

IUNS 21st ICN International Congress of Nutrition “From Sciences to Nutrition Security”



INTERNATIONAL UNION OF
NUTRITIONAL SCIENCES

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EVENT



Conflict of Interest Disclosure

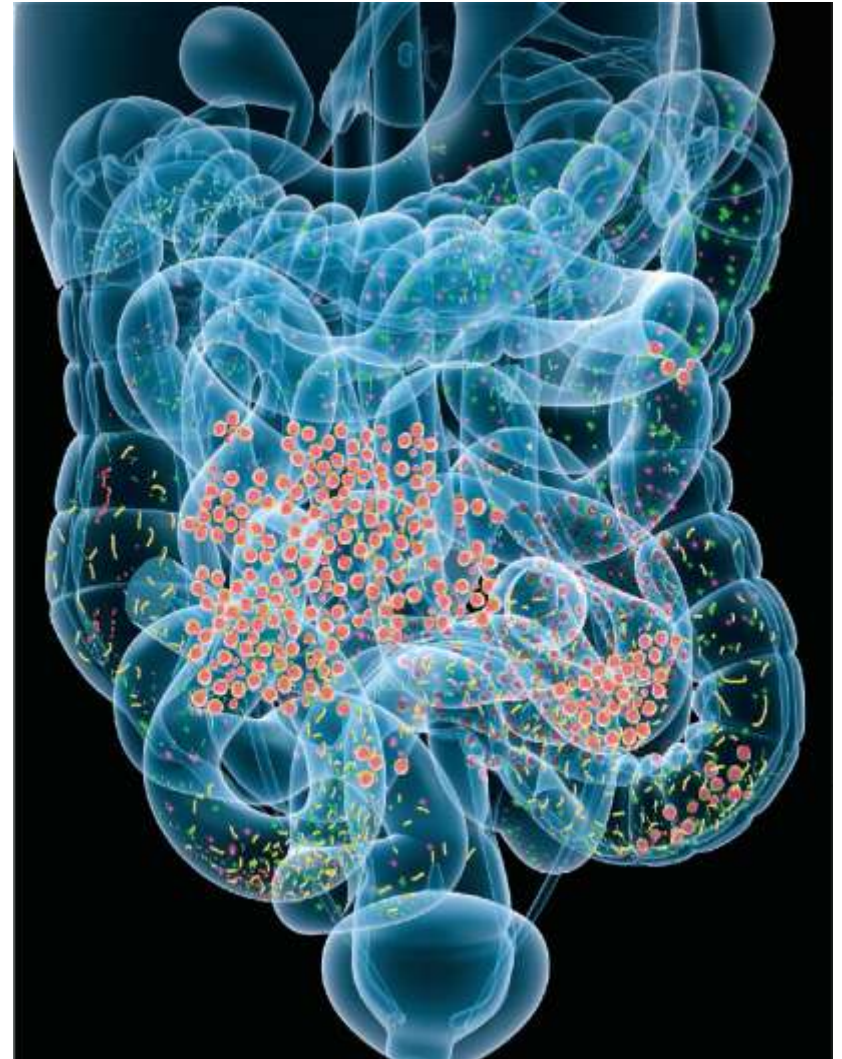
I have no conflict of interest to report in relation to this presentation.

Sharing Our Bodies: The Symbiosis of Humans and Our Microbiota

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 - ▶ 10/2017
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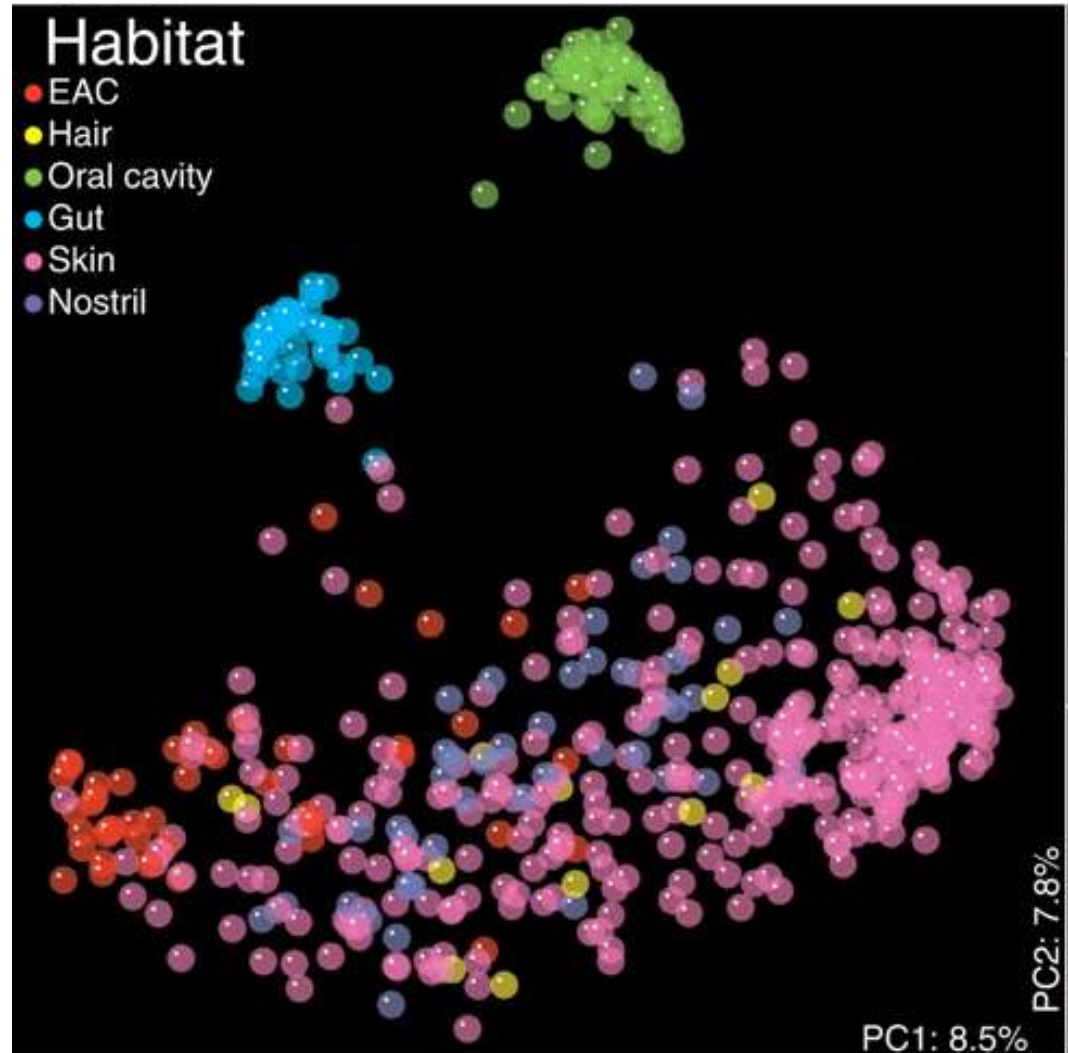
The Human Microbiome

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

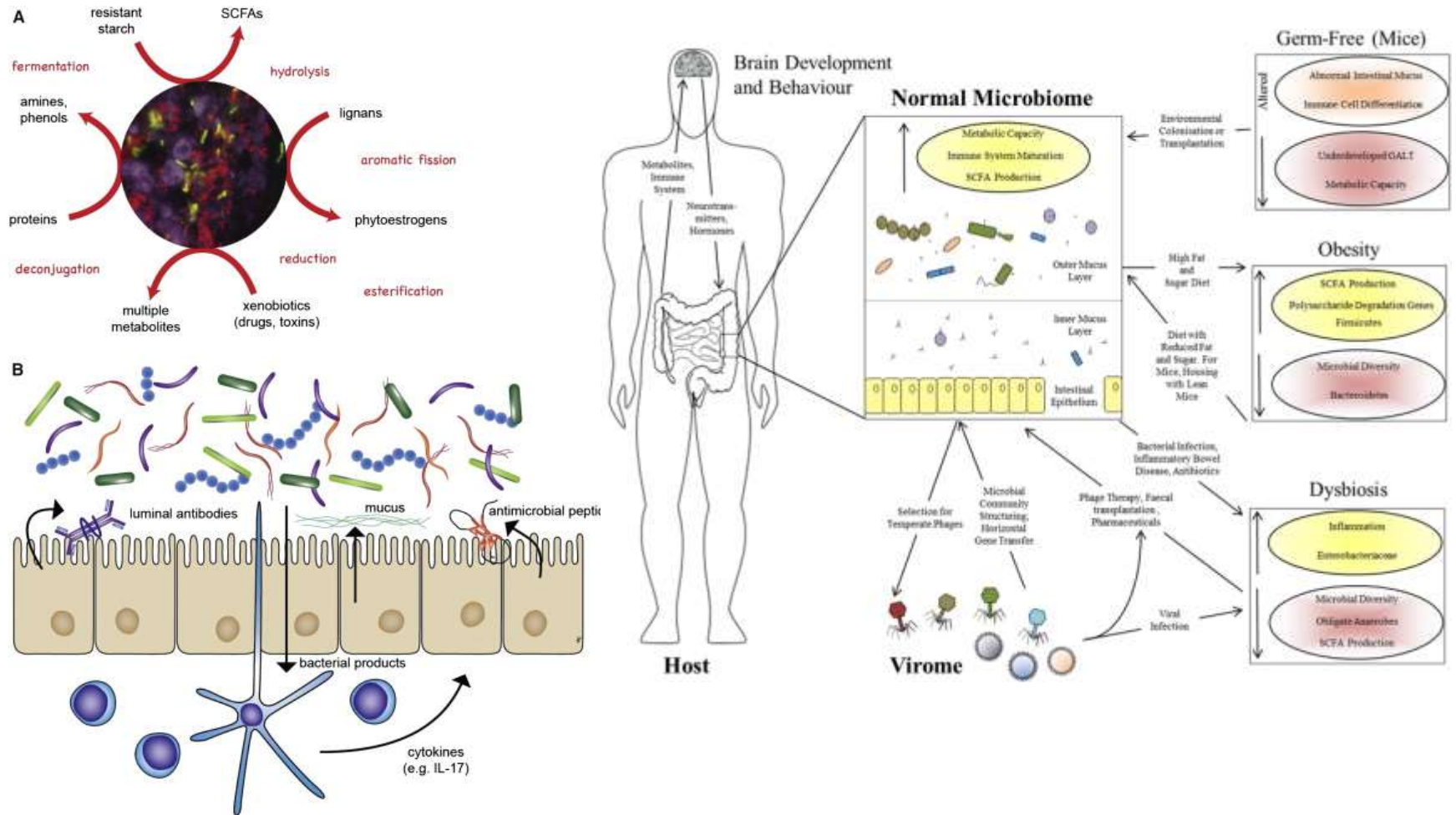


The Human Microbiome

- ▶ 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.)



