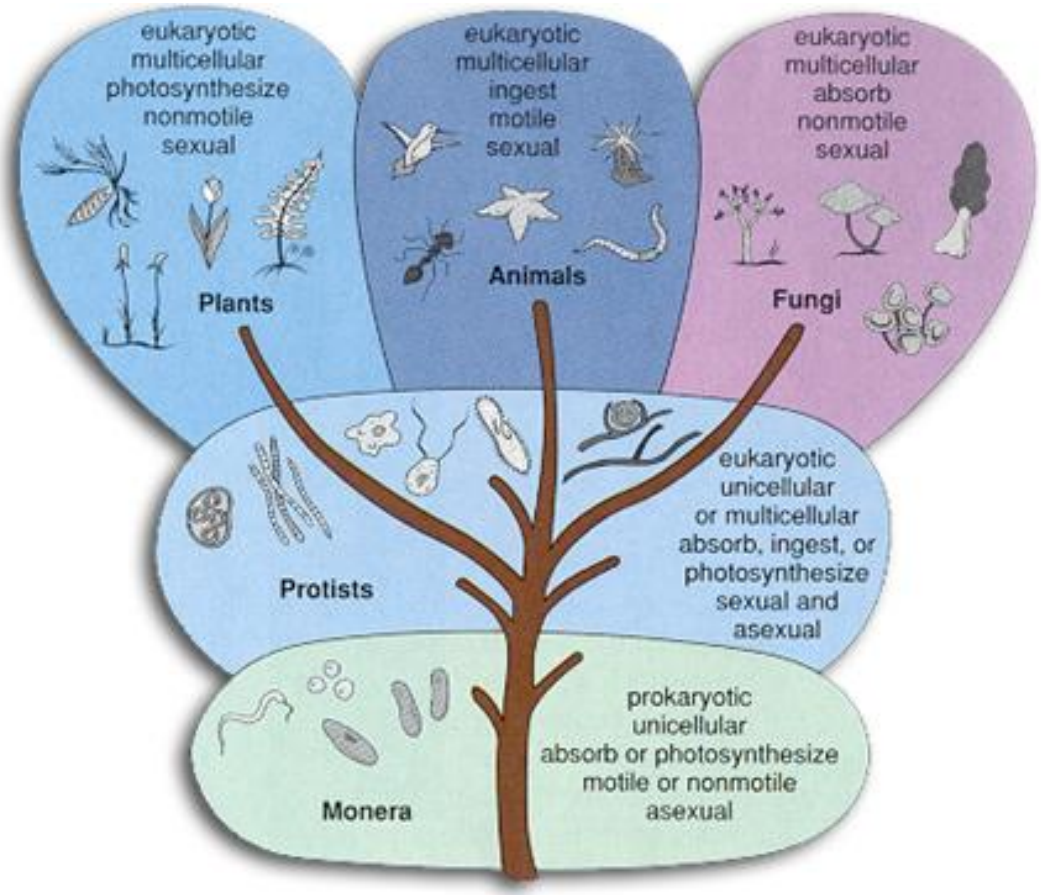
Bacterial diversity

- **Purpose of the lecture:**
  - Provide further examples of bacterial diversity
    - Introduction to the human microbiome

(Scan Chapter 11 of Tortora)

Classification of Microorganisms

- **Five-Kingdom system**
  - Superkingdom: Prokaryotae
  - Kingdom: Monera (Bacteria)


eukaryotic
multicellular
photosynthesize
nonmotile
sexual
Plants
eukaryotic
multicellular
ingest
motile
sexual
Animals
eukaryotic
multicellular
absorb
nonmotile
sexual
Fungi
Protists
eukaryotic
unicellular
or multicellular
absorb, ingest, or
photosynthesize
sexual and
asexual
Monera
prokaryotic
unicellular
absorb or photosynthesize
motile or nonmotile
asexual

