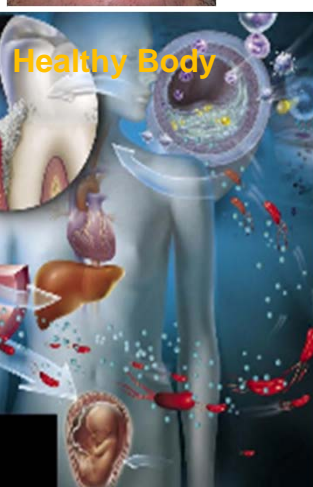


Microbiome in Metabolism

Hui Wu, PHD
University of Alabama at Birmingham
School of Dentistry

Oral infection and systemic disease



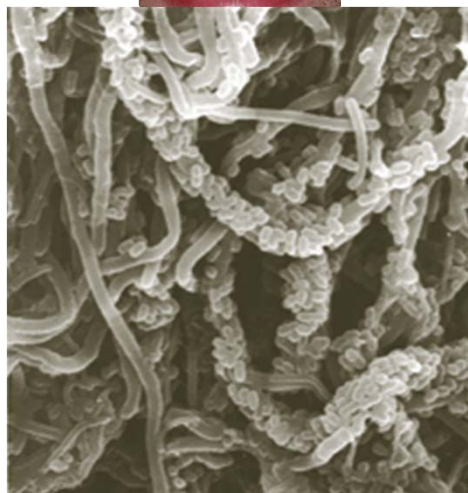
Cardiovascular
Complications

Respiratory
infection

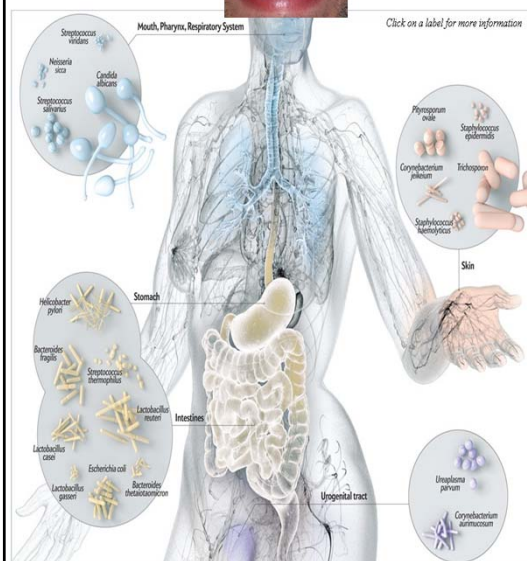
Pregnancy
complication

Colon
cancer

Dental Plaque Complex bacterial communities



Microbes are everywhere



Who are they?

What are they doing?

How is the host responding?

What forces maintain the equilibrium?
Symbiosis versus Dysbiosis

How do we differ?

How do we manipulate microbes?

10 % human cells
90 % microbial cells
Genetic info > 100

The Human Genome Project

The project funded by the US government in 1990, and declared complete in 2003.

A parallel project by the Celera Genomics in 1998.

