Environmental Microbiome of Asthmatic Homes

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Microbiome

Definition
The community composition of microorganisms in a niche

Capabilities of Microbiome

- Diversity of niche
- Relationships between samples
- Composition of niche

Limitations of Microbiome

- Relative abundances
- Functional information is missing
- Sequencing length limits depth of taxonomic classification
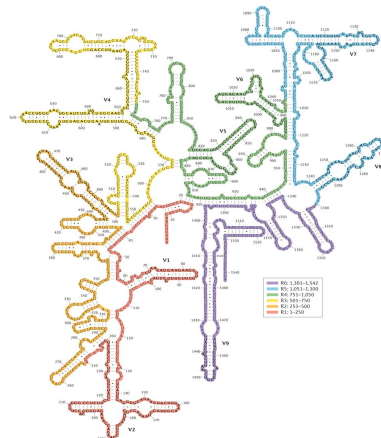
Microbiome Sequencing Methods

Conserved Universal Gene
16S ribosomal RNA:
A genetic element found across
all prokaryotes

Regions of 16S
Contains alternating segments of
conserved and hypervariable
regions allowing for amplification
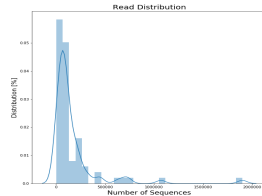and differentiation

Yarza, P, et al. (2014)

BRASS Data Collection

BRASS Study Swabs (76 total)
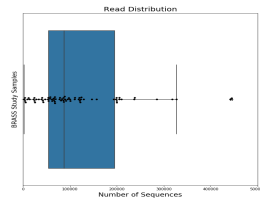
- Swabs from 7 patients' homes
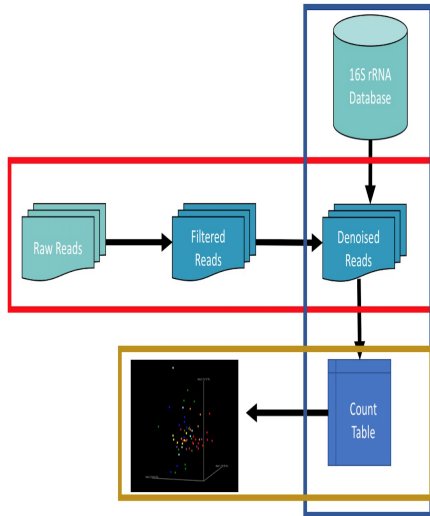- 1 to 3 visits per patient
- 7 study sites

16S Sequencing

- Reads generated on Illumina MiSeq
- More than 12 Million Paired End Reads

Read Distribution

Qiime2 Workflow

Operations

- Illumina error correction
- Taxnomic assignment
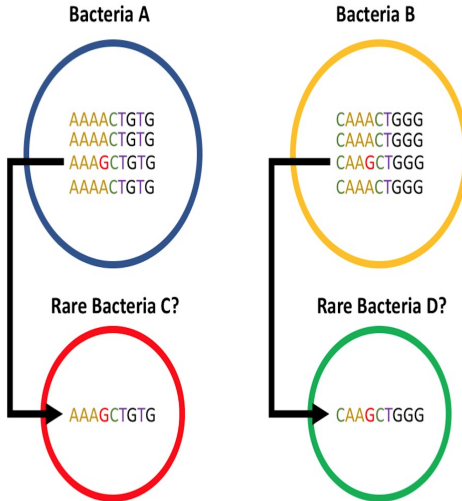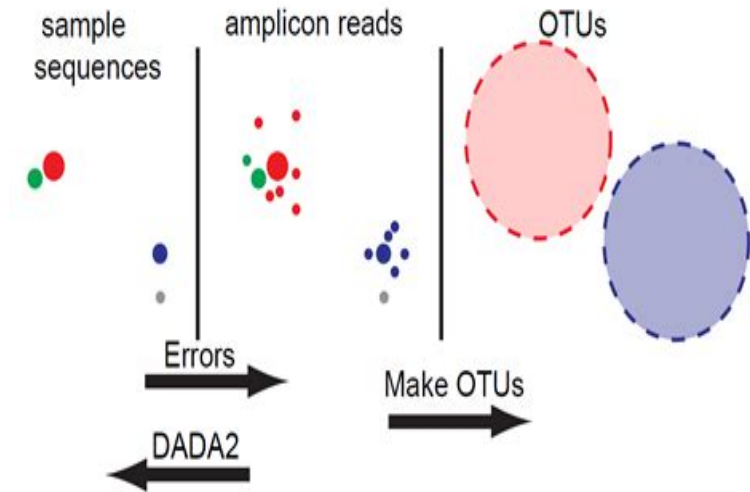- Diversity metrics

Illumina Error Correction

Illumina Error Correction

Workflows

Illumina Error Correction
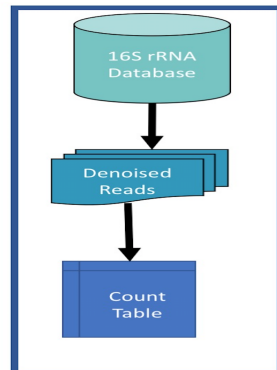
Workflows

Taxonomic Assignment

Taxonomy Classifier
Assign raw reads with a Naive Bayes classifer trained on 16S Database

16s rRNA Databases
GreenGenes
Silva 132 (Troubleshooting)

