

# **Gammaproteobacteria**

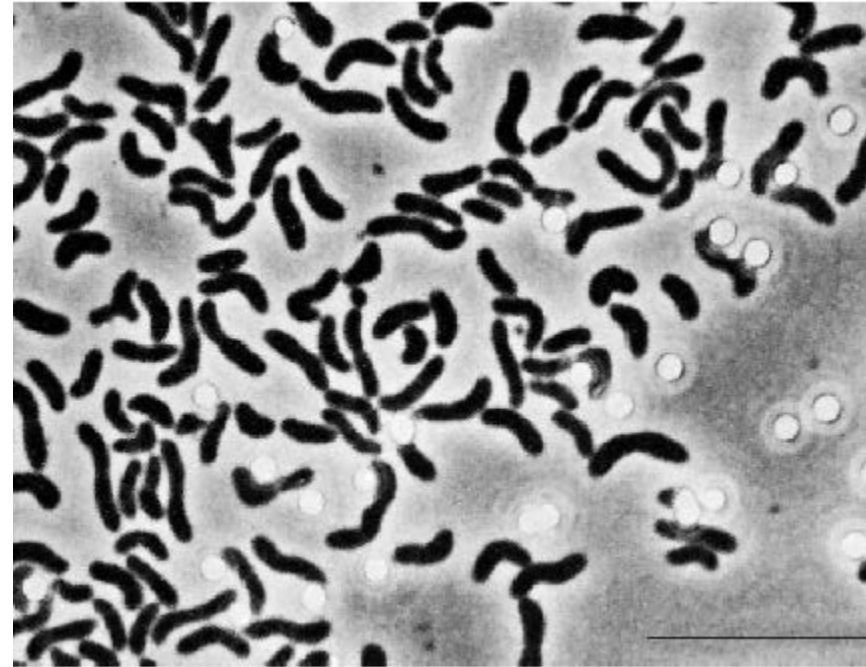
**By- Dr. Ekta Khare**

# Gammaproteobacteria

- The second edition of *Bergey's Manual* divides the class Gammaproteobacteria into 13 orders, 20 families, and around 160 genera.
- The  **$\gamma$ -proteobacteria** constitute the largest subgroup of **proteobacteria** with an extraordinary variety of physiological types.
- Many important genera are chemoorganotrophic and facultatively anaerobic.
- Other genera contain aerobic chemoorganotrophs, photolithotrophs, chemolithotrophs, or methylotrophs.

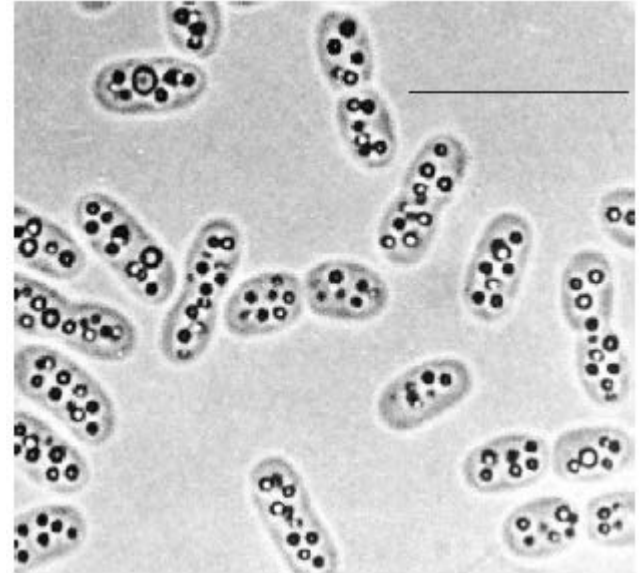
# The Purple Sulfur Bacteria

- *Bergey's Manual* divides the purple sulfur bacteria into two families: the *Chromatiaceae* and *Ectothiorhodospiraceae*.
- *Ectothiorhodospira* has red, spiral-shaped, polarly flagellated cells that deposit sulfur globules externally.
- Internal photosynthetic membranes are organized as lamellar stacks.
- The typical purple sulfur bacteria are located in the family *Chromatiaceae*, which is much larger and contains 22 genera.