Capacity-3 billion bps

Major advance in DNA sequencing

versus the Human Microbiome Project 2007

US National Microbiome Initiatives May 2016

Microbiome Analysis-16sRNA profiling/metagenomics



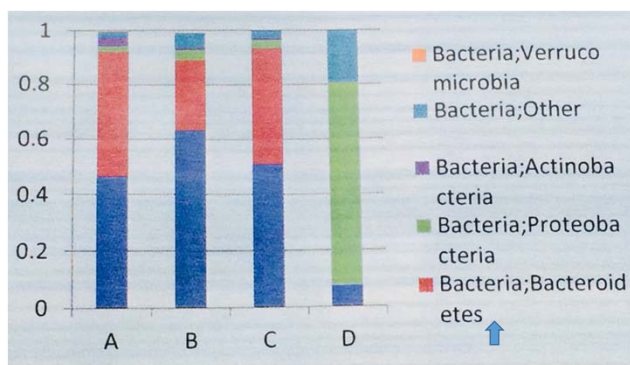
Plaque or saliva



PCR with bar coded primers specific for 16S rDNA region for amplification

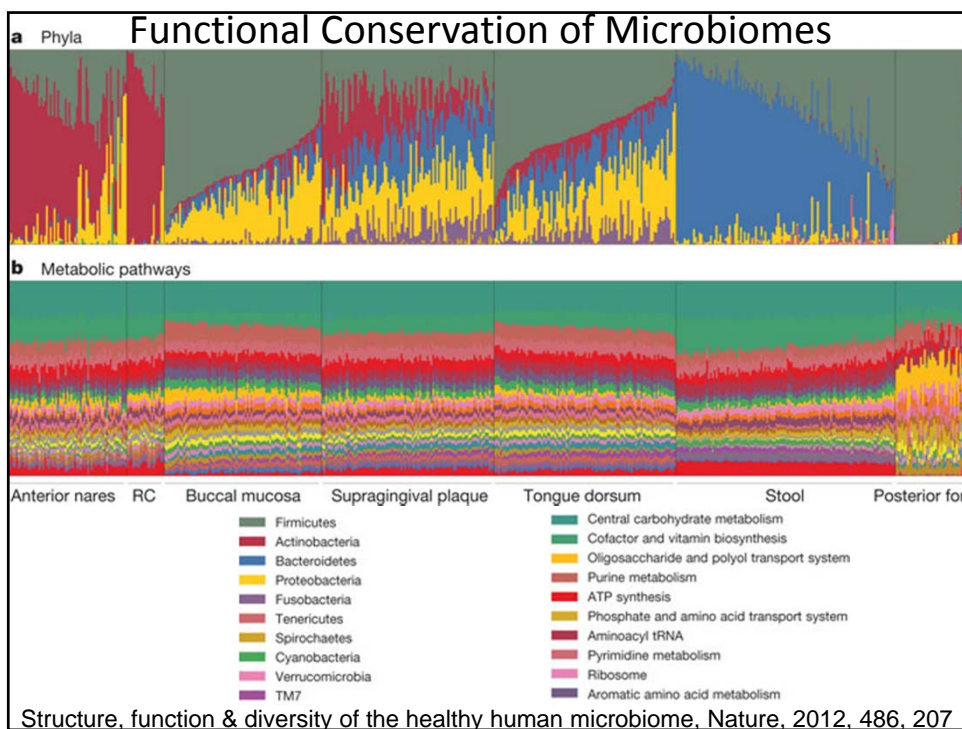
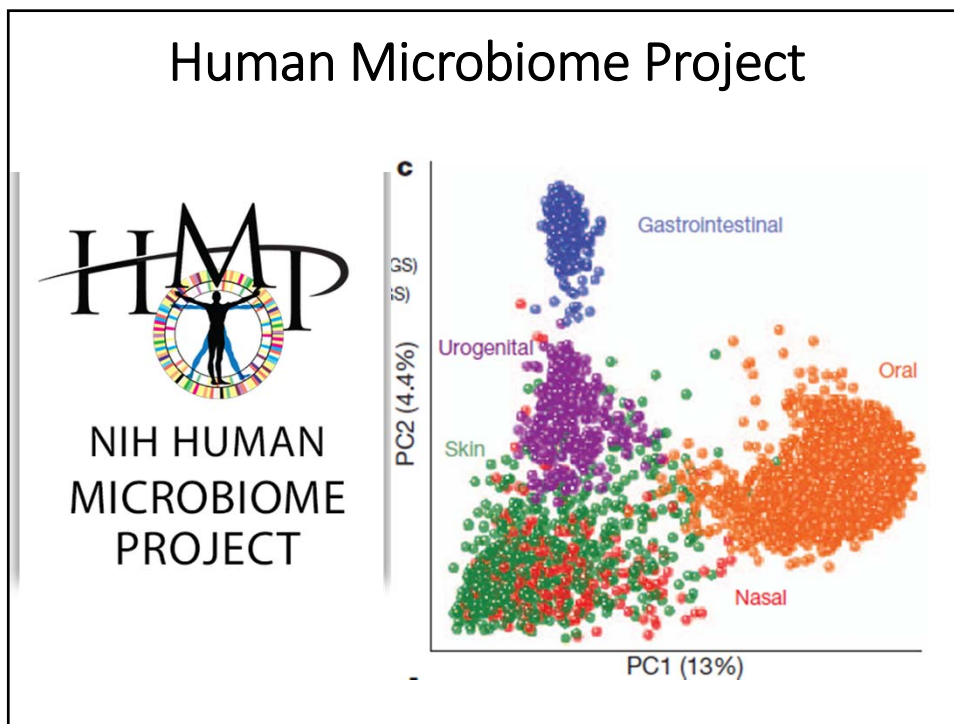


