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Dysbiosis

- everyone has a unique microbiome.
- since we all have a unique "fingerprint" of our microbiome, dysbiosis can be hard to detect.
- we usually think of dysbiosis as a disease state, but it is simply just the difference in an individual's microbiome.
- * Cook's postulate: Sick individual $\rightarrow$ give to healthy person, see if they get sick, and see original organism.

Alpha diversity

- measures diversity within a sample.
- measures richness and evenness
- higher alpha diversity in formula-fed infants than in breastfed infants.

Metrics of Alpha diversity.

- Richness (R) $\rightarrow$ Number of species
- Shannon $-\sum_{i=1}^R p_i \ln p_i = H'$ $\rightarrow p_i$ = proportion of the total belonging to the i^{th} element.

- Simpson $-\frac{1}{\sum_{i=1}^R (n_i/N)^2}$

$N \rightarrow$ total # of species

$n \rightarrow$ total # of a GIVEN species

Beta Diversity

- Information about differences between samples.
- Beta diversity is useful for clustering groups of samples based on some common features.

Metrics of Beta Diversity

- Bray-Curtis $-\text{BC}_{ij} = 1 - \frac{2c_{ij}}{s_i + s_j}$

- unifrac $-\left(\frac{\text{Sum of unshared branch lengths}}{\text{Sum of all tree branches}} \right) = \text{fraction of branches}$