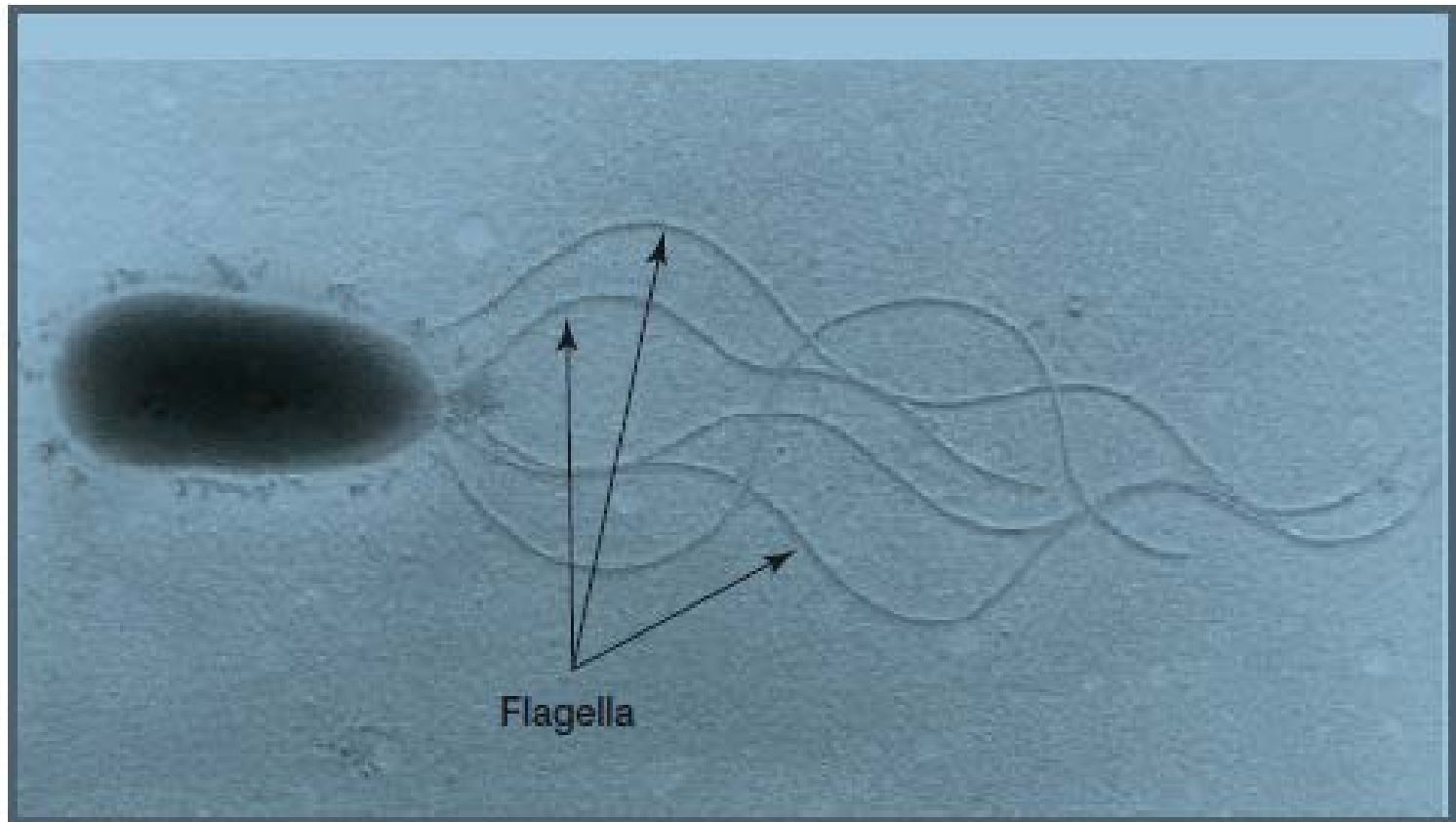
# ... The Purple Sulfur Bacteria

- The **purple sulfur bacteria** are strict **anaerobes** and **usually** photolithoautotrophs.
- They oxidize hydrogen sulfide to sulfur and deposit it internally as sulfur granules (usually within invaginated pockets of the plasma membrane); often they eventually oxidize the sulfur to sulfate.
- Hydrogen also may serve as an electron donor.
- *Thiospirillum*, *Thiocapsa*, and *Chromatium* are typical purple sulfur bacteria.
- **They are found in anaerobic**, sulfide-rich zones of lakes.
- Large blooms of purple sulfur bacteria occur in bogs and lagoons under the proper conditions.