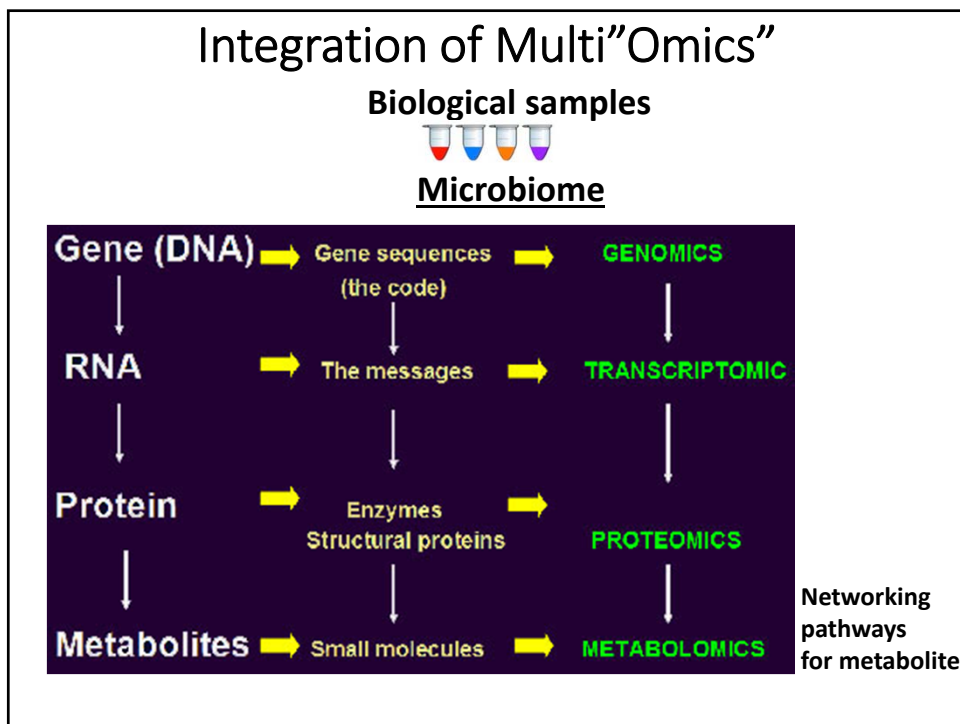
Metagenomics






```

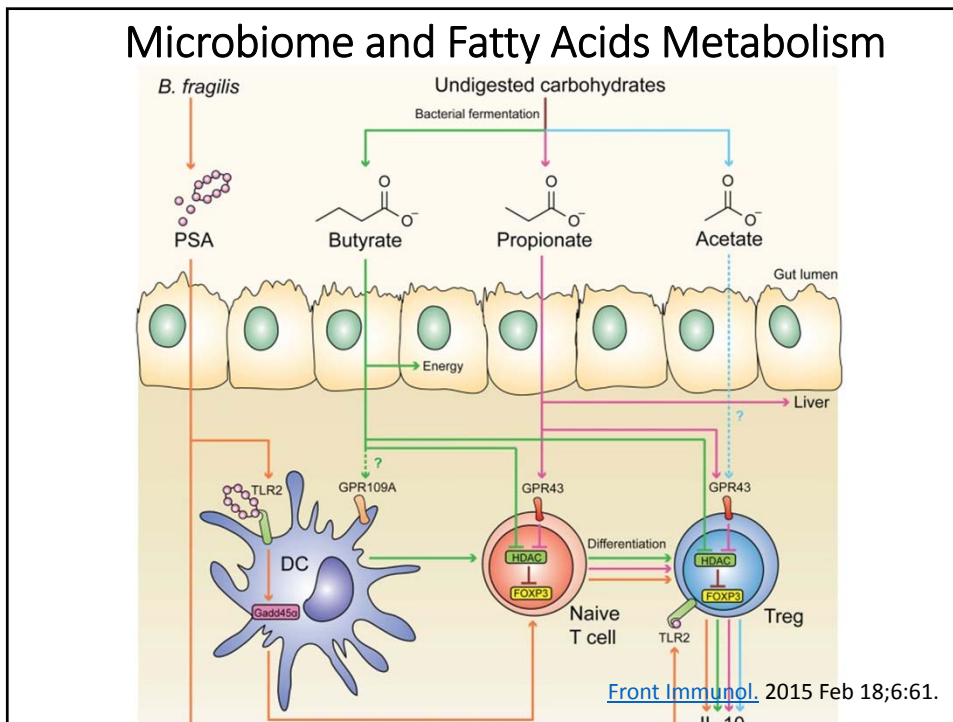
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>TCACATGAACCTAGGCAGGACGAA...
>CTACCGGAGGACAGGCATGAGGAT...
>TCACATGAACCTAGGCAGGAGGAA...
>GCACCTGAGGACACGCAGGACGAC...
>CTACCGGAGGACAGGCAGGAGGAA...
>CTACCGGAGGACACACAGGAGGAA...
>GAACCTTCACATAGGCAGGAGGAT...
>TCACATGAACCTAGGGCAAGGAA...
>GCACCTGAGGACAGGCAGGAGGAA...
    
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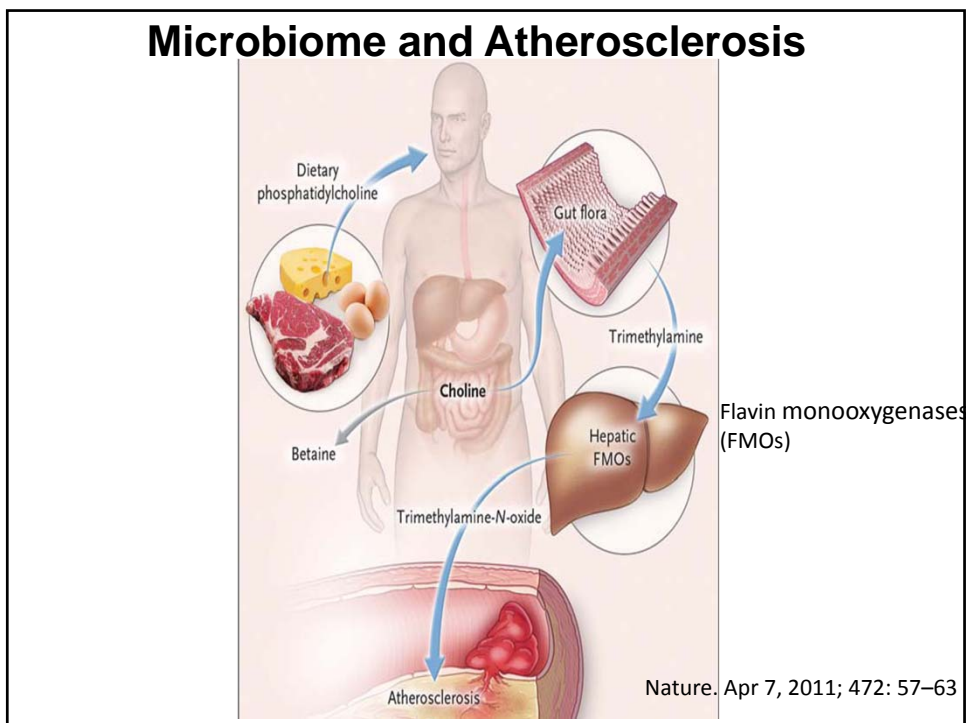


