

## Phylum *Cyanobacteria*

Largest, most diverse group of photosynthetic bacteria, the most important class *Chlorophyceae* ; blue green algae is the common term.

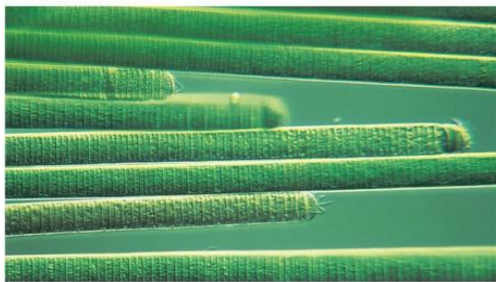
The characteristic features of the class are :

- 1- Gram-negative
- 2- many are obligate photolithoautotrophs; some can grow slowly in dark as chemoheterotrophs

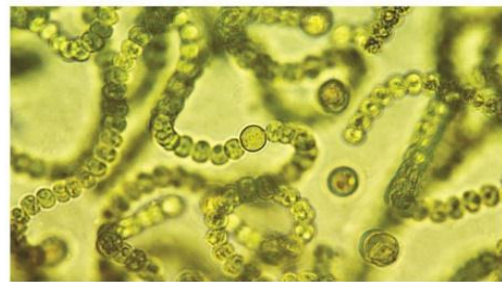
## Photosynthesis in Cyanobacteria

Resembles that of eukaryotes ; have photosystems I and II and have chlorophyll *a* as well as oxygenic photosynthesis (Fig.1).

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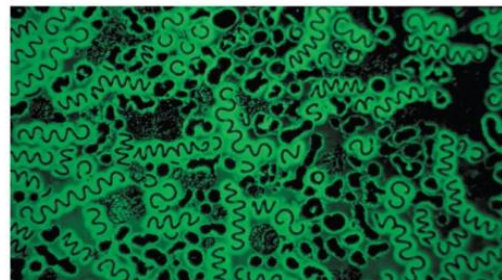
(a) *Oscillatoria*



(c) *Nostoc*



(b) *Chroococcus turgidus*



(d) *Anabaena spiroides* and *Microcystis aeruginosa*

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**Figure 1:** Some genera in *Cyanobacteria*

## Morphological characters

Range in diameter from ~1 to 10  $\mu\text{m}$ . May be unicellular, colonial, or filaments called trichomes (a row of cells in close contact) .

## Pigmentation

- 1- Most appear blue-green due to presence of phycocyanin
- 2- Presence of phycoerythrin in many ocean isolates gives them red or brown coloration
- 3- Chromatic adaptation
- 4- Modulation of pigment concentrations in different light
- 5- Photo taxis by use of gas vacuoles

## Specialized Reproductive Cells and Structures

Binary fission, budding, fragmentation, multiple fission.

**Hormogonia** are small, motile fragments of filamentous cyanobacteria.

**Akinetes** are dormant, thick-walled resting cells resistant to desiccation. often germinate to form new filaments

## Ecology of Cyanobacteria

Thermophilic species can grow at temperatures up to 75°C , often are primary colonizers . Can cause blooms in nutrient-rich ponds and lakes , some produce toxins . Often form symbiotic relationships

## Classification of Cyanobacteria

*Bergey's Manual* divides Cyanobacteria into five subsections . major characteristics include morphology and reproductive patterns other characteristics used ultrastructure genetic , physiology and biochemistry habitat/ecology.

## Prochlorophytes / Order Prochlorales

Cyanobacteria in general represented by 3 genera: *Prochloron*, *Prochlorococcus*, and *Prochlorothrix* distinguished by presence of chlorophyll *a* and *b* and lack of phycobilins ,they are the only prokaryotes to possess chlorophyll *b*.

## Phylum Chlamydiae

Gram-negative , obligate intracellular parasites , must grow and reproduce inside host cells , although known for ability to cause disease, many grow within hosts such as protists, and animal cells without adverse effects.