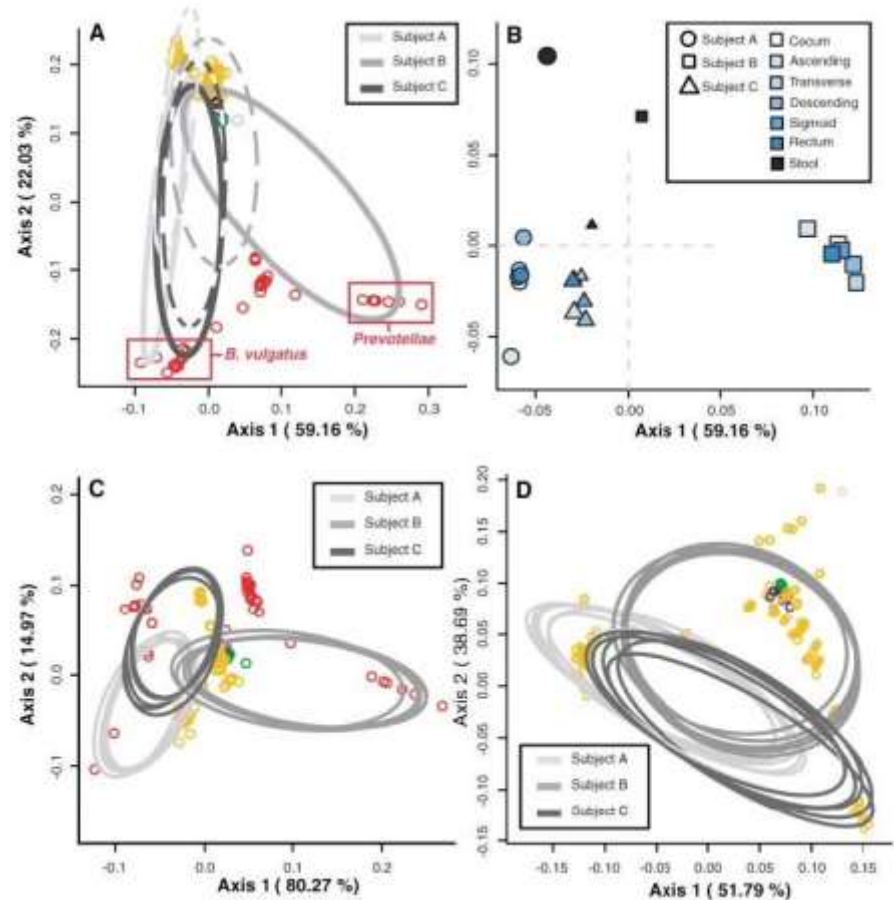
Symbiosis and Dysbiosis



In the beginning:

► In this issue of *Science*, we have:

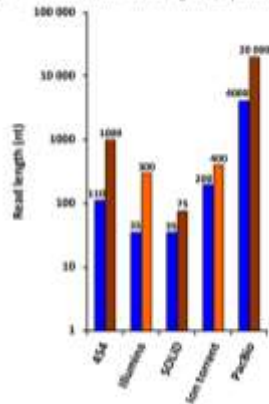
- 3 volunteers
- Sanger
 - 11831 seqs: bacteria
 - 1524 seqs: archaea
 - “Diversity of the Human Intestinal Microbial Flora”



With the advent of NGS

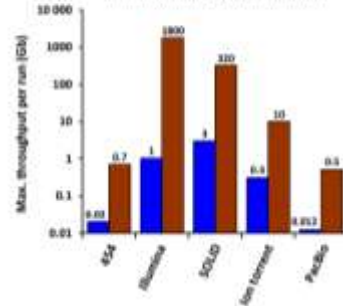


(A) Maximum read length NGS platforms

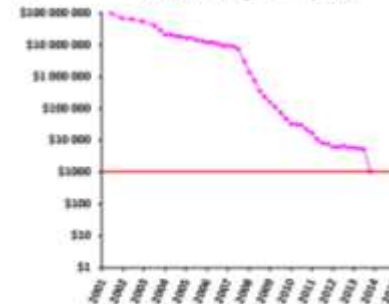


(B)

Maximum throughput NGS platforms

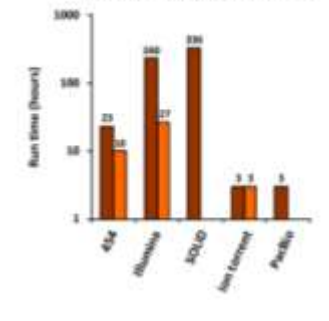


(C) Cost per human genome sequence

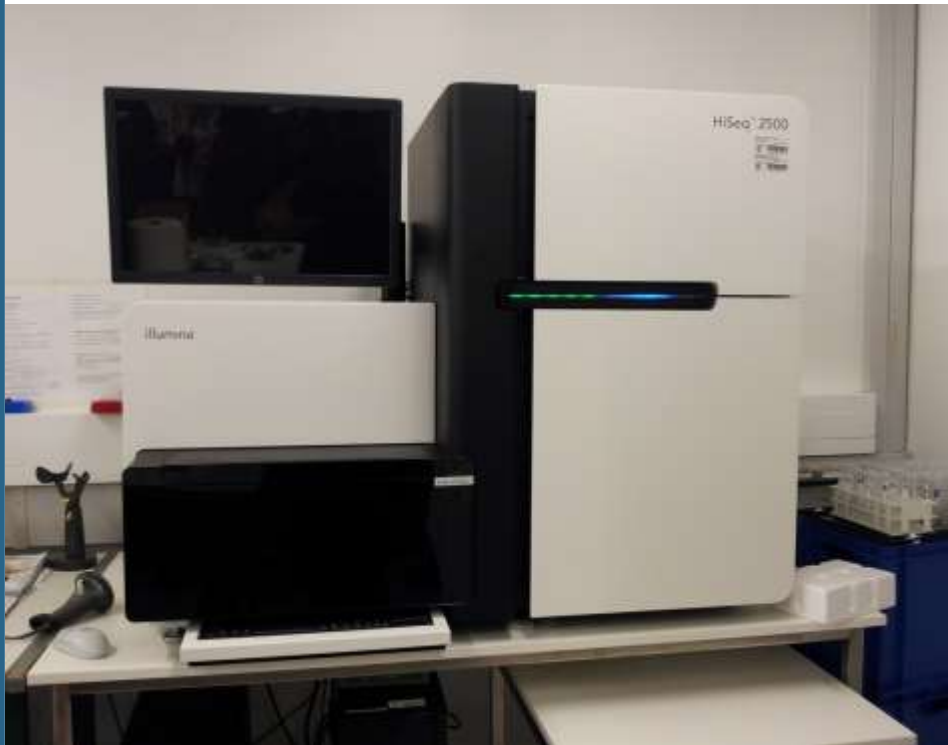


(D)