 <p>Fruit fly <i>(Drosophila melanogaster)</i></p>	<p>Microbiomes impact behaviors</p> <p>Gut microbiota Diet-specific microbiota influence mating preferences</p>
 <p>Mosquito <i>(Anopheles gambiae)</i></p>	<p>Human skin microbiota Skin microbes of humans influence attraction to mosquitoes</p>
 <p>Mouse</p>	<p><i>Lactobacillus rhamnosus</i> The probiotic <i>L. rhamnosus</i> decreases anxiety in mice</p> <p>Fighting microbes or Farming microbes?</p>

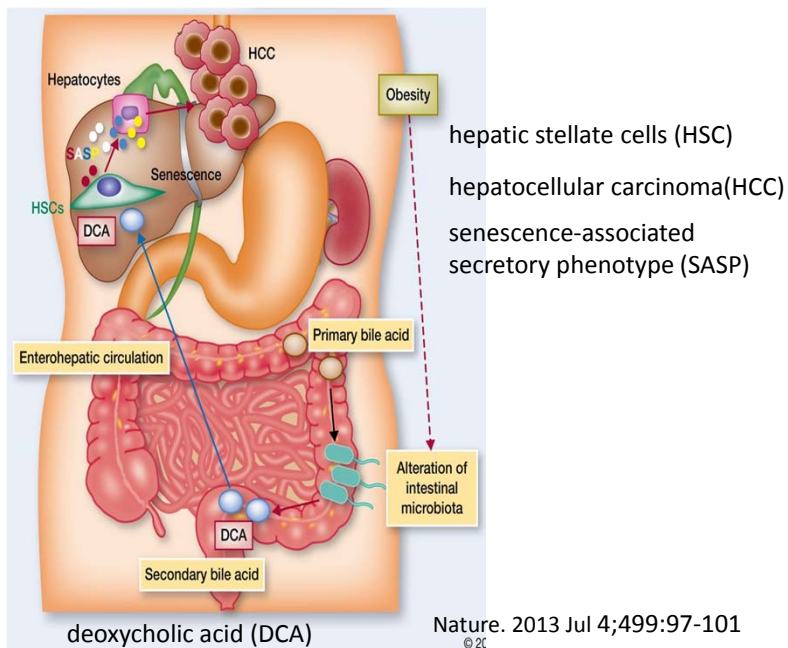
Microbiome and Fatty Acids Metabolism



Microbiome and Atherosclerosis



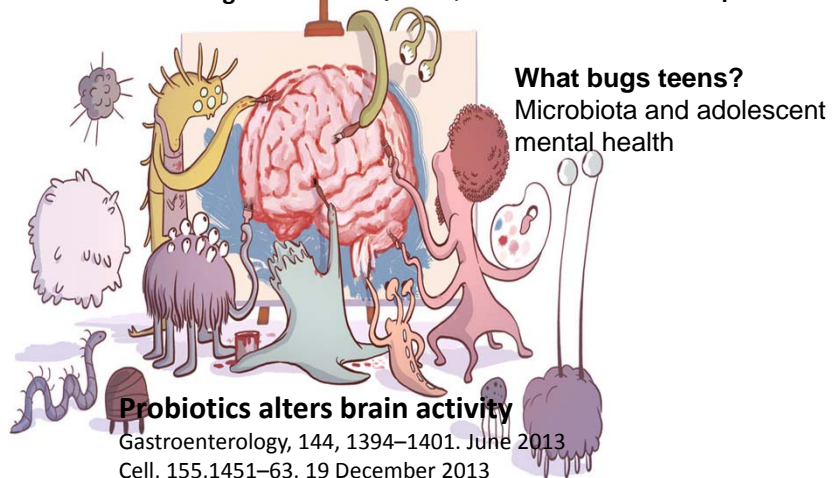
