

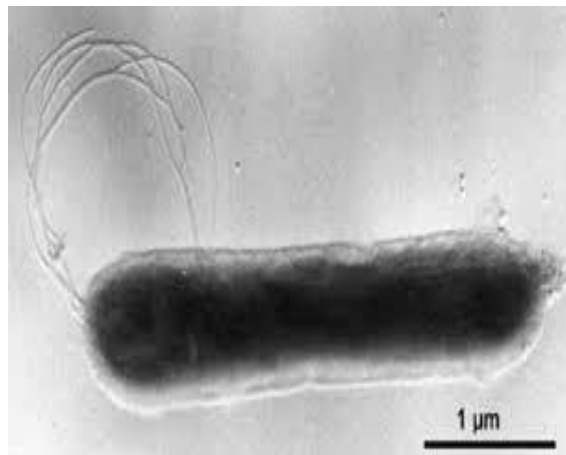
2-Domain: Bacteria

According to Bergey's Manual of Systematic Bacteriology, true bacteria are divided into a large number of phyla. In this semester, we will discuss the most important of these phyla.

Phylum: Aquificae

Thought to be deepest (oldest) branch of *Bacteria*. Contains one class, one order, and five genera. Two best studied genera are *Aquifex* and *Hydrogenobacter*.

Domain	Bacteria
Phylum	Aquificae
Class	Aquificae
Order	Aquificales
Family I	Aquificaceae
Genus I	<i>Aquifex</i>
Genus II	<i>Calderobacterium</i>
Genus III	<i>Hydrogenobacter</i>
Genus IV	<i>Thermocrinis</i>
Family II	Incertae sedis
Genus	<i>Desulfurobacterium</i>



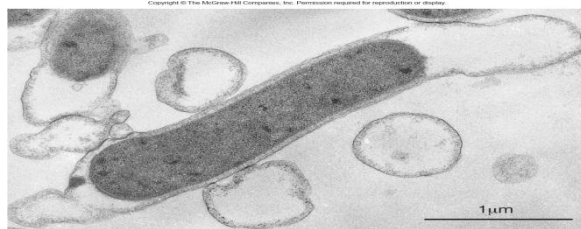
Genus Aquifex

Are Gram-negative rod-shaped bacteria with a length of **2 to 6** μm, have a diameter of around **0.5** μm and are motile. They are non-sporeforming. *Aquifex* means *water-maker* in Latin, and refers to the fact that its method of respiration creates water. *Aquifex* tend to form cell aggregates composed of up to **100** individual cells. Thermophile, growth optimum **85°C** - maximum **95°C**. Microaerophilic & Chemolithoautotroph (uses hydrogen, thiosulfite, and sulfur as electron donor, uses oxygen as electron acceptor). Genome **~1/3** size of *E. coli*.

Phylum: Thermotogae

Second deepest branch of *Bacteria*. Contains **one** class, **one** order, and **six** genera (best studied genus is *Thermotoga*).

Domain	Bacteria
Phylum	Thermotogae
Class	Thermotogae
Order	Thermotogales
Family	Thermotogaceae
Genus	<i>Thermotoga</i>



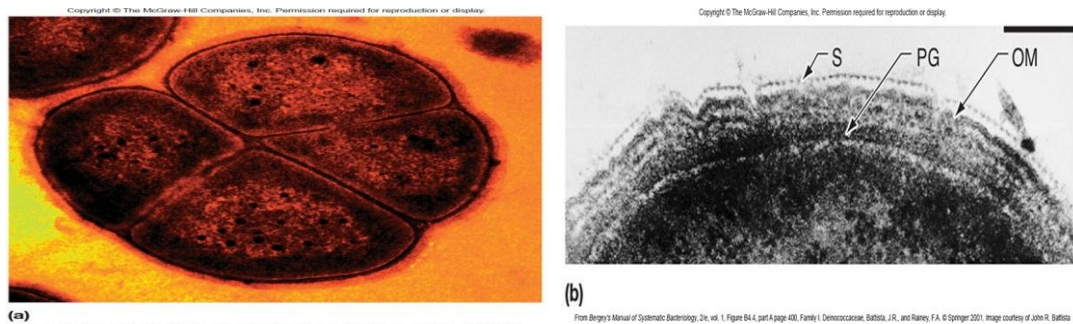
Genus *Thermotoga*

Gram-negative rods outer sheath-like envelope balloons from ends of cell, called a "**toga**". Thermophiles (optimum **80°C**; maximum **90°C**). Grow in active geothermal areas (marine hydrothermal vents/terrestrial solfataric springs). Chemoheterotrophs, have functional glycolytic pathway and can grow anaerobically on carbohydrate/protein digests. **~24%** of coding sequences similar to archaeal genes (may be due to horizontal gene transfer).