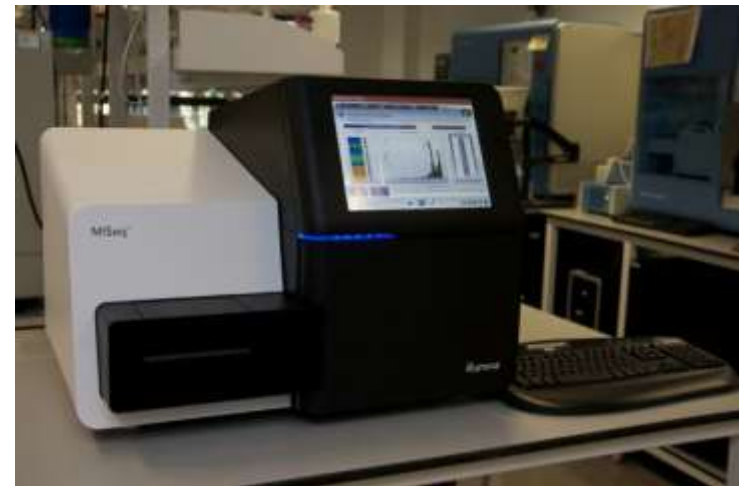
Run time bacterial genome sequencing



Now

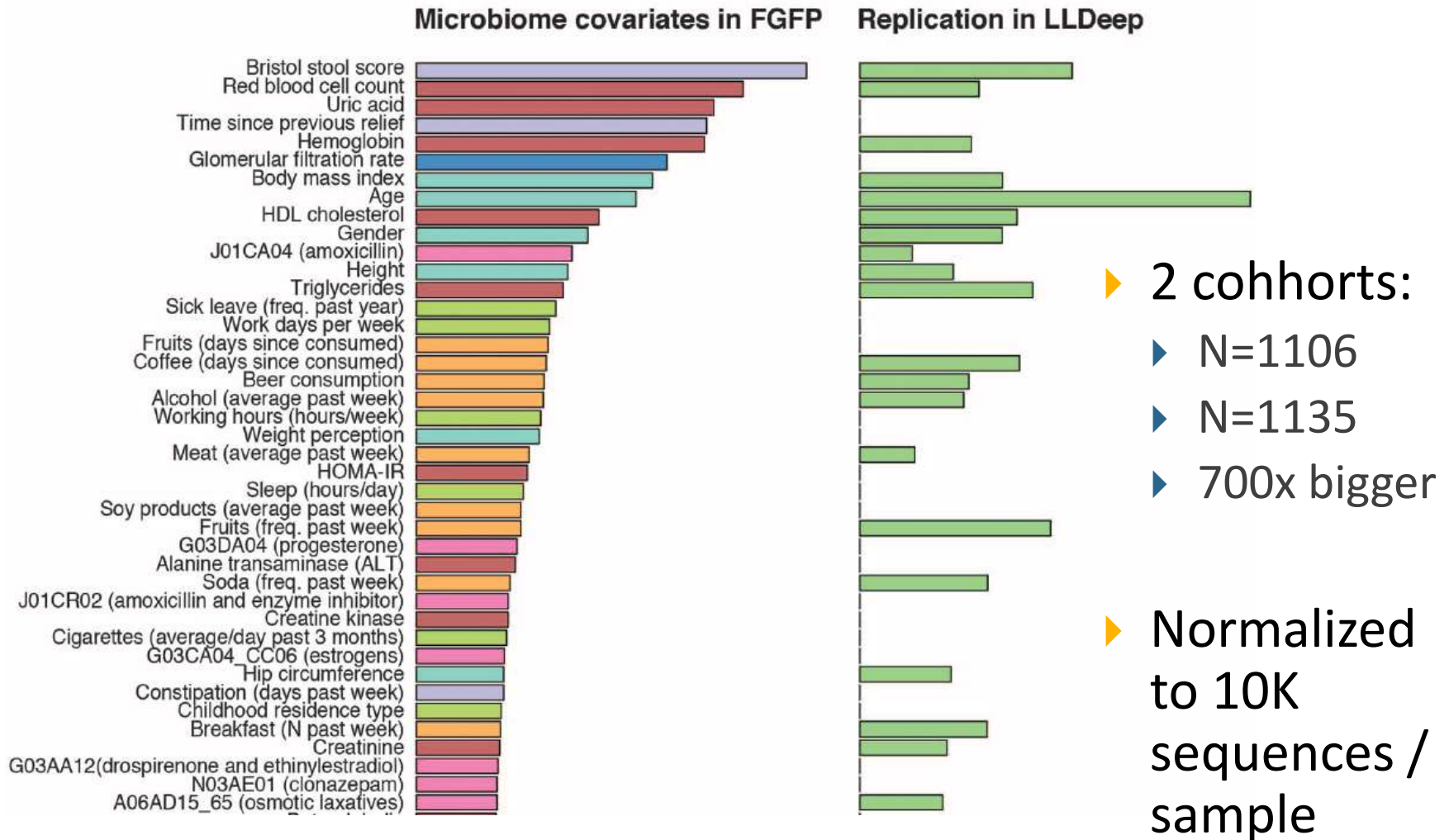


▶ 3 to 6 billion *reads*



▶ 25 million *reads*

Co-variation with health/diet/lifestyle



Diversity and Function

- ▶ Bacteria

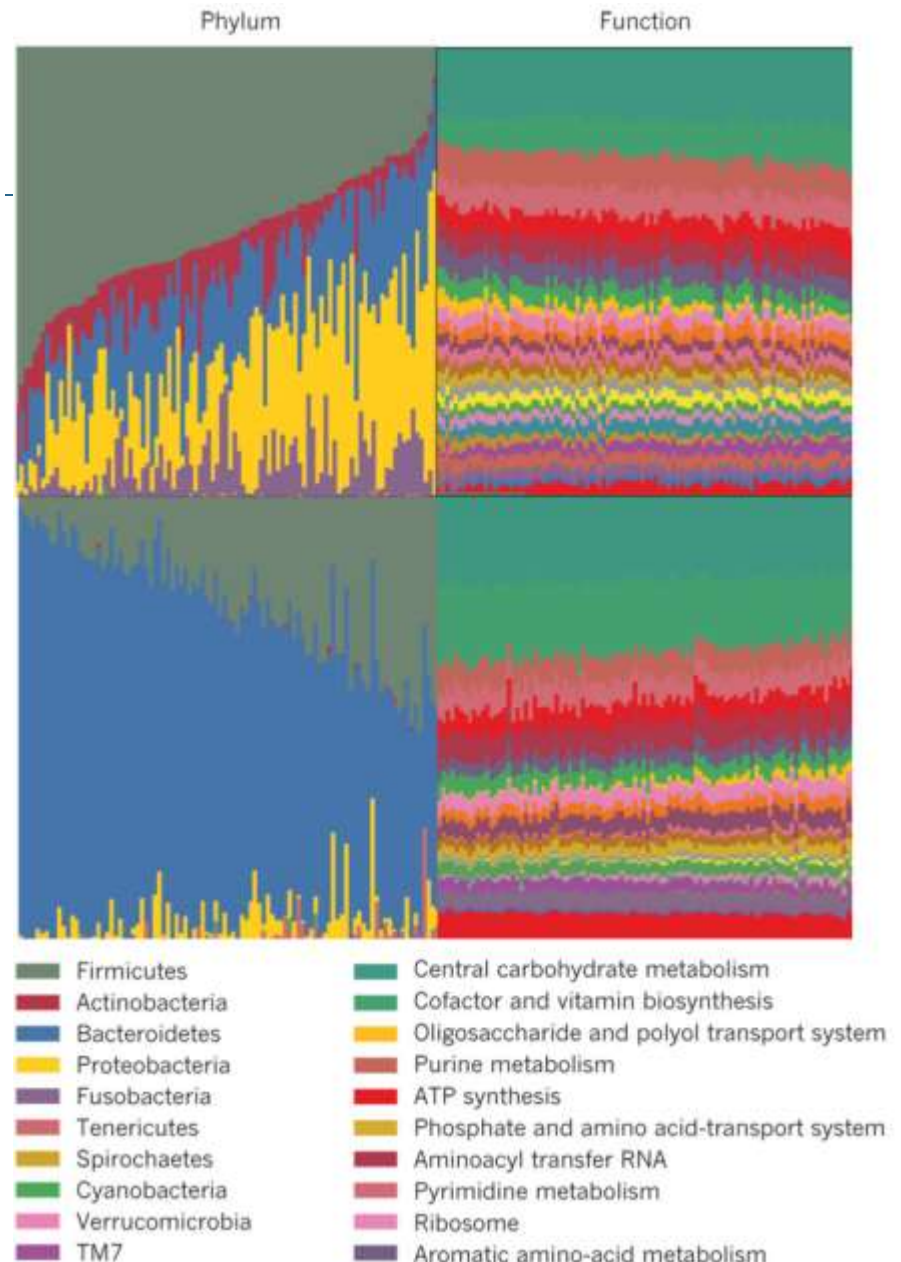
- ▶ Differences in species composition

- ▶ Similarities in metabolic functions

- ▶ Phage?