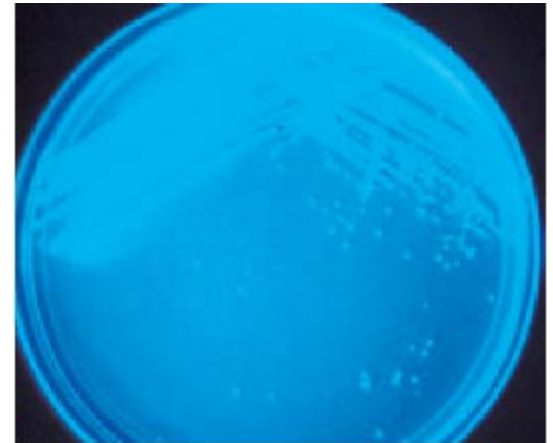
# Order Pseudomonadales

- *Pseudomonas* is the most important genus in the order Pseudomonadales, family Pseudomonadaceae.
- The genus *Pseudomonas* contains straight or slightly gram-negative curved rods, 0.5 to 1.0  $\mu\text{m}$  by 1.5 to 5.0  $\mu\text{m}$  in length, that are motile by one or several polar flagella and lack prosthecae or sheaths .
- These chemoheterotrophs are aerobic and carry out respiratory metabolism with  $\text{O}_2$  (and sometimes nitrate) as the electron acceptor.
- All pseudomonads have a functional tricarboxylic acid cycle and can oxidize substrates to  $\text{CO}_2$ .
- Most hexoses are degraded by the Entner-Doudoroff pathway rather than glycolytically.



# *Pseudomonas*

- In the first edition, the genus is an exceptionally heterogeneous taxon composed of 70 or more species. Many can be placed in one of five rRNA homology groups.
- The three best-characterized groups, RNA groups I–III, are subdivided according to properties such as the presence of:
  - poly--hydroxybutyrate (PHB),
  - the production of a fluorescent pigment,
  - pathogenicity,
  - the presence of arginine dihydrolase, and
  - glucose utilization.



# Order Enterobacteriales

- It contains gram-negative, peritrichously flagellated or nonmotile, facultatively anaerobic, straight rods with simple nutritional requirements.
- In the second edition the order Enterobacteriales has only one family, Enterobacteriaceae, with 41 genera.
- Members of the family, often called **enterobacteria** or **enteric bacteria**, all degrade sugars by means of the Embden-Meyerhof pathway and cleave pyruvic acid to yield formic acid in formic acid fermentations.
- Those enteric bacteria that produce large amounts of gas during sugar fermentation, such as *Escherichia spp.*, have the *formic hydrogenlyase complex* that degrades formic acid to H<sub>2</sub> and CO<sub>2</sub>.
- The family can be divided into two groups based on their fermentation products.
  - The majority (e.g., the genera *Escherichia*, *Proteus*, *Salmonella*, and *Shigella*) carry out mixed acid fermentation and produce mainly lactate, acetate, succinate, formate (or H<sub>2</sub> and CO<sub>2</sub>), and ethanol.
  - In butanediol fermentation the major products are butanediol, ethanol, and carbon dioxide. *Enterobacter*, *Serratia*, *Erwinia*, and *Klebsiella* are *butanediol fermenters*.



# *Enterobacteriaceae*

- Members of the *Enterobacteriaceae* are so common, widespread, and important that they are probably more often seen in most laboratories than any other bacteria.
- *Escherichia coli* is undoubtedly the best-studied bacterium and the experimental organism of choice for many microbiologists.
- It is an inhabitant of the colon of humans and other warm-blooded animals, and it is quite useful in the analysis of water for fecal contamination.
- Some strains cause gastroenteritis or urinary tract infections.
- Several enteric genera contain very important human pathogens responsible for a variety of diseases: *Salmonella*, **typhoid fever and gastroenteritis**; *Shigella*, bacillary dysentery; *Klebsiella*, pneumonia;
- *Yersinia*, plague.
- Members of the genus *Erwinia* are major pathogens of crop plants and cause blights, wilts, and several other plant diseases.