The phylum can be classified into one class, one order, four families, six genera genus *Chlamydia* is best studied

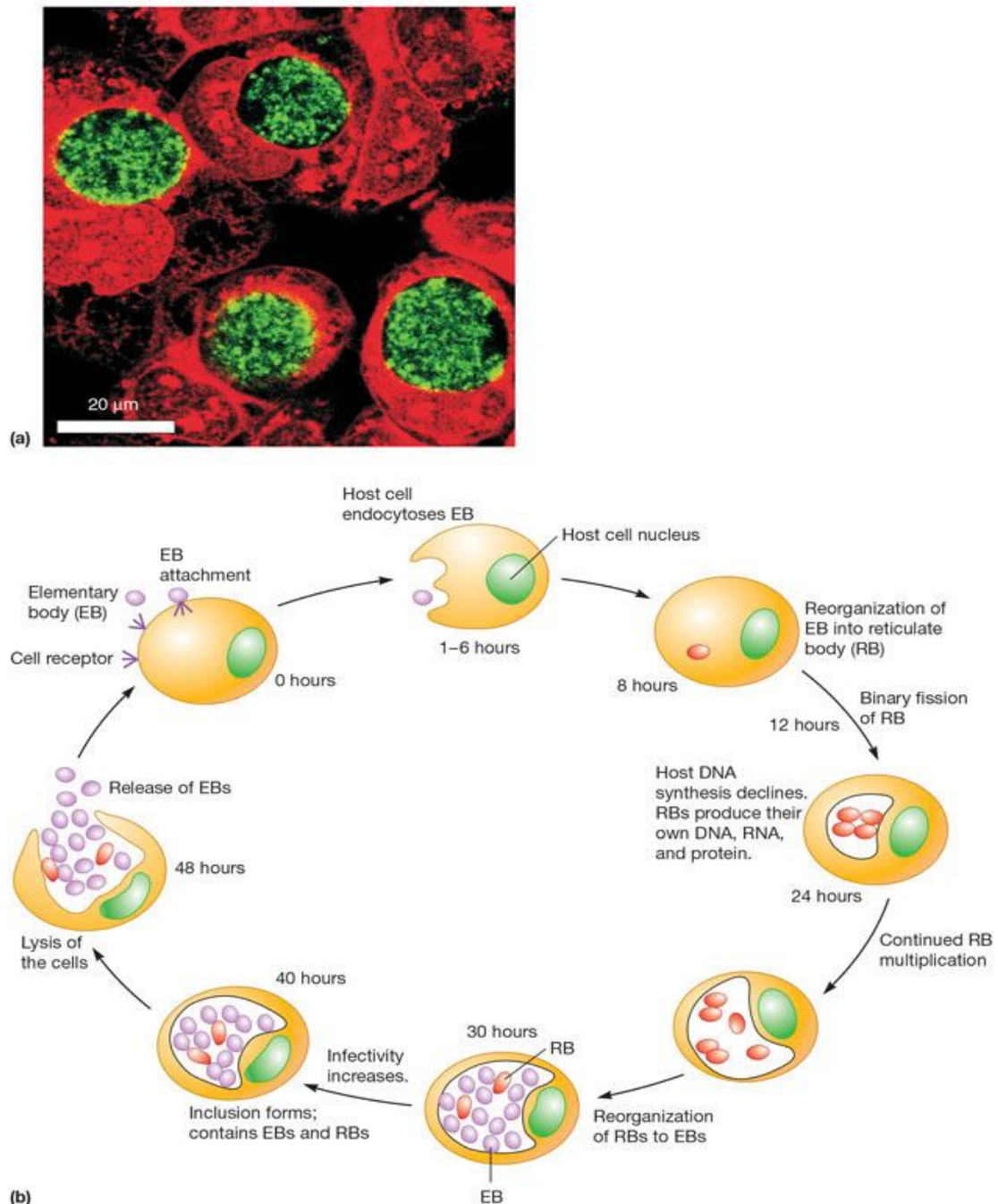
### Genus *Chlamydia*

- 1-Nonmotile, coccoid, Gram-negative, cell walls lack muramic acid, peptidoglycan.
- 2- Have very small genomes.
- 3- Obligate intracellular parasites with unique developmental cycle.
- 4-Elementary body (EB) attaches to host cell.