Obesity and Cancer: a Microbial Connection



Gut Bacteria and the Workings of Our Minds

Of Humans
MRI scans to look at the brains
the types of bacteria in their guts

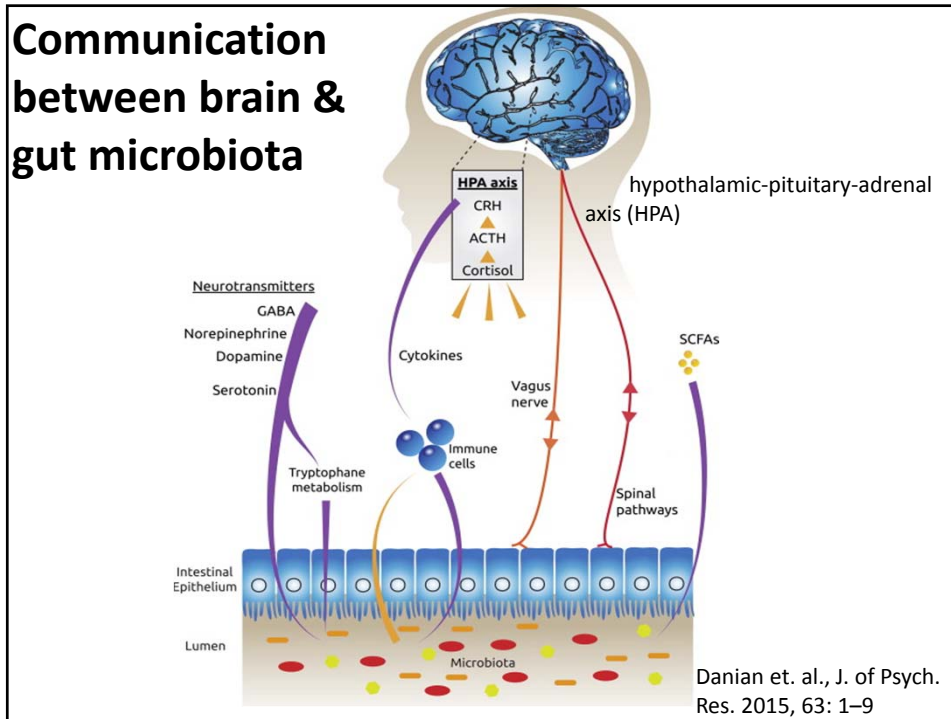
Of Mice
Gut microbiota/ mouse behavior
Bold/timid, brain-derived neurotrophic factor



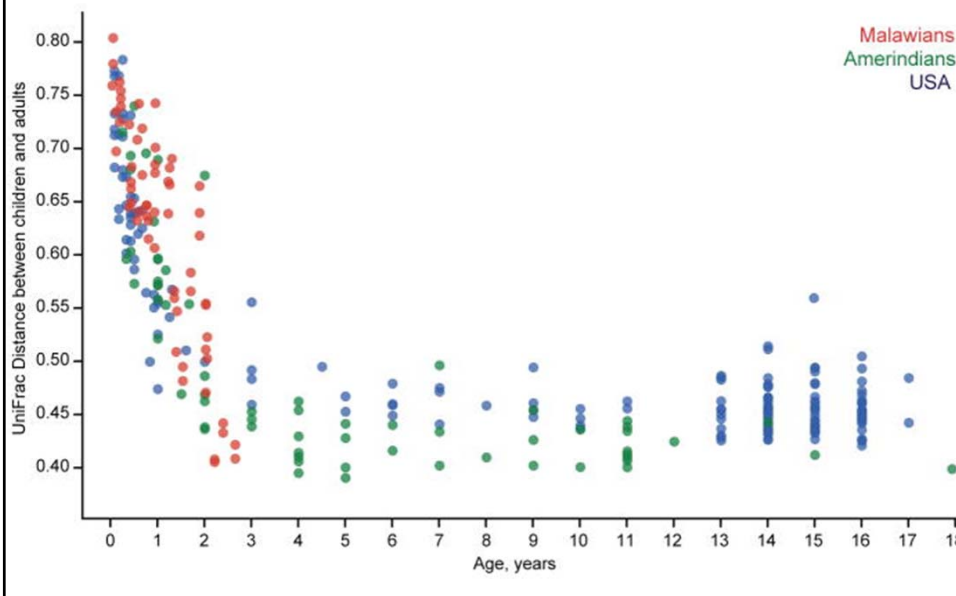
What bugs teens?
Microbiota and adolescent
mental health

Probiotics alters brain activity

Gastroenterology, 144, 1394–1401. June 2013
Cell, 155,1451–63. 19 December 2013