Oral

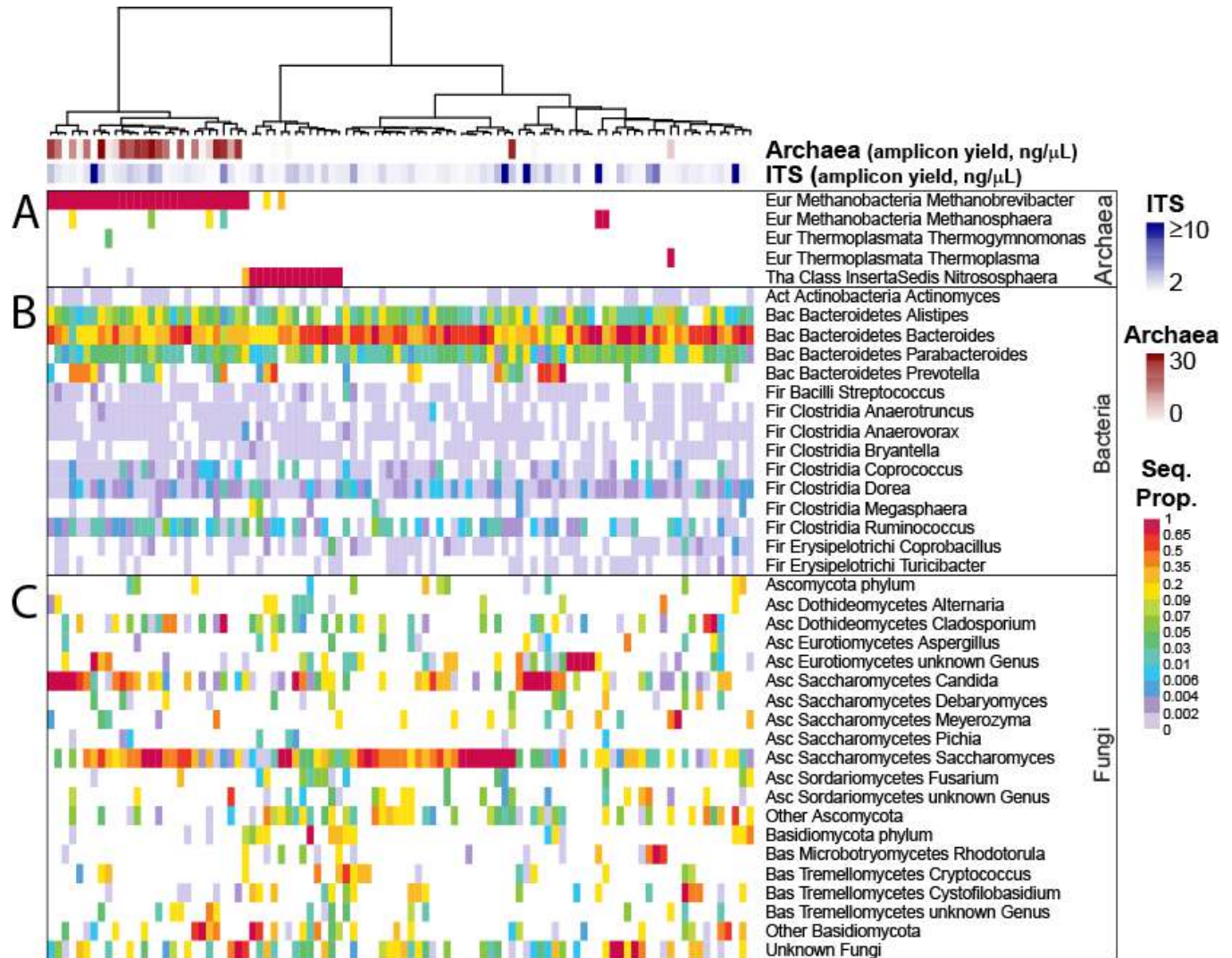
Intestinal



Diversity: Fungi and Archaea

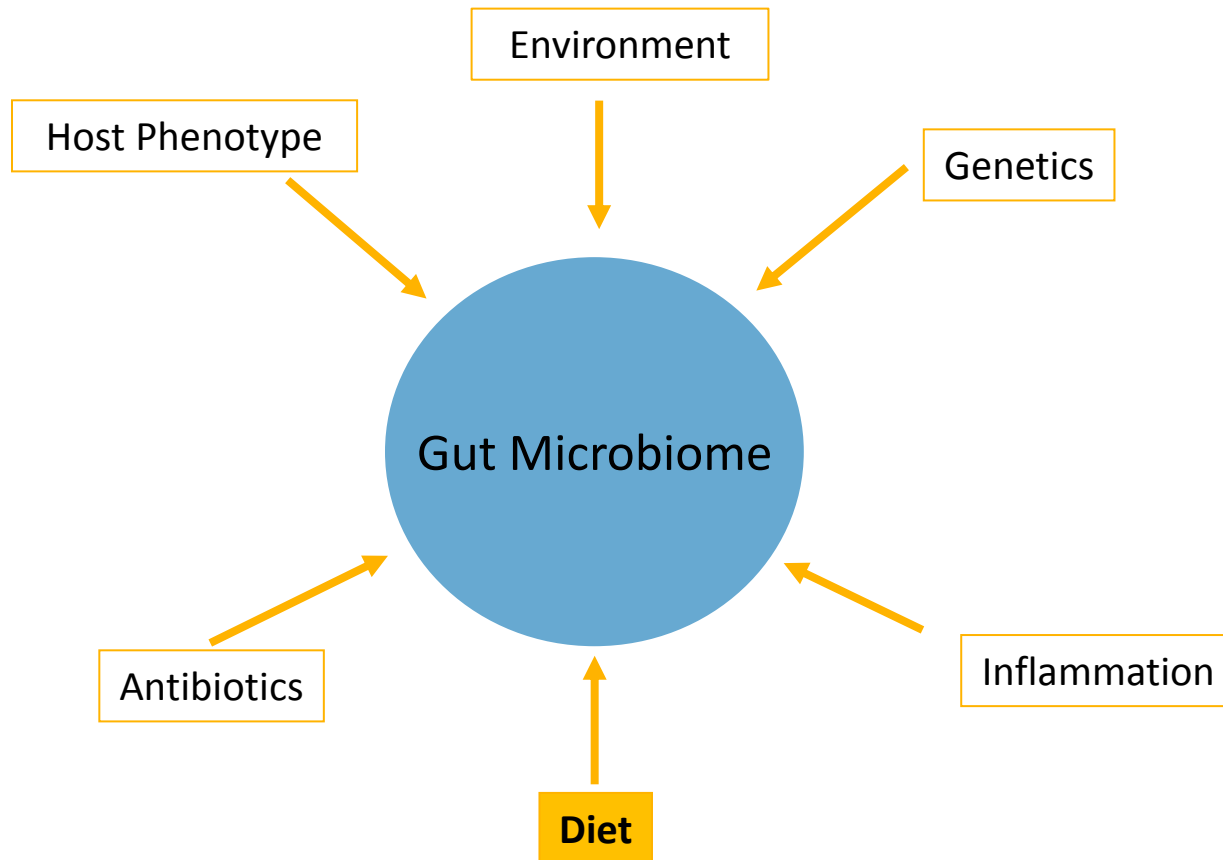
▶ 5 archaea genera

▶ 66 fungi genera

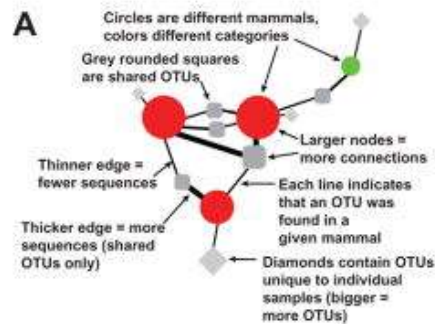


What Influences the Gut Microbiome?

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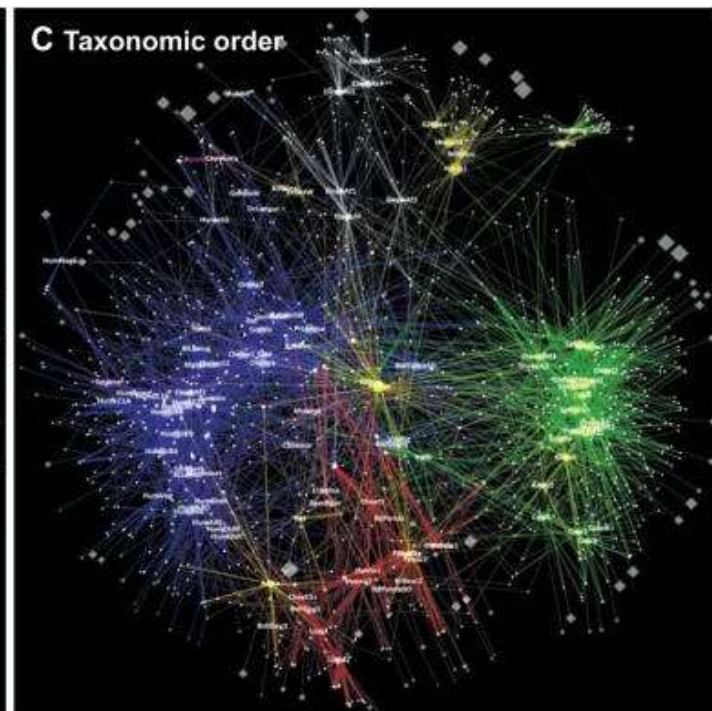
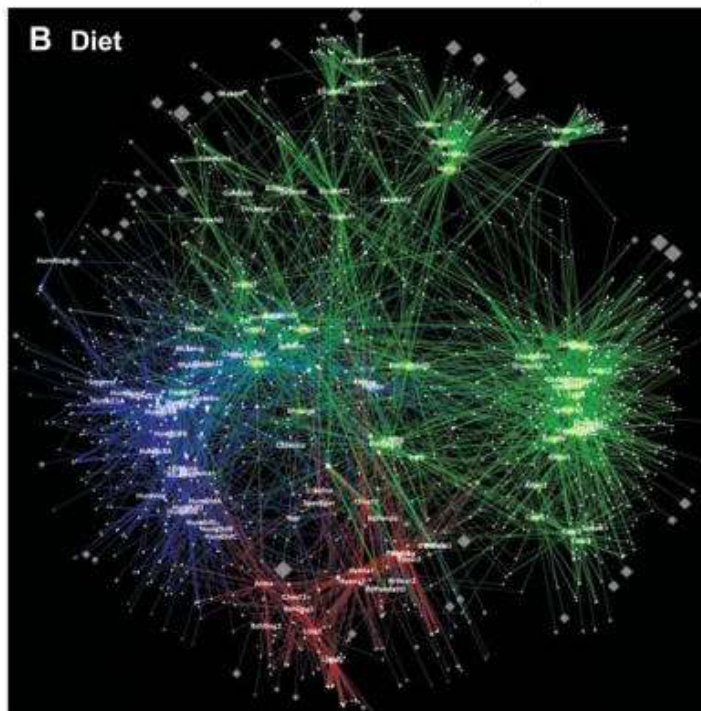


Microbiome, Diet e Co-evolution



Animal nodes color key (by panel)

Diet (B)	Mammalian order (C)	
● Herbivore	● Artiodactyla	● Persissodactyla
● Carnivore	● Carnivora	● Proboscidae, Hyracoidea
● Omnivore	● Chiroptera	● Rodentia
	● Primates	● Xenartha, Insectivora
Provenance (D)		
● St Louis Zoo		
● San Diego Zoo		
● Wild & other		
	● Lagomorpha	
	● Monotremata	● Diprotodontia

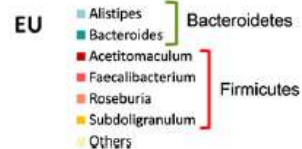
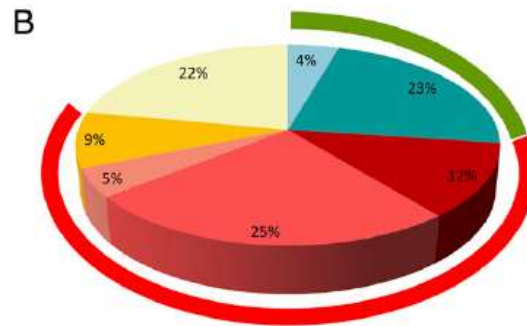
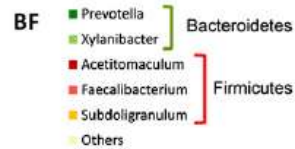
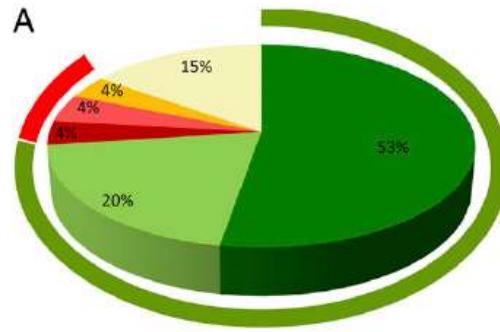


Diet and the Microbiome: the case of Burkina Faso.

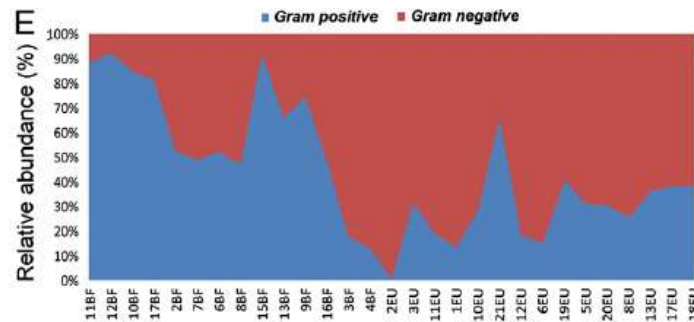
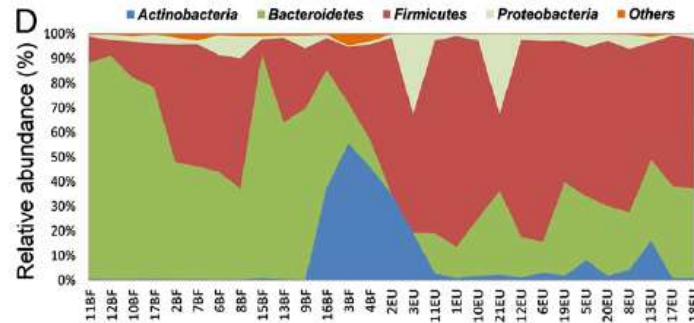
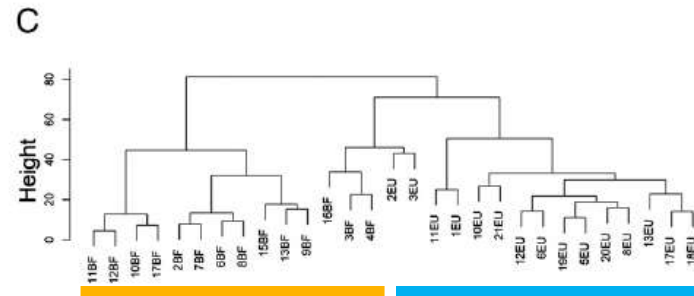


Diet and the Microbiome: the case of Burkina Faso.