### Metabolism in *Chlamydia*

- 1-Cannot catabolize carbohydrates
- 2-Cannot synthesize ATP or NAD<sup>+</sup>
- 3-import up from host
- 4-do have genes for substrate-level phosphorylation, electron transport, and oxidative phosphorylation
- 5-RBs have biosynthetic capabilities when supplied precursors from host; can synthesize some amino acids
- 6-EBs seem to be dormant forms (Fig .2)

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**Figure 2:** Morphology and life cycle of the genus *Chlamydia*

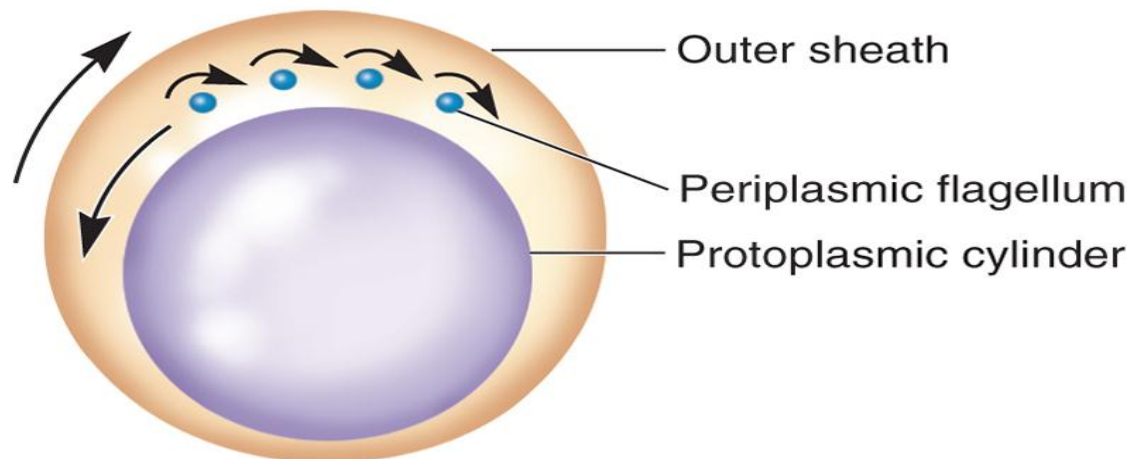
### **Phylum *Spirochaetes***

Contains **one** class; **one** order, three families, **13** genera . Gram-negative, chemoheterotrophic bacteria with distinctive structure and motility ,slender, long with flexible helical shape , creeping (crawling) motility due to a structure called an axial filament. Oxygen requirements vary.

### ***Spirochaetes* Motility**

Axial filament lies inside outer sheath, rotate, causing corkscrew-shaped outer sheath to rotate and move cell through surrounding liquid. Motility adapted to moving through viscous solutions (Fig.3).

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**Figure 3 :** Axial filament in *Spirochaetes*

Genera belonging to this phylum are ecologically diverse, free living or symbiotic or disease causative agents like Lyme disease and syphilis that caused by ***Treponema pallidum***

### **Scientific classification**

Domain: Bacteria

Phylum: Spirochaetes

Order: Spirochaetales

Family: Spirochaetaceae

Genus: *Treponema*

Species: *T. pallidum*

## **Phylum Bacteroidetes**

Very diverse ,grouped in **three** classes:

**1-Bacteroidia**    **2-Flavobacteria**    **3-Sphingobacteria** , classified into **12** families include **63** genera

### **Class Bacteroidia**

- 1**-Gram-negative rods, various shapes
- 2**-Do not form endospores
- 3**-Motile or nonmotile
- 4**-Chemoheterotrophs - fermentative
- 5**-Often found in oral cavity and intestinal tract of humans and other animals and the rumen of ruminants
- 6**-Often benefit host by degrading complex carbohydrates, providing extra nutrition constitute up to **30%** of bacteria from human feces
- 7**-Some cause disease

The most important and characteristic feature of **Bacteroidia** is gliding motility. The most studied genus is *Bacteroides fragilis*.

### **Scientific classification**

Domain : Bacteria

Phylum : Bacteroidetes

Class : Bacteroidia

Order :Bacteroidales

Family : Bacteroidaceae

Genus : Bacteroides

Species : *B. fragilis*