Cell, 165,1762-75. Jun 16, 2016 (maternal diet, gut microbiota & Social and Synaptic Deficits)



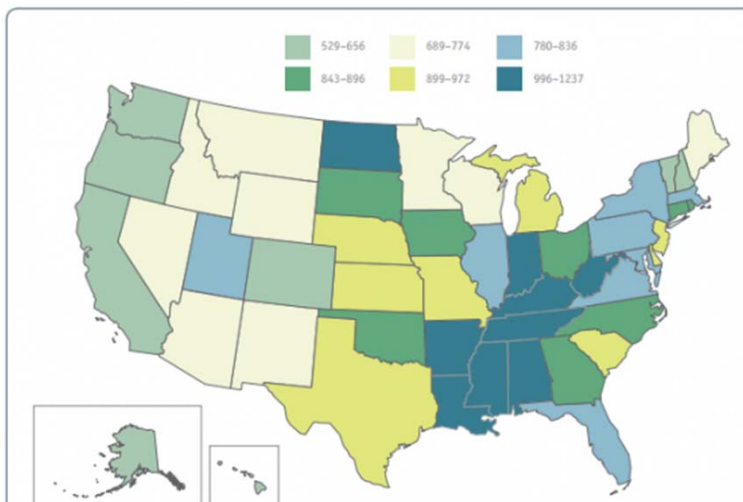
When do our body establish our microbiome?



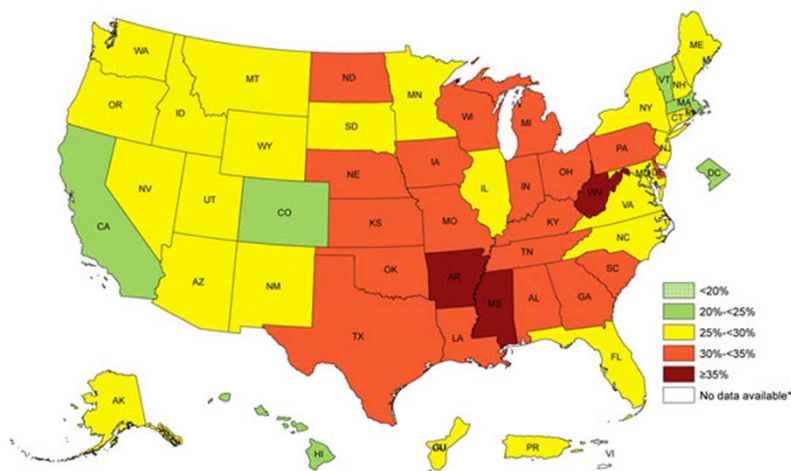
Antibiotic Use & Promotion of Animal Growth



Use of Antibiotics Map

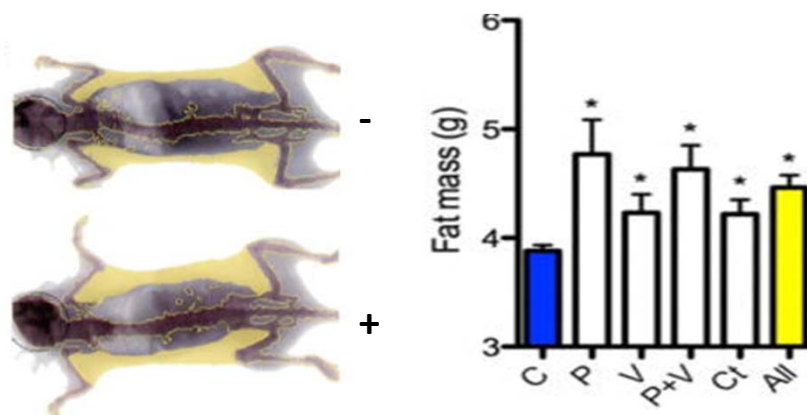


Obesity Among U.S. Adults



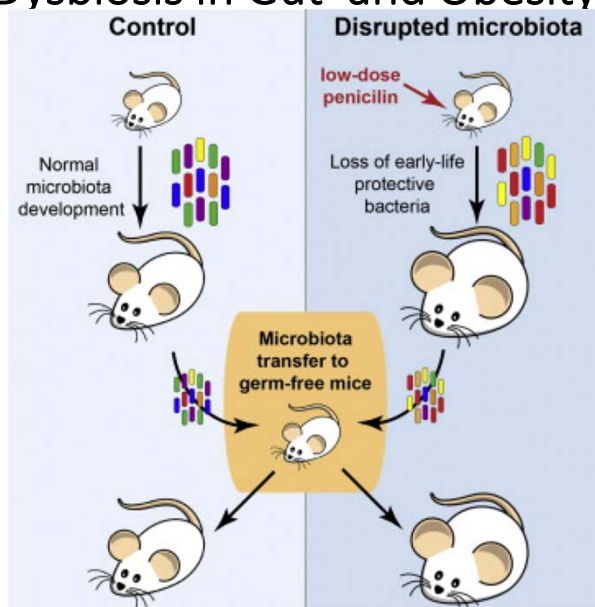
2014

Increased body fat by the use of antibiotics



Cho I et. al., Nature. 2012 Aug 30;488(7413):621-6.

Dysbiosis in Gut and Obesity



Cox et al., Cell 158, 705–721, August 14, 2014