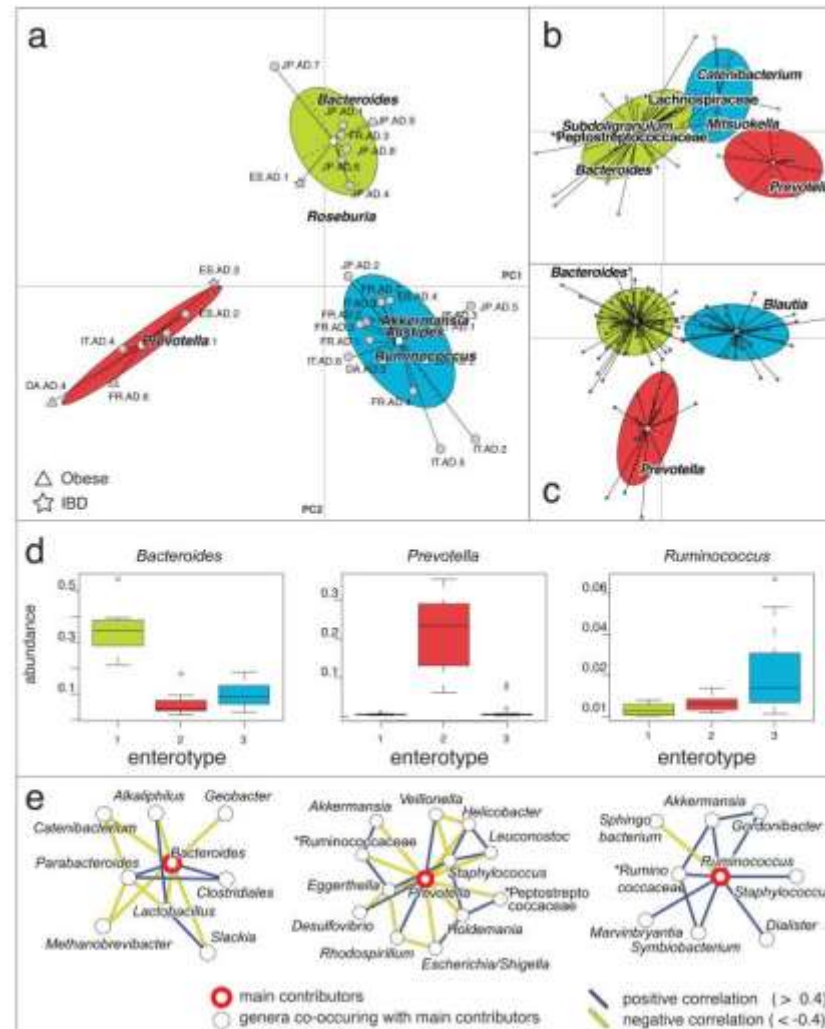
Burkina Faso



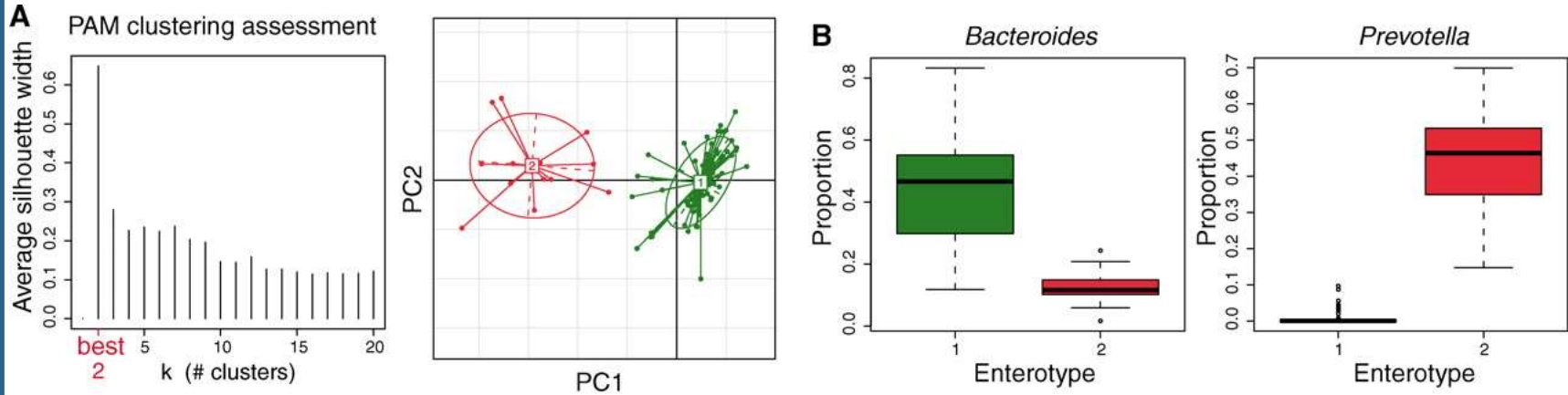
Italy



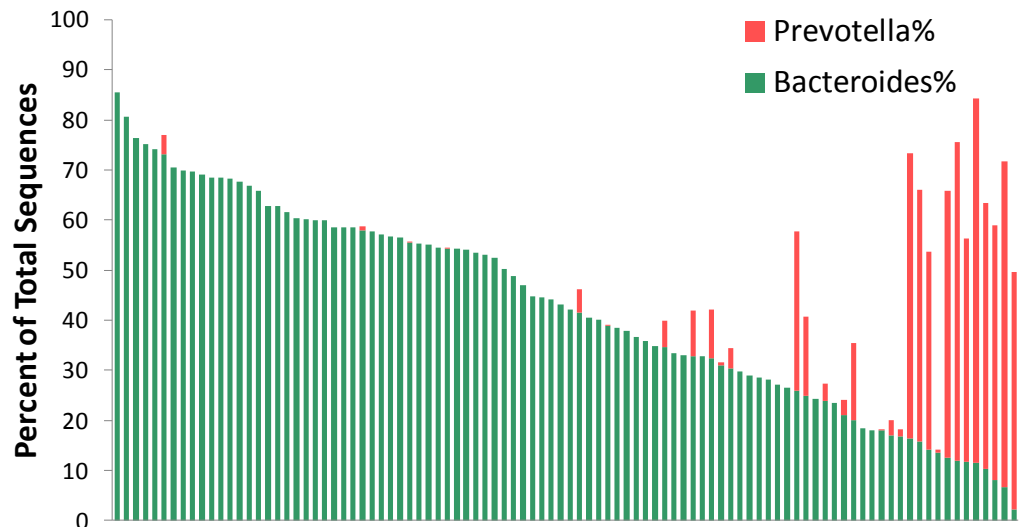
Microbiome variation: Enterotypes



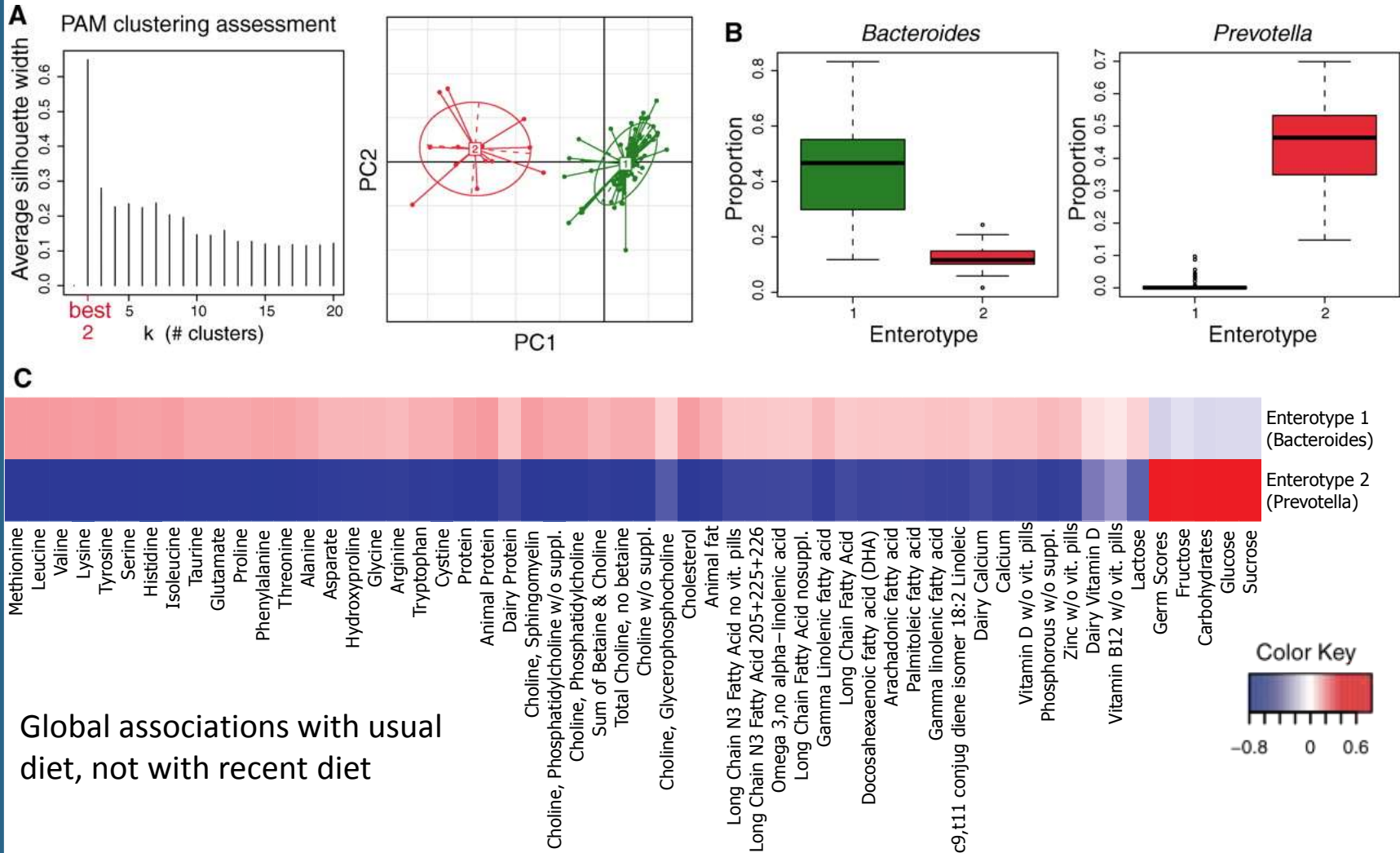
Microbiome variation: Enterotypes



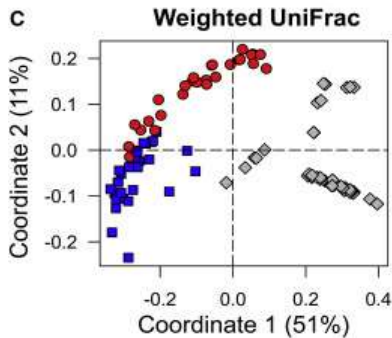
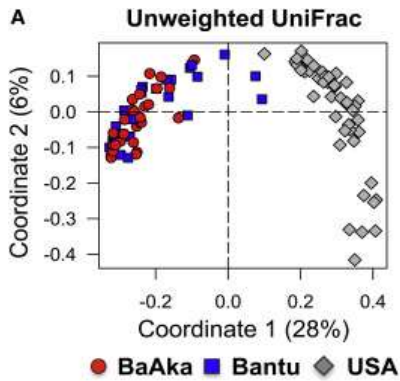
► A balance between *Bacteroides* e *Prevotella*