Phylum: *Deinococcus-Thermus*

Spherical or rod-shaped; in pairs or tetrads. Gram-positive (lack typical Gram-positive cell wall, layered outer membrane similar to Gram-negatives , L-ornithine in peptidoglycan & lacks teichoic acid. Aerobic, catalase positive. Resistant to desiccation and radiation. radiation resistance due to ability to repair genome when it is severely damaged efficient proteins (protected by **manganese**) and enzymes for DNA repair (Within **12–24** hours can repair chromosomes fragmented by exposure to radiation).

Isolated from ground meat, feces, air, fresh water, and other sources, but natural habitat unknown. Genome consists of **two** circular chromosomes, a **megaplasmid**, and a small **plasmid**.

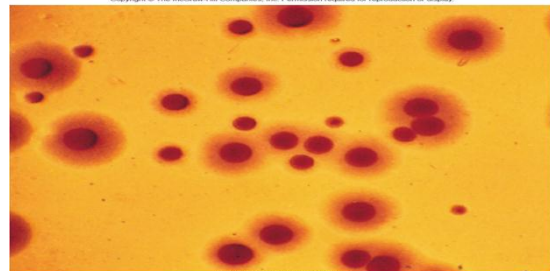
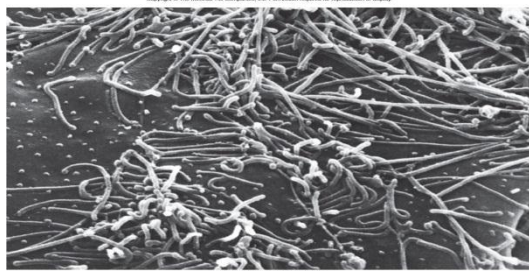


Contains **one** class, **Two** orders & **Three** genera (genus *Deinococcus* is best studied). **9** of **11** species are mesophilic; **2** are thermophilic.

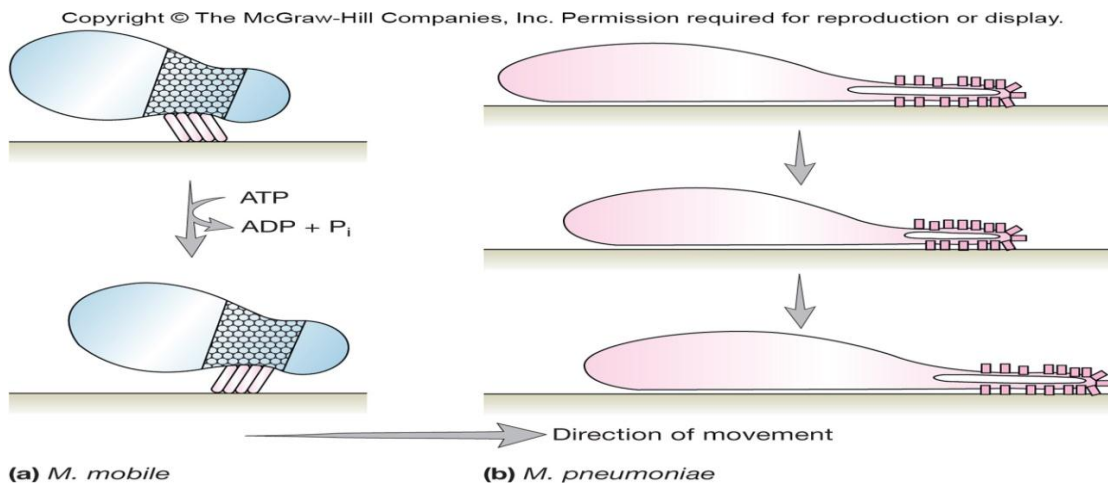
Domain	Bacteria
Phylum	Deinococcus-Thermus
Class	Deinococci
Order I	Deinococcales
Family	Deinococcaceae
Genus	<i>Deinococcus</i>
Order II	Thermales
Family	Thermaceae
Genus I	<i>Thermus</i>
Genus II	<i>Meiothermus</i>

Phylum: Tenericutes

Class *Mollicutes* (The *Mycoplasmas*) : Contains five orders and six families. Smallest bacteria capable of self-reproduction. Cannot synthesize peptidoglycan precursors . Lack cell walls and are pleomorphic. Grow as fried egg appearance on agar surface.



