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Conflict of Interest Disclosure

I have no conflict of interest to report in relation to this presentation.
Sharing Our Bodies: The Symbiosis of Humans and Our Microbiota

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The Human Microbiome

- Composed of: Bacteria, Archaea, Eukaryotes and Virus
- Density: $10^{11}$ to $10^{12}$ cells/mL (colon)
- High number of species present
- One microbiome to each body part (nose, mouth, intestine, skin etc.)

Data overload <- NGS(sequences)
The Human Microbiome

- Composed of: Bacteria, Archaea, Eukaryotes e Viruses

- Density: $10^{11}$ a $10^{12}$ cells/mL (colon)

- High number of species present

- Distinct compositions for each body site (nose, mouth, intestine, skin etc.)
Symbiosis and Dysbiosis

In the beginning:

- In this issue of *Science*, we have:
  - 3 volunteers
  - Sanger
    - 11831 seqs: bacteria
    - 1524 seqs: archaea
    - “Diversity of the Human Intestinal Microbial Flora”

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With the advent of NGS

Now

- 3 to 6 billion reads
- 25 million reads
Co-variation with health/diet/lifestyle


- 2 cohorts:
  - N=1106
  - N=1135
  - 700x bigger

- Normalized to 10K sequences/sample
Diversity and Function

- Bacteria

- Differences in species composition

- Similarities in metabolic functions
  - Phage?
Diversity: Fungi and Archaea

- 5 archaea genera
- 66 fungi genera

What Influences the Gut Microbiome?
What Influences the Gut Microbiome?

- Diet
- Genetics
- Host Phenotype
- Antibiotics
- Inflammation
- Environment
- Diet

Muegge et al. Science 2011. 332(6032):970-974
Microbiome, Diet and Co-evolution

Diet and the Microbiome: the case of Burkina Faso.

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Microbiome variation: Enterotypes

Microbiome variation: Enterotypes

A balance between *Bacteroides* and *Prevotella*

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Enterotypes and human diet

Global associations with usual diet, not with recent diet

Wu et al. 2011 Science 334(6052): 105-108
Population variation


Martinez et al. 2015 Cell Reports 11(4):527-538

Schnor et al. 2014. Nature Communications 5:3654


Cardiovascular disease: Atherosclerosis

- An example of where we are now
Cardiovascular disease: Atherosclerosis

- **Risk factors:**
  - High cholesterol
  - Obesity
  - Diabetes
  - Etc

CVD risk

- N = 1865
- Serum levels

CVD risk

- TMAO
- N=4007
- 3 year followup
- What is TMAO?

Tang et al. 2013. NEJM 368:1575-1584
Atherosclerosis

- Animal models:
  - Choline
  - Foam cells (macrophage),
    - With and without ABX

Atherosclerosis

Atherosclerosis

- Microbiome metabolism influences:
  - Example: Choline/Carnitine -> TMA -> TMAO -> Atherosclerosis

Atherosclerosis

- Many bacterial genes with the same function
Archaeobiotic X Atherosclerosis

- *Methanomassiliicoccus luminyensis*
- Methanogenic
- Intestinal isolate
- Can grow using TMA producing methane

Archaeobiotic X Atherosclerosis
Thanks!
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