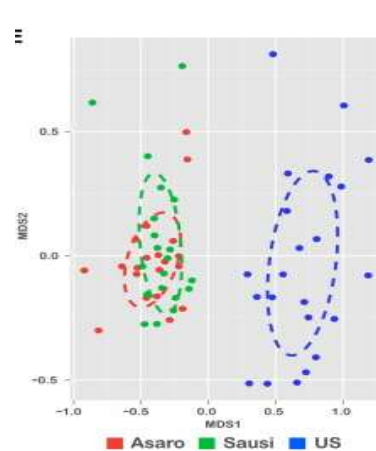
Enterotypes and human diet



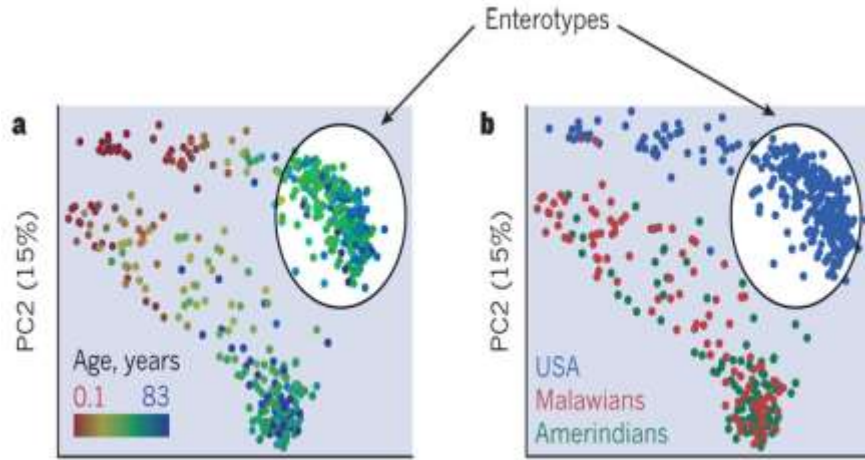
Population variation



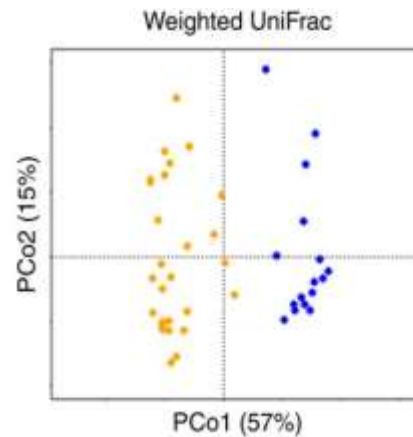
Gomez et al. 2016. Cell Reports 14(9):2142-2153



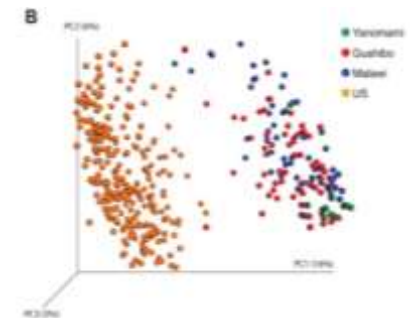
Martinez et al. 2015 Cell Reports 11(4):527-538



Lozupone et al. Nature 2012. 489:220-230



Schnor et al. 2014. Nature Communications 5:3654



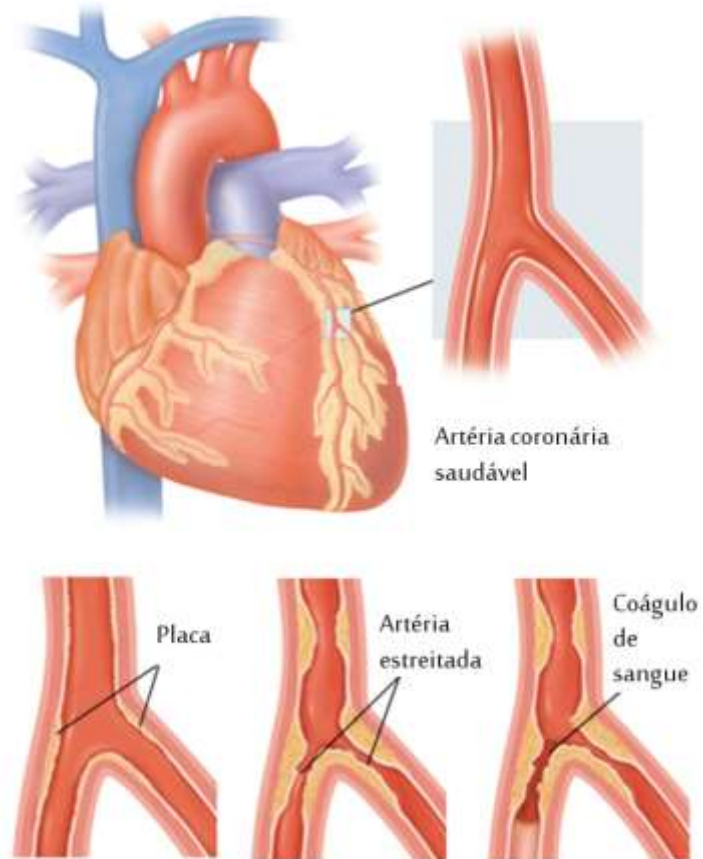
Clemente et al. 2015. Science Advances 1(3):e1500183

Cardiovascular disease: Atherosclerosis

- ▶ An example of where we are now

Cardiovascular disease: Atherosclerosis

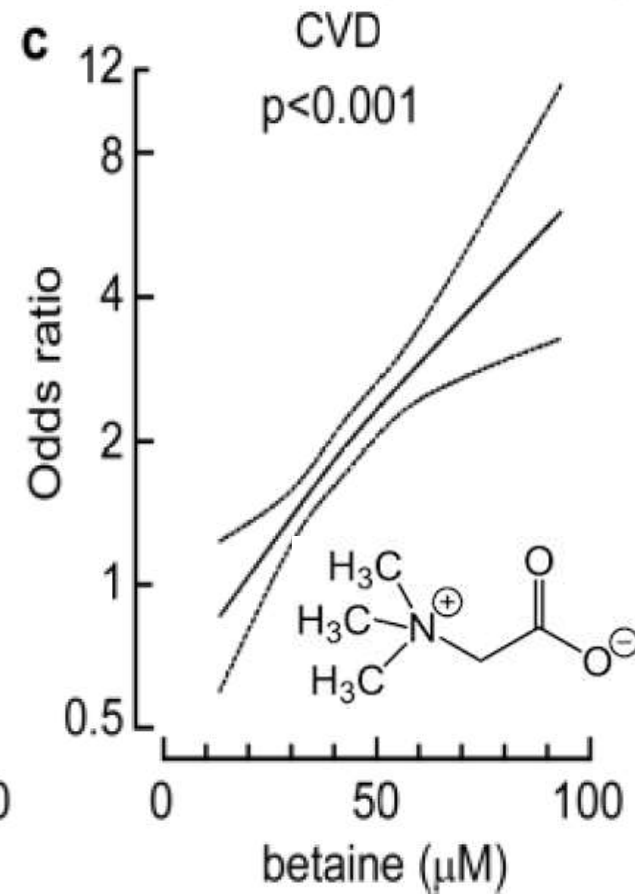
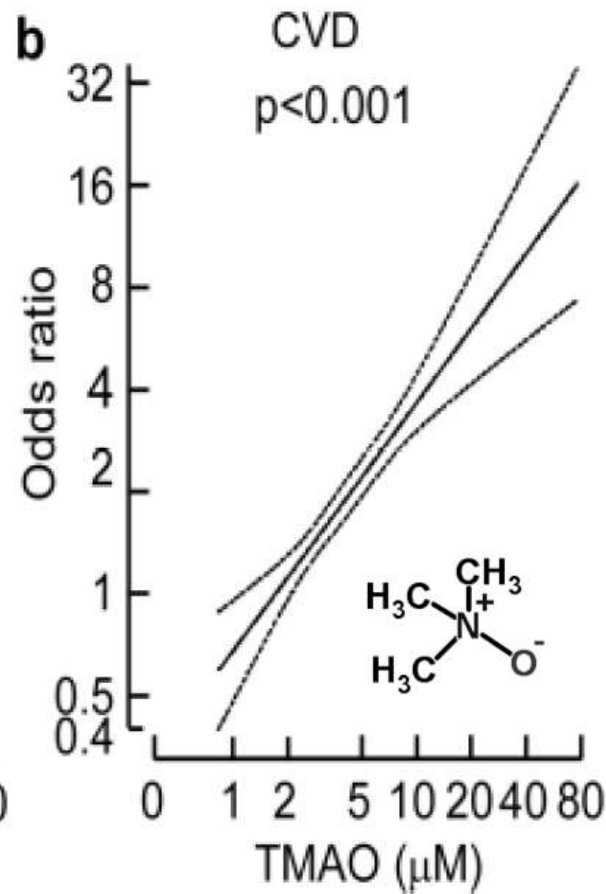
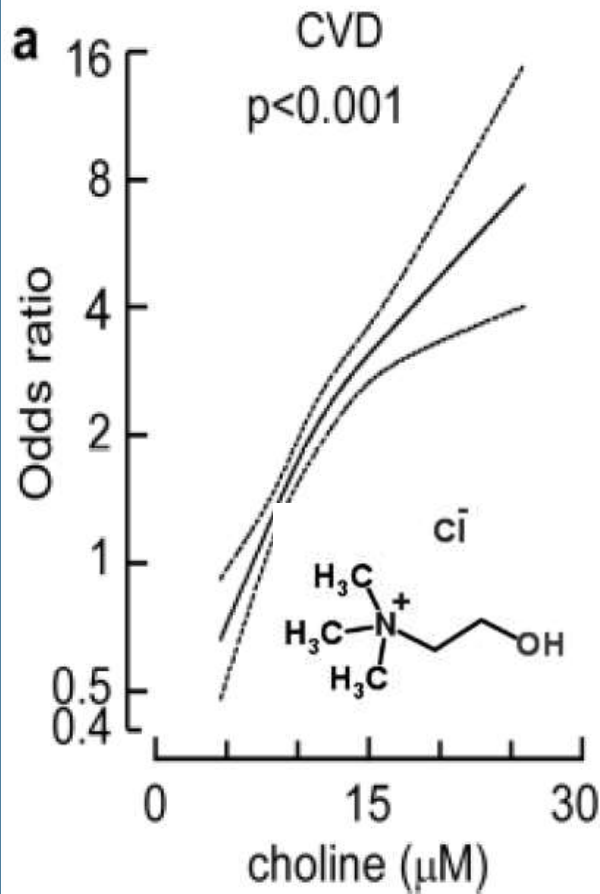
- ▶ Risk factors:
 - ▶ High cholesterol
 - ▶ Obesity
 - ▶ Diabetes
 - ▶ Etc



CVD risk

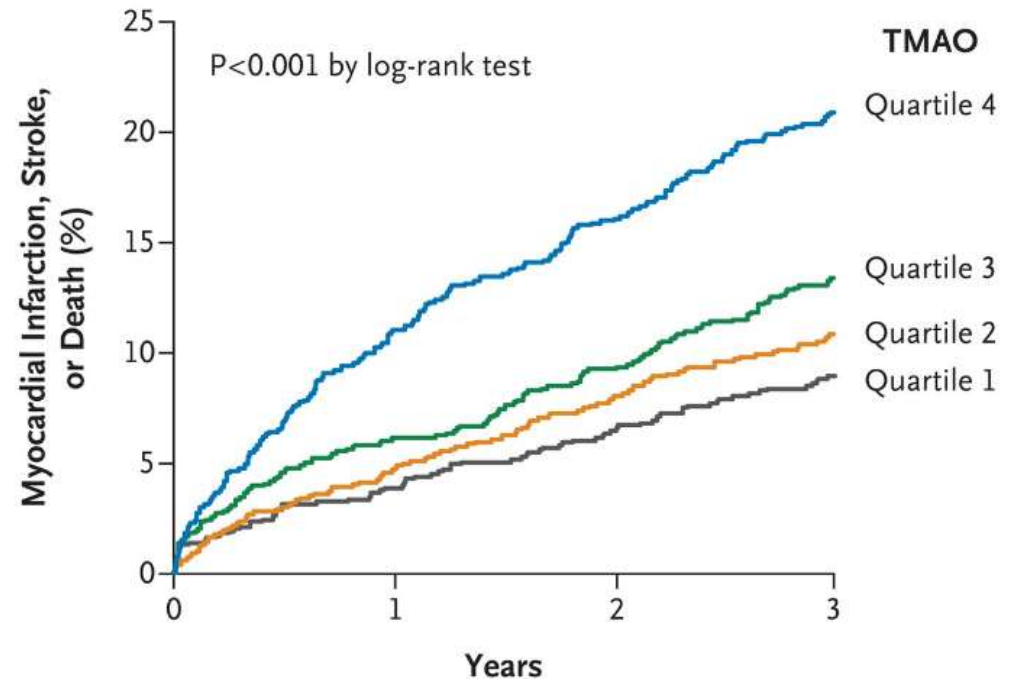
▶ N = 1865

▶ Serum levels



CVD risk

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

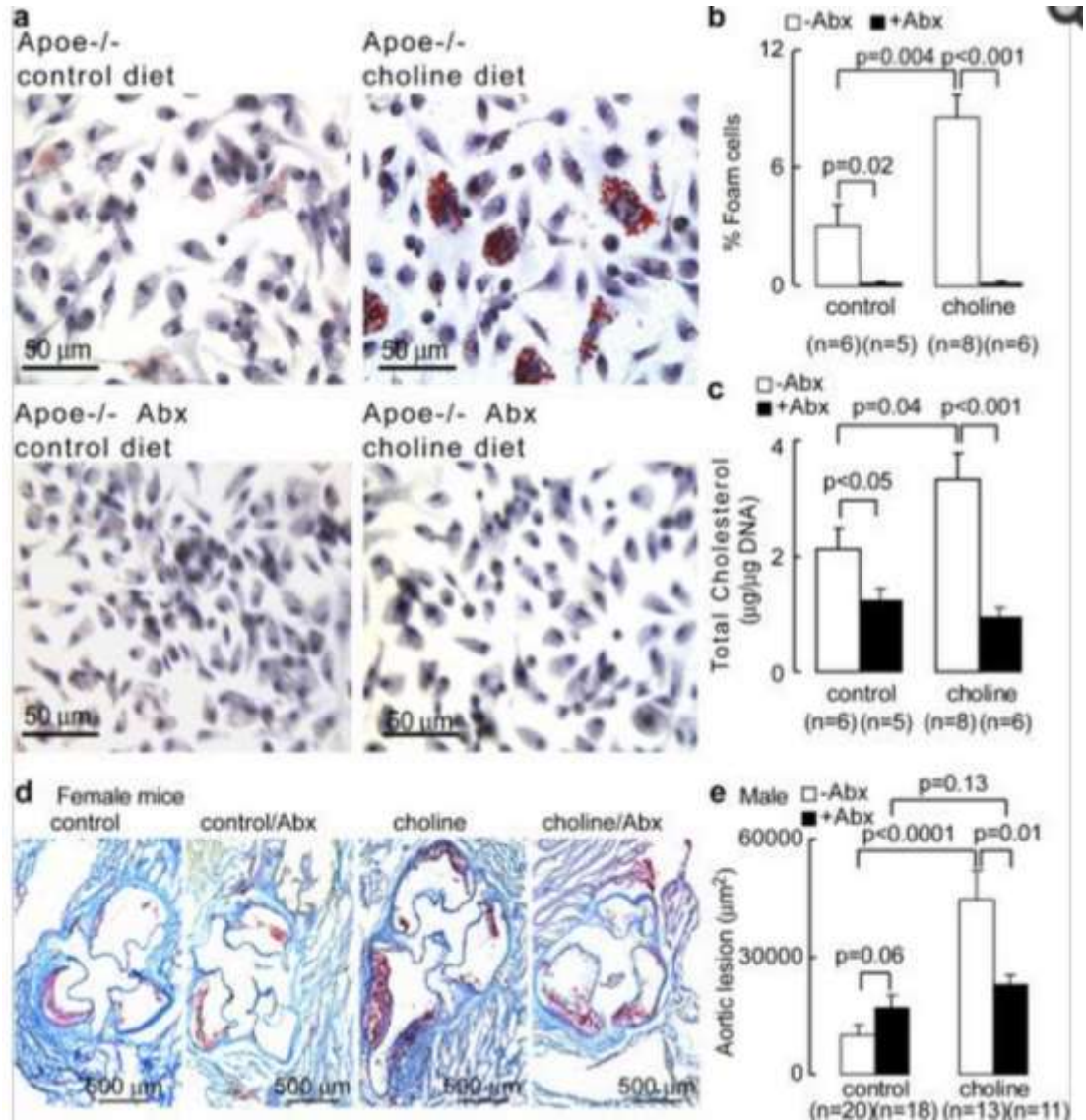


No. at Risk

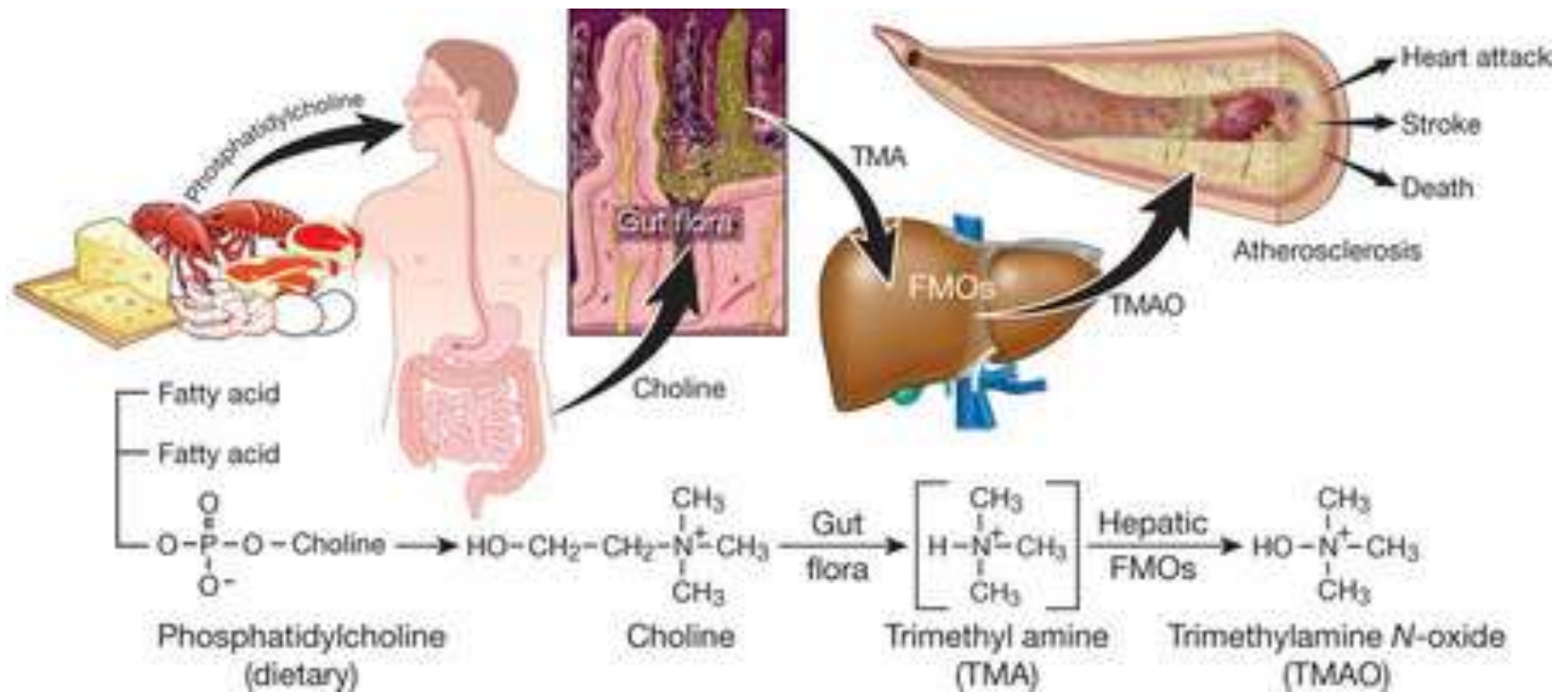
Quartile 1	1001	933	869	827
Quartile 2	998	940	884	843
Quartile 3	1003	938	888	835
Quartile 4	1005	913	849	791

