all ages with their loved ones. Rewards are offered in some cases. Use the Search Center below to find specific cases.

Featured Fugitives and Missing Persons



Ten Most Wanted
ERIC JUSTIN
TOTH



Most Wanted
Terrorists
JAMEL AHMED
MOHAMMED ALI



Crimes Against
Children
GRANT LAVELLE
HUDSON, III



White Collar
Crimes
SLOBODAN
MAKSIM LUNIC



Kidnapping &
Missing Persons
BARBARA B.
BLOUNT



Parental
Kidnapping
RYOKO
UCHIYAMA



Unknown Bank
Robbers
UNKNOWN
SERIAL BANK



Seeking
Information
UNKNOWN
SUSPECT



Case of the Week

MURDER - ATTEMPTED ARMORED CAR ROBBERY

REWARD: The FBI is offering a reward of up to \$20,000 for information leading to the arrest and conviction of those responsible for Oelcher's

death.

The FBI is seeking information regarding an unsolved homicide in Albuquerque, New Mexico. On August 25, 1994, Jeff Oelcher was driving a Wells Fargo Armored Service Corporation van from Socorro, New Mexico, to Grants, New Mexico, on a remote stretch of Highway 6 outside of Albuquerque. He was traveling the routine cash carrier route around 10:30 a.m. when, as he approached mile marker 13, a man lying prone in the bed of a pickup truck on the side of the road opened fire with a high-powered rifle. One of the rounds struck Oelcher in the head. The other courier in the van returned fire, forcing the shooter to flee without getting any money. The truck, which was last seen heading northwest on Highway 6 in the direction of Interstate 40, is described as being dark-colored, with a light-colored camper top.

The suspect may have been armed with a high-powered rifle. The suspect is described as a male with a dark

SUMMARY
MORE
PHOTOS

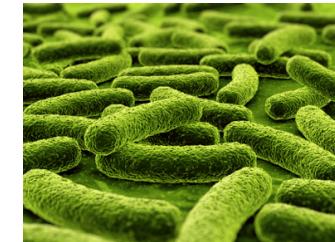
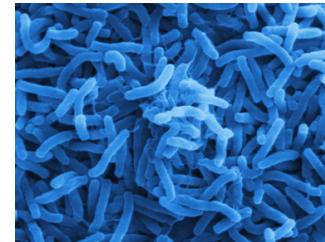
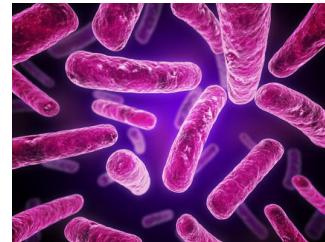
GET POSTER
SUBMIT A
TIP

THE EMP EARTH MICROBIOME PROJECT

Wanted by the EMP

Be part of the solution.

Protect your environment, your intestine, your ocean by helping the EMP identify these wanted bacteria. Rewards are Offered in some cases (though probably not these ones).



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THE EMP EARTH MICROBIOME PROJECT

Wanted by the EMP

#	OTU	NCBI nt closest match	Abundance by ENV_FEATURE								
1	>emp.isme14..26.CleanUp.ReferenceOTU84852 TACGAAGGGGGCGAGCGTTATCCATCATGACTGGCGTAA AGGGTCTGTAGGTGCTTTCTGATCAAAGGTGAAAGAGT AAAGCACAACTTTACAAGC	HM460666.1 (86.0% sim.)	 <table> <tr> <td>ENVO:creek (98.31%)</td> </tr> <tr> <td>ENVO:human-associated habitat (0.73%)</td> </tr> <tr> <td>ENVO:ocean (0.48%)</td> </tr> <tr> <td>ENVO:freshwater lake (0.24%)</td> </tr> <tr> <td>ENVO:river (0.24%)</td> </tr> <tr> <td>ENVO:forest soil (0.00%)</td> </tr> <tr> <td>ENVO:oil contaminated soil (0.00%)</td> </tr> <tr> <td>ENVO:surface soil (0.00%)</td> </tr> </table>	ENVO:creek (98.31%)	ENVO:human-associated habitat (0.73%)	ENVO:ocean (0.48%)	ENVO:freshwater lake (0.24%)	ENVO:river (0.24%)	ENVO:forest soil (0.00%)	ENVO:oil contaminated soil (0.00%)	ENVO:surface soil (0.00%)
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2	>emp.isme14..13.CleanUp.ReferenceOTU50340 CACCAAGGCCACAAGTGGTGGCCTAATTATGGGTCTAA AGCGTCCGTAGCAGGTTAGCAAATCTCTTGAAACTGTT TAGGCTTAACCTAACACAGT	HQ330694.1 (86.46% sim.)	 <table> <tr> <td>ENVO:creek (96.99%)</td> </tr> <tr> <td>ENVO:freshwater lake (1.81%)</td> </tr> <tr> <td>ENVO:human-associated habitat (0.60%)</td> </tr> <tr> <td>ENVO:ocean (0.60%)</td> </tr> <tr> <td>ENVO:forest soil (0.00%)</td> </tr> <tr> <td>ENVO:oil contaminated soil (0.00%)</td> </tr> <tr> <td>ENVO:surface soil (0.00%)</td> </tr> <tr> <td>ENVO:tundra (0.00%)</td> </tr> </table>	ENVO:creek (96.99%)	ENVO:freshwater lake (1.81%)	ENVO:human-associated habitat (0.60%)	ENVO:ocean (0.60%)	ENVO:forest soil (0.00%)	ENVO:oil contaminated soil (0.00%)	ENVO:surface soil (0.00%)	ENVO:tundra (0.00%)
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3	>emp.isme14..2.CleanUp.ReferenceOTU80819 TACGTAAAAGACTAGTGTATTCTCTTATTGGGTTAA AGGGTACCTAAACTGTATTATTAGCCCATAATTAGGGTACA ATATTGCTAGAGTTTATAA	AY544746.1 (89.8% sim.)	 <table> <tr> <td>ENVO:taiga (59.67%)</td> </tr> <tr> <td>ENVO:forest soil (38.69%)</td> </tr> <tr> <td>ENVO:forest (1.36%)</td> </tr> <tr> <td>ENVO:grassland (0.27%)</td> </tr> <tr> <td>ENVO:oil contaminated soil (0.00%)</td> </tr> <tr> <td>ENVO:surface soil (0.00%)</td> </tr> <tr> <td>ENVO:tundra (0.00%)</td> </tr> <tr> <td>ENVO:dry stream (0.00%)</td> </tr> </table>	ENVO:taiga (59.67%)	ENVO:forest soil (38.69%)	ENVO:forest (1.36%)	ENVO:grassland (0.27%)	ENVO:oil contaminated soil (0.00%)	ENVO:surface soil (0.00%)	ENVO:tundra (0.00%)	ENVO:dry stream (0.00%)
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Get Involved

- Membership defined by participation
- Send us your samples
 - Why would the EMP help you answer your hypotheses?
 - What metadata have you collected?
- Help analyze data through github



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microbiome**project**