Diversity Metrics

Alpha Diversity

Richness or organismal
diversity of samples
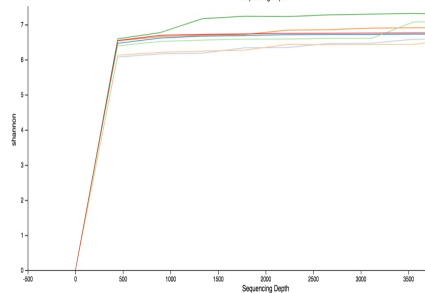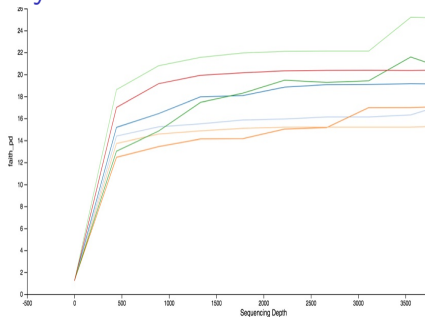
- Faith's Phylogenic
  Diversity
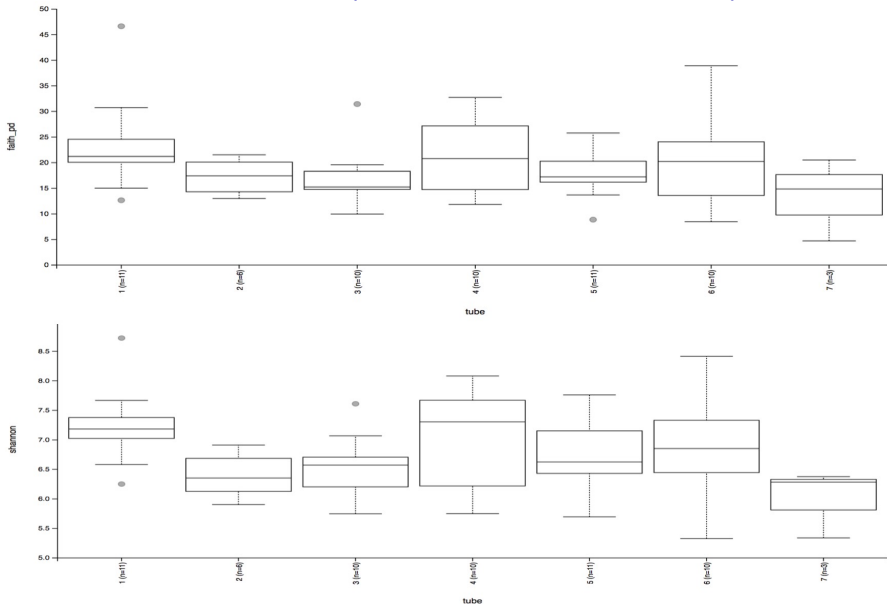 Tree Based Alpha
  Diversity Estimate

- Shannon Diversity
  Index
  $H = -\sum[(p_i) * ln(p_i)]$
  $E = H/H_{m}ax$
  $SI = \sum[E_i]$

Diversity Metrics (Alpha Diversity Barplots)

Diversity Metrics

Beta Diversity
Evenness or distances of counts between samples

Weight Unifrac
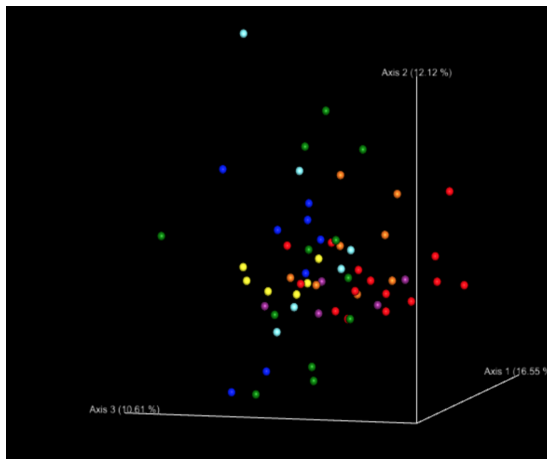Measure takes into
account abundances and
phylogeny

PERMANOVA
Distances within a group is
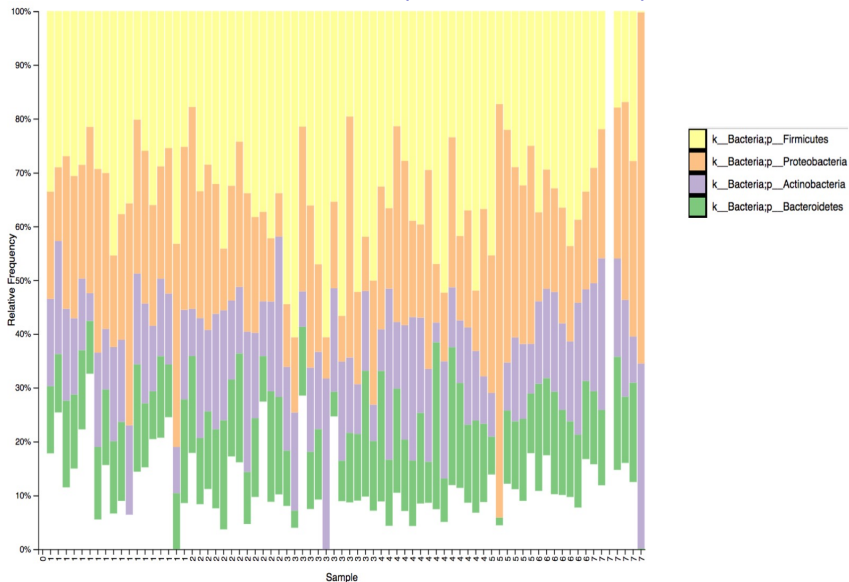more similar to each other
than outside group

Significance
By House: $p < 0.001$
By Tube: $p < 0.001$

Diversity Metrics (Taxa Bar Plots)

Acknowledgements

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Questions?

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