Antibiotics in Infancy and Early Childhood Obesity

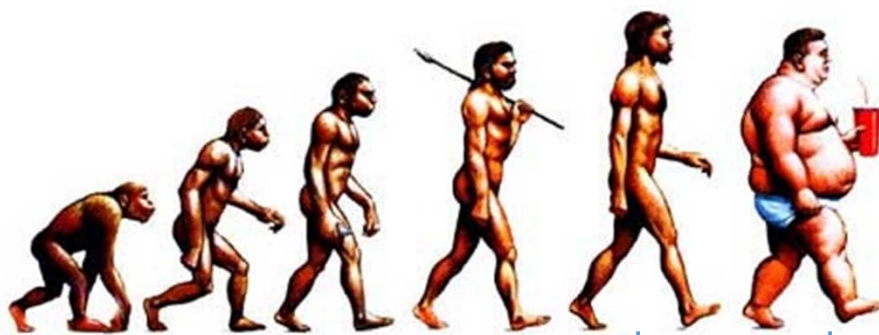
- 69% of children exposed to antibiotics before 2nd year
- Exposure to broad-spectrum antibiotics increased risk to obesity
 - Asthma and wheezing conditions
- Exposure to narrow-spectrum antibiotics **did not** increase risk to obesity

Antibiotics

A modifiable risk factor for childhood obesity??

Bailey et al., *JAMA Pediatr.* September 29, 2014

Evolution of Human Beings



1,000s to 1,000,000 years

20-40 years



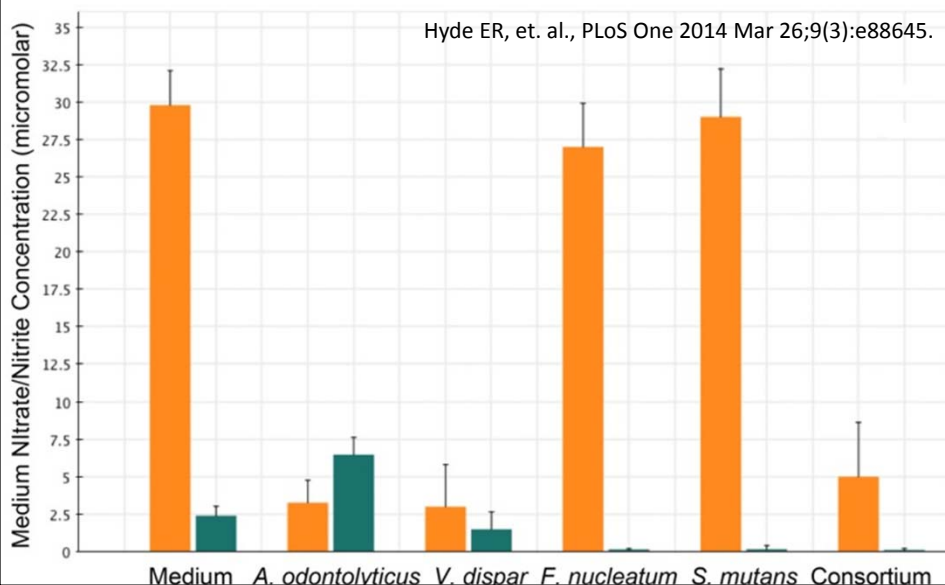
Antiseptic Mouthwash and Blood Pressure