Have genomes less than 1000 genes (one of the smallest found in prokaryotes). Most nonmotile , some have **gliding motility** (2 to 5 microns/second ,self surface proteins surround “neck” of cell ,attach to cytoskeletal proteins; function like microscopic legs ,powered by ATP hydrolysis) see the figure below.



Important Pathogens:

<i>Mycoplasma mycoides</i>	pleuropneumonia in cattle
<i>Mycoplasma gallisepticum</i>	chronic respiratory disease in chickens
<i>Mycoplasma hyopneumoniae</i>	swine pneumonia
<i>Mycoplasma pneumoniae</i>	primary atypical pneumonia in humans
<i>Ureaplasma urealyticum</i>	premature birth, neonatal meningitis and pneumonia
spiroplasmas	pathogenic in insects, ticks, and a variety of plants

Photosynthetic Bacteria:

There are **5** Phyla of Photosynthetic Bacteria:

1-Phylum *Chlorobi* – green sulfur bacteria

2-Phylum *Chloroflexi* – green nonsulfur bacteria

3-Phylum *Cyanobacteria*

4-Purple bacteria divided into **3** groups : purple sulfur (2 γ -proteobacterial families: *Chromatiaceae* and *Ectothiorhodospiraceae*) and purple non-sulfur (distributed between α - and β -proteobacteria).

5-Phylum *Firmicutes* – heliobacteria

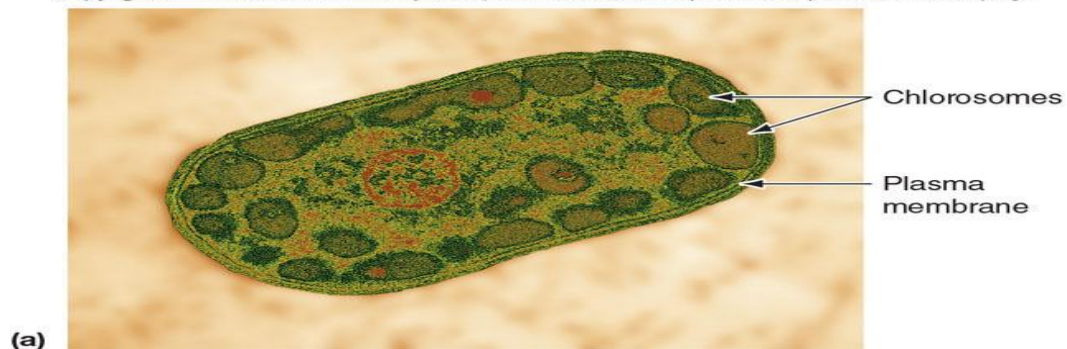
Phylum: Chlorobi

Green sulfur bacteria. Consists of **one** class, *Chlorobia*; **one** order, *Chlorobiales*; **one** family, *Chlorobiaceae*. Representative genera are *Chlorobium*, *Prosthecochloris*, and *Pelodictyon*.

Morphologically diverse. Thrive in sulfide rich areas. Have chlorosomes.

Chlorosomes: Ellipsoidal vesicles attached to plasma membrane , contain accessory photosynthetic pigments.

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Lack flagella; Nonmotile. Some have gas vesicles(adjust depth of cell for light/H₂S). Obligate anaerobic photolithoautotrophs.

Phylum: Chloroflexi

Green nonsulfur bacteria. Has both :

Photosynthetic members :e.g., genus *Chloroflexus*

Nonphotosynthetic members: e.g., genus *Herpetosiphon*.

Domain	Bacteria
Phylum	Chloroflexi
Class	Chloroflexi
Order I	Chloroflexales
Family	Chloroflexaceae
Genus	<i>Chloroflexus</i>
Order II	Herpetosiphonales
Family	Herpetosiphonaceae
Genus	<i>Herpetosiphon</i>

Genus *Chloroflexus*

Filamentous (with gliding motility). Thermophilic , often isolated from neutral to alkaline hot springs; grow in orange-reddish mats.



Genus *Herpetosiphon*

Non-photosynthetic, gliding, rod-shaped, or filamentous. Aerobic chemoorganotrophs with respiratory metabolism. Isolated from fresh water and soil habitats.

