

## Overview of Bacterial Groups

Group	Gram Rxn	Characteristics	Examples
Spirochetes	--	helical (flexible spirals), motile, axial filaments (endoflagella), some pathogens	<u>Treponema pallidum</u> <u>Borrelia burgdorferi</u>
Aerobic/Microaerophilic Spirals	--	helical or curved (rigid spirals), motile, flagella, some pathogens	<u>Campylobacter</u> <u>Helicobacter pylori</u> <u>Azospirillum</u>
Aerobic Rods/Cocci	--	important medically, environmentally, industrially	<u>Pseudomonas</u> <u>Legionella</u> , <u>Neisseria</u> , <u>Rhizobium</u> , <u>Agrobacterium</u>
<u>Facultatively Anaerobic Rods</u>	--	<u>important pathogens, motile and nonmotile</u>	<u>E. coli</u> , <u>Salmonella</u> , <u>Shigella</u> , <u>Klebsiella</u> , <u>Yersinia</u> , <u>Vibrio</u> <u>cholerae</u> , <u>Serratia</u> , <u>Proteus</u> , <u>Enterobacter</u>
Rickettsias and Chlamydias	--	<u>obligate intracellular</u>	<u>Rickettsia rickettsii</u> <u>Chlamydia trachomatis</u> , <u>C. psittaci</u>
<u>Mycoplasmas</u>	--	<u>lack cell walls, pleomorphic</u>	<u>M. pneumoniae</u>
<u>Gram Positive Cocci</u>	+	<u>important pathogens</u>	<u>Staph and Strep</u>
<u>Endospore-Forming Rods and Cocci</u>	+	<u>endospores</u> , aerobic, facultative anaerobic and strict anaerobes	<u>Bacillus sp.</u> , <u>Clostridium sp.</u> <u>(tetani, perfringens, botulinum)</u>
Regular Nonsporing Rods	+	<u>no endospores</u> , important flora, <u>commercial</u>	<u>Lactobacillus acidophilus</u>
Irregular Nonsporing Rods	+	pleomorphic, some pathogens	<u>Corynebacterium sp.</u> <u>(diphtheriae, xerosis)</u> , <u>Propionibacterium acnes</u>

<u>Mycobacteria</u>	<u>+, not easy to gram stain</u>	<u>thick waxy CW, acid fast, slow growing, antimicrobials hard to get in, pathogens</u>	<u><i>Mycobacterium tuberculosis</i>, <i>M. leprae</i>, <i>M. phlei</i></u>
Appendaged Bacteria	--	stalk (prostheca), unusual binary fission: stalked cell → nonmotile stalked cell + motile flagellated swarmer cell	<i>Caulobacter</i>
Chemoautotrophic Bacteria	--	important environmental flora, soil, water, nitrifying bacteria ( $\text{NH}_4^+ \rightarrow \text{NO}_2^- \rightarrow \text{NO}_3^-$ )	<i>Nitrosomonas</i> , <i>Nitrobacter</i> , <i>Nitrococcus</i>
Archaea	varies	bizarre, extremophiles, CW lack peptidoglycan	
Anoxygenic Phototrophic Bacteria	--	photosynthetic but do not produce oxygen; some use $\text{H}_2\text{S}$ , others use organic acids and carbohydrates	purple and green sulfur bacteria, purple and green nonsulfur bacteria, <i>Rhodospirillum rubrum</i>
Oxygenic Phototrophic Bacteria	--	produce oxygen, some fix nitrogen	cyanobacteria (blue-green algae)

## Plant pathogen

*Agrobacterium*: Insert a plasmid into plant cells, inducing a tumor

## Nitrogen Fixation

- Nitrogen-fixing bacteria
  - *Azospirillum*
    - Grow in soil, using nutrients excreted by plants
    -
  - *Rhizobium*
    - Fix nitrogen in the roots of plants

## Human Pathogen

- *Neisseria*
  - Chemoheterotrophic, cocci
  - *N. meningitidis*
  - *N. gonorrhoeae*
  
- Vibrionales
  - Found in coastal water
    - 
    - *V. parahaemolyticus* causes gastroenteritis
  
- *Campylobacter*
  - One polar flagellum
  -
  
- *Helicobacter*
  - Multiple flagella
  - 
  - Stomach cancer

## Enterics (Enterobacteriaceae)

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- facultative anaerobes
- medically important pathogens
- inhabit intestines of humans and animals
- motile and non-motile - can be variable within a species
- many produce bacteriocins - proteins that kill other related species
- many produce toxins - exotoxins =
- some ferment lactose, some don't - important for ID for contamination
- examples:
  - *Enterobacter* -
  
  - *E. coli* - normal flora

- 0157:H7 - produces potent enterotoxin (exotoxin)
- *Klebsiella* - pneumonia
- *Proteus* -
- *Salmonella* - salmonellosis, typhoid fever, food poisoning
- *Serratia*
  - nosocomial urinary tract infections (UTI), respiratory tract infections (RTI)
- *Shigella*
  - dysentery / shigellosis
  - shiga toxin (\_\_\_\_\_)
- *Yersinia pestis* -

### **Bacterial Predator**

*Bdellovibrio*:

### **Purple and Green Photosynthetic Bacteria**

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- Purple and green sulfur bacteria

### **Clostridiales**

- *Clostridium*
  - 
  - Obligate anaerobes
  -

### **Gram (+) Cocci**

- *Staphylococcus* and *Streptococcus* medically important
- *Staph. aureus*
  - 
  - antibiotic resistance
  - toxins including enterotoxins →
- *Streptococcus*
  - 
  - cause many diseases - sore throat, scarlet fever, pneumonia, “flesh eating strep”
  - produces toxins -
    - worst is  $\beta$ -hemolysin - lyses RBCs
  - antibiotic resistance

## **Mycoplasmatales**

- Wall-less, pleomorphic
- 0.1 - 0.24  $\mu\text{m}$  (small!)
- *M. pneumoniae*

## **Chlamydias**

- *Chlamydia trachomatis*
  - STD, urethritis
- *Chlamydophila pneumoniae*
- *Chlamydophila psittaci*
  - Causes psittacosis – disease in birds that causes pneumonia in humans

## **Spirochaetes**

- *Borrelia* –
- *Treponema* -

## **Cyanobacteria**

- Gliding motility
- Fix nitrogen

## **Microbial Diversity**

- Bacteria size range
  - *Thiomargarita* (750  $\mu\text{m}$ )
  - Nanobacteria (0.02  $\mu\text{m}$ ) in rocks
  - *Epulopiscium*
    - Huge bacterium
    - ~500  $\mu\text{m}$  long!
- PCR indicates up to 10,000 bacteria/gm of soil. Many bacteria have not been identified or characterized because they
  - Haven't been cultured
  - Need special nutrients
  - Are a part of complex food chains requiring the products of other bacteria
  - Need to be cultured to understand their metabolism and ecological role

## **Domain Archaea**

- Hyperthermophiles

- *Pyrodictium*
- *Sulfolobus*
  
- Methanogens
  - *Methanobacterium*
  
- Extreme halophiles
  - *Halobacterium*
  
- Extremophiles live in
  - High pressure
  - High temperature
  -

## **Study Objectives**

1. Emphasize underlined items in chart including diseases associated with those organisms.
2. Describe major characteristics of the enterics.
3. List and describe the major gram (-) rods and the diseases/conditions they cause.
4. List and describe the major characteristics of *Staphylococcus* and *Streptococcus*.