The three-domain system

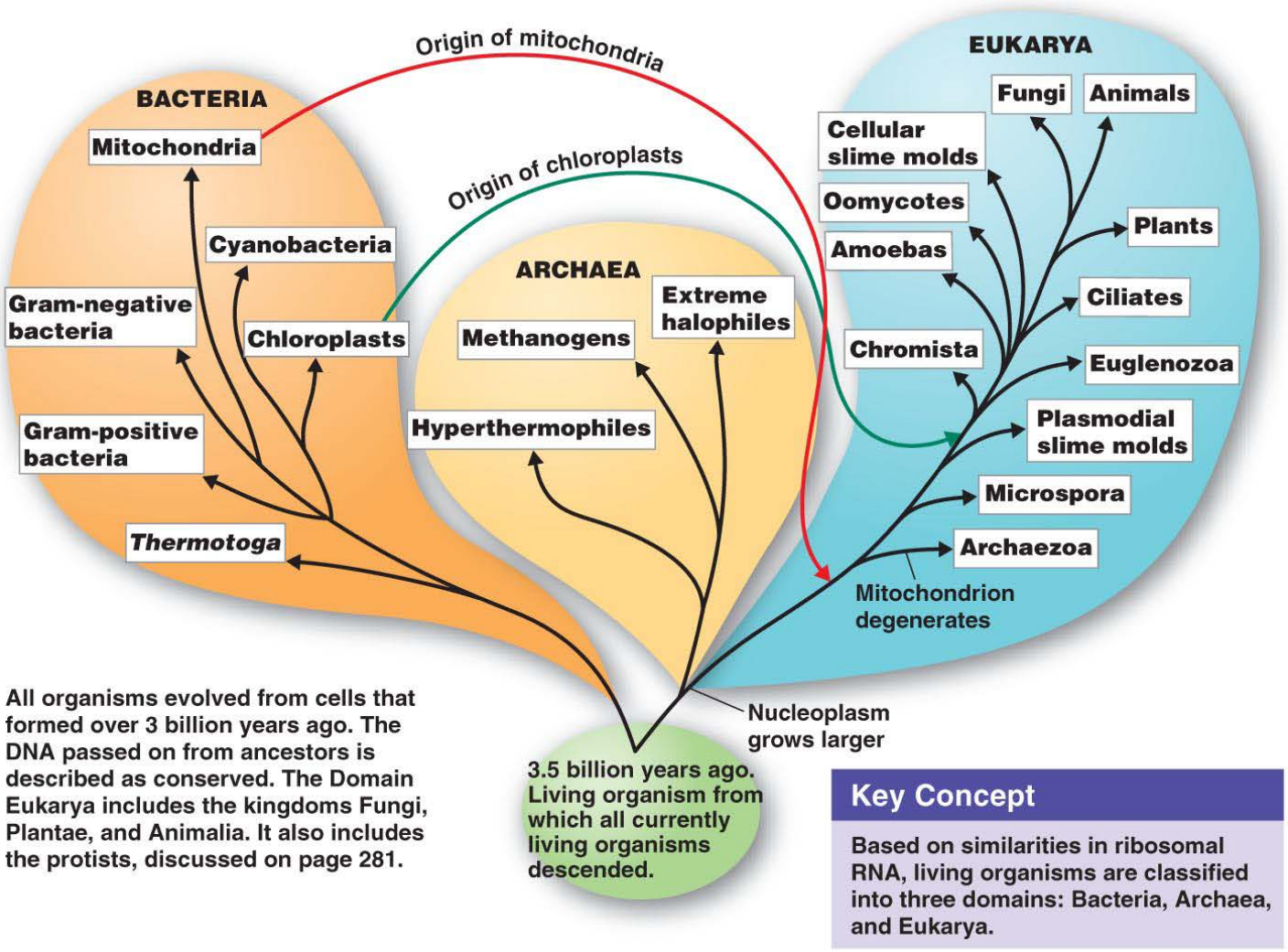


Figure 10.1

Phylogenetic Relationships of Prokaryotes

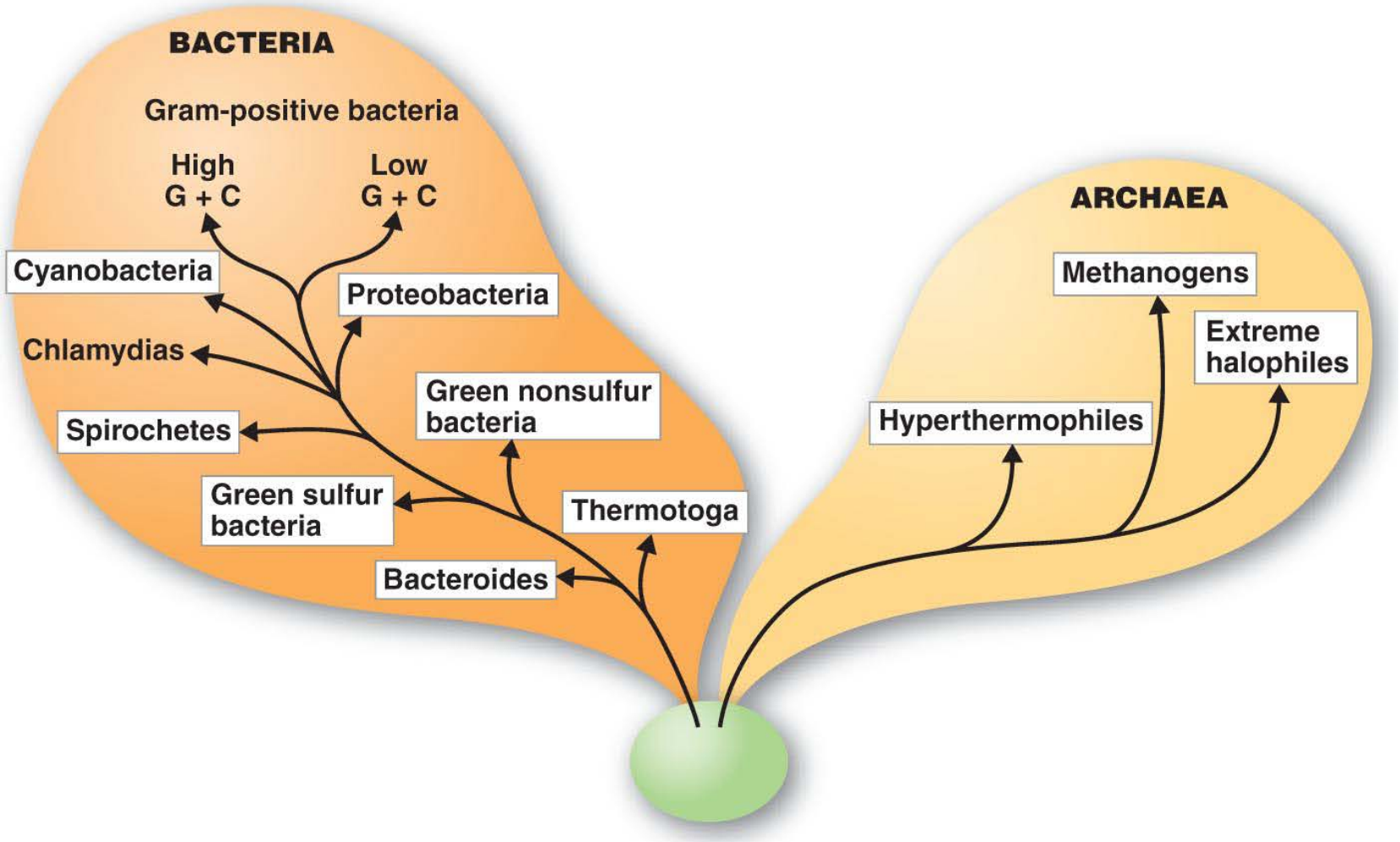


Figure 10.6

- ***Bdellovibrio***
  - Prey on other bacteria

- ***Pelagibacter ubique***
  - Discovery?
  - Numerous
  - Size: 0.4 to 0.9 µm x 0.1 to 0.20 µm
  - Smallest (known) genome of free-living bacteria
    - 1354 genes