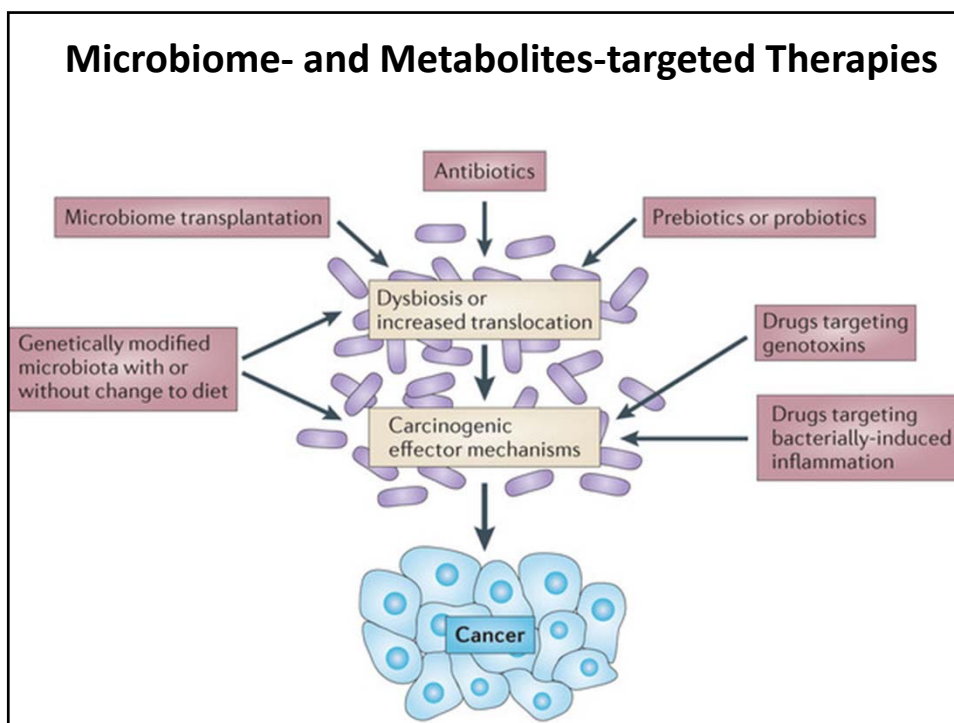
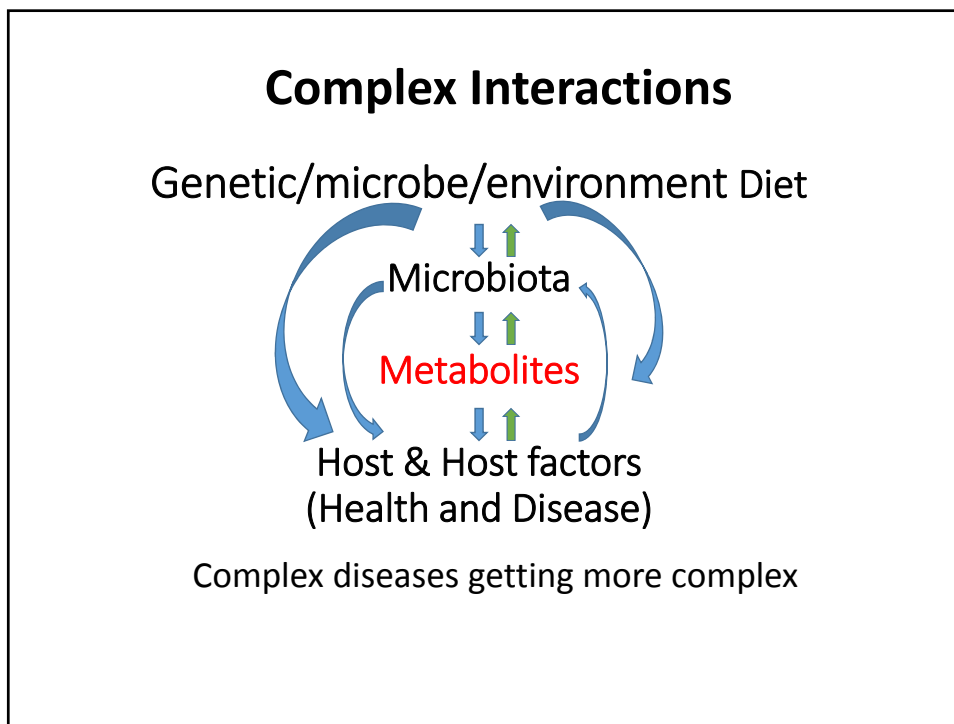
- Bacteria in the mouth reduce nitrates to nitrites
- Nitrite reduced to **NO**– relaxes vessels and lowers blood pressure
- Antiseptic mouthwash reduced oral nitrite production by 90% and plasma nitrite levels by 25% ($p < 0.001$)
- Systolic and diastolic blood pressure increased by 2–3.5 mm Hg



Kapil et al., Free Radic Biol Med. Feb 2013; 55(C): 93–100.

The nitrate- and nitrite-reducing capacity of oral bacteria





Microbes rule the world



Thank you!