
Bacterial Classification

Taxonomy and Characteristics

Prokaryotes

- Domain Archaea
[ancient bacteria]
- Domain Eubacteria
[true bacteria]
make up the old
Kingdom Monera