Human microbiome

- Microbiota
  - All the microbes in a community or that reside in an environmental niche
- Microbiome
  - The collective genomes of the microbes in a community or that reside in an environmental niche
- Human microbiome?
  - A comprehensive genetic view of *Homo sapiens* as a life-form should include the genes in our microbiome

Major players

- Tongue (7,947)
  - *Streptococcus salivarius*
- Inner elbows (2,012)
  - *Corynebacterium simulans*
- Vaginal opening (2,062)
  - *Lactobacillus acidophilus*
- Throat (4,154)
  - *Neisseria lactamica*

- Behind the ears (2,359)
  - *Propionibacterium acnes*
- Nostrils (2,264)
  - *Staphylococcus epidermis*
- Large intestine (33,267)
  - *Bacteroides thetaiotaomicron*

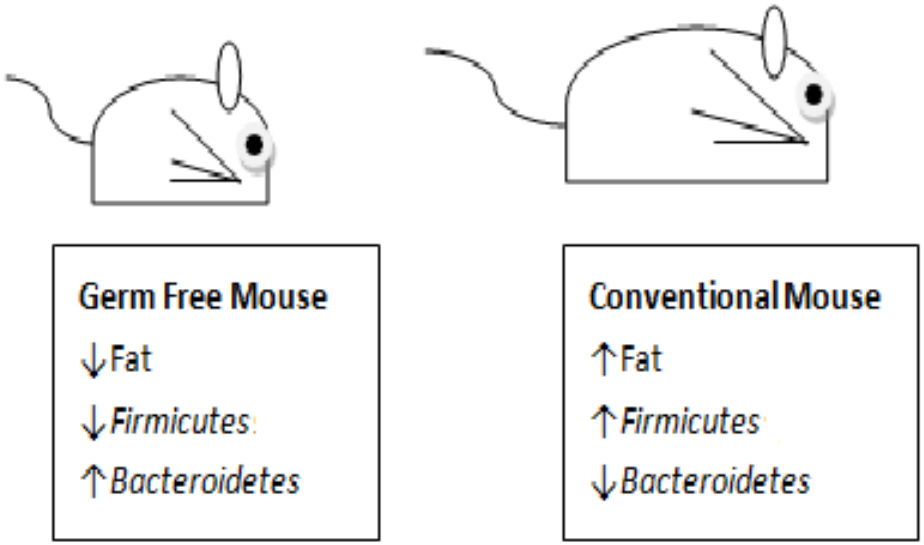
- Is natural birth important?
  - Lactobacillales order

INTESTINAL MICROFLORA

10^{14} micro-organisms, >500 differentes species

Lactobacilli	Stomach	10^2 to 10^3
	Duodenum	$<10^{4-5}$
Streptococci Lactobacilli	Jejunum	
Enterobacteria Enterococcus Faecalis Bacteroides Bifidobacteria Peptococcus Peptostreptococc Ruminococcus Clostridia Lactobacilli	Ileum	10^3 to 10^7
and....	Colon with appendix	10^9 to 10^{12}

- **Obesity?**

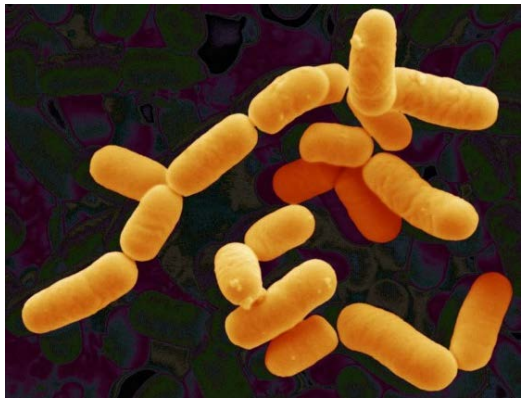


  - Lean mice →
  - Lean human →

- **Malnourished children?**

Behaviour effects?

- Anxiety and fear
  - *Lactobacillus rhamnosus*



- Autism and brain development

- **Human health**
  - Should be thought of as a collective property of the human-associated microbiota
- **Improve your microbiome?**