Atherosclerosis

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



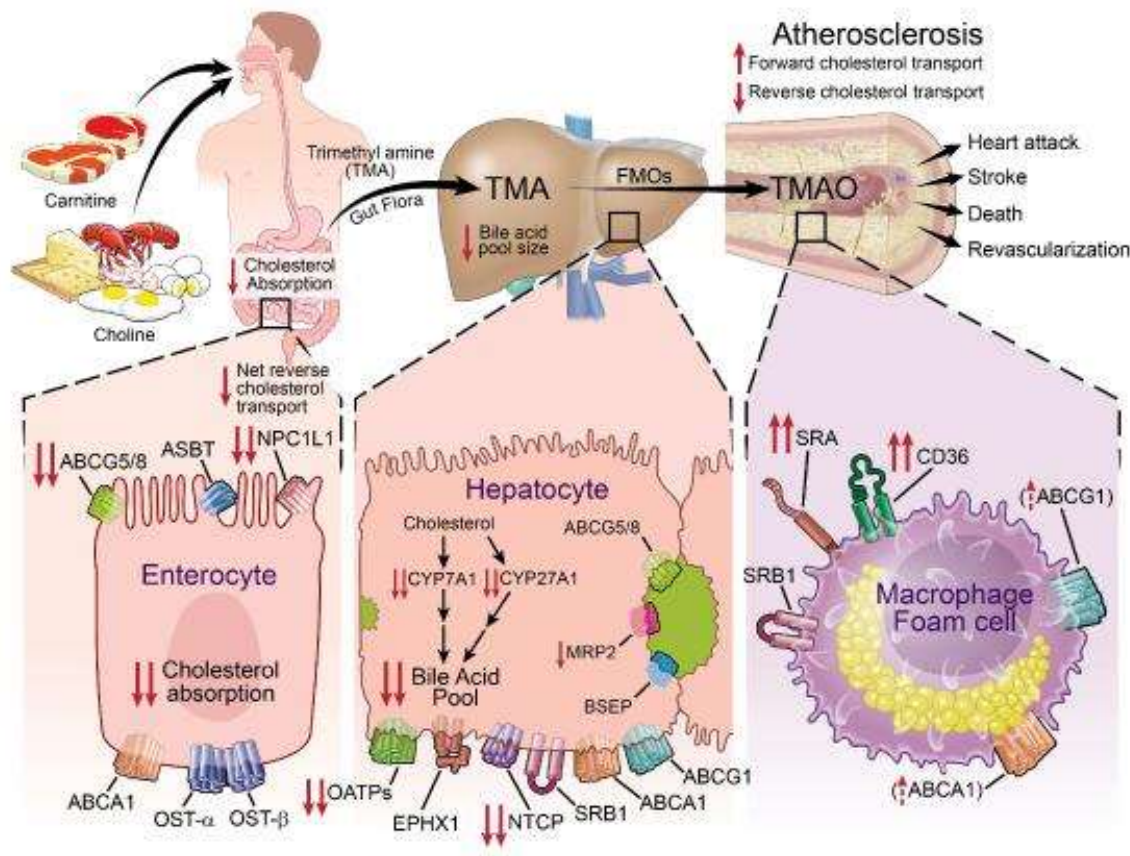
Atherosclerosis



Atherosclerosis

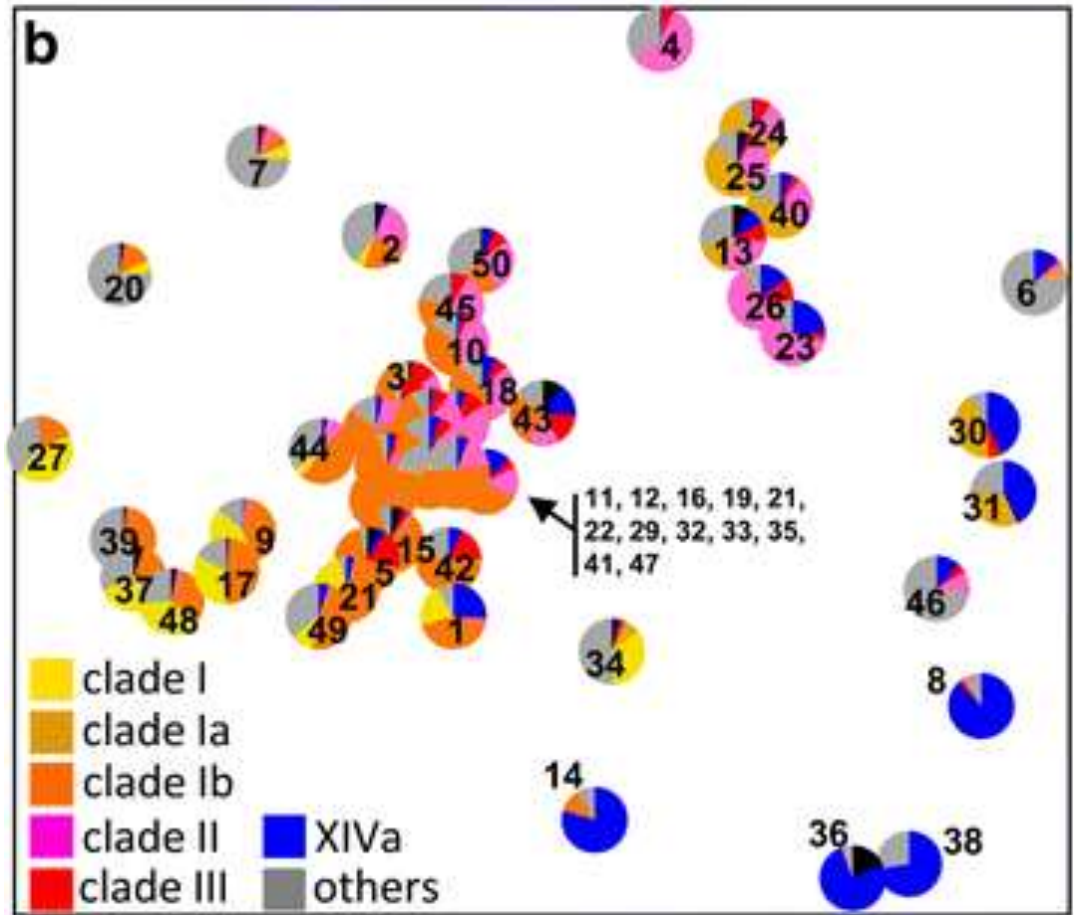
▶ Microbiome metabolism influences:

- Example: Choline/Carnitine -> TMA-> TMAO -> Atherosclerosis



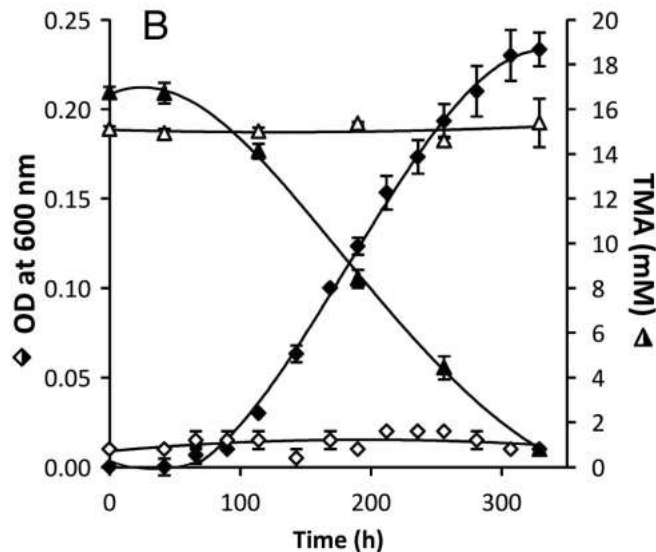
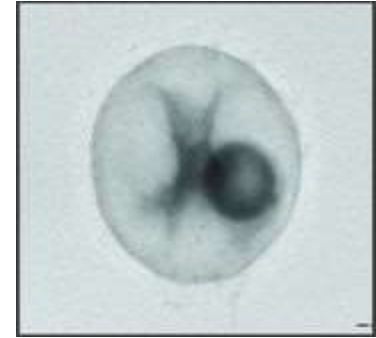
Atherosclerosis

- ▶ Many bacterial genes with the same function



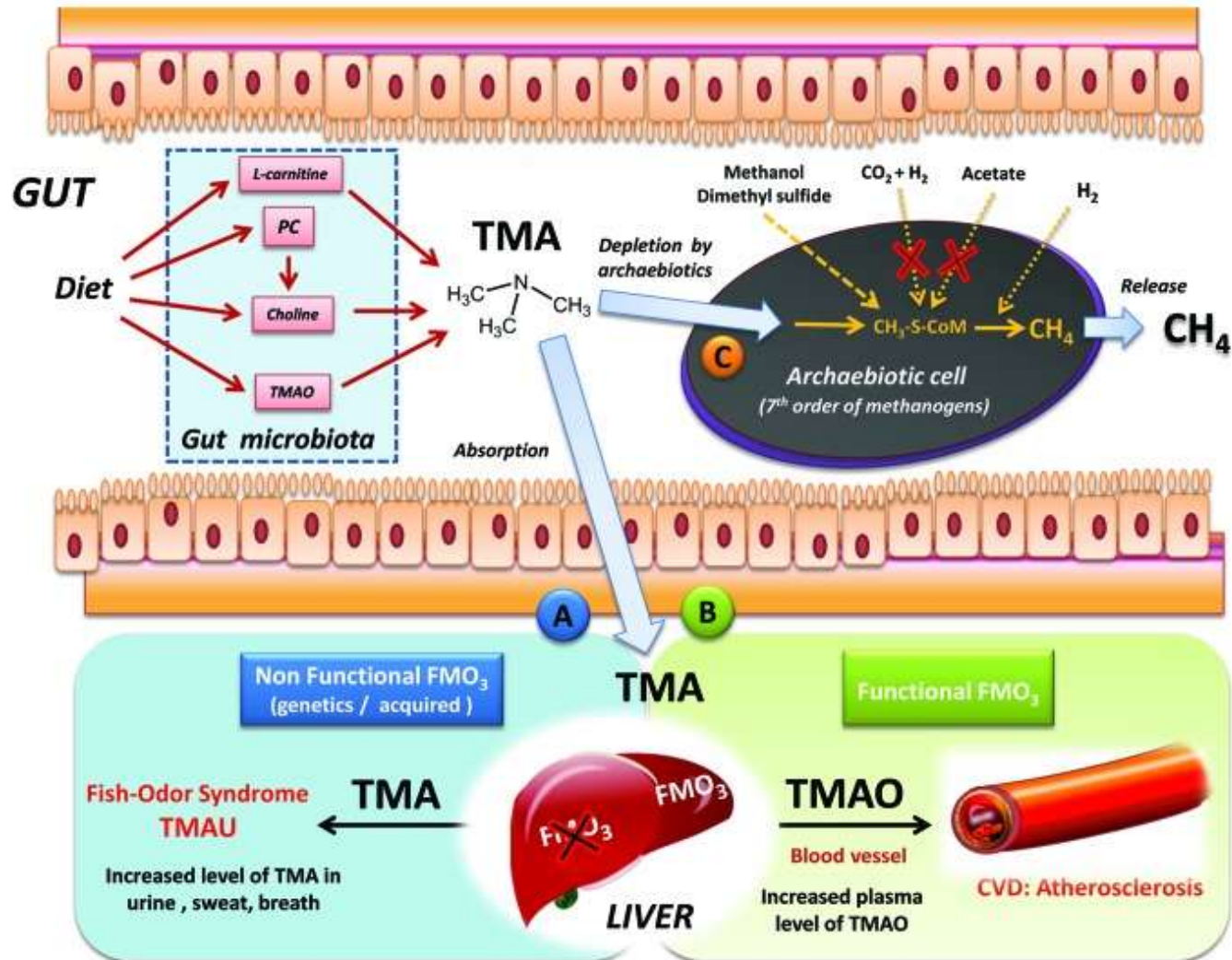
Archaeobiotic X Atherosclerosis

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



- ▲ [TMA] - TMA with H₂
- △ [TMA] - TMA w/out H₂
- ◆ *M.lum.* Growth with TMA / H₂
- ◇ *M.lum.* Growth w/out TMA / H₂

Archaeobiotic X Atherosclerosis



▶ Thanks!

▶ c.hoffmann@usp.br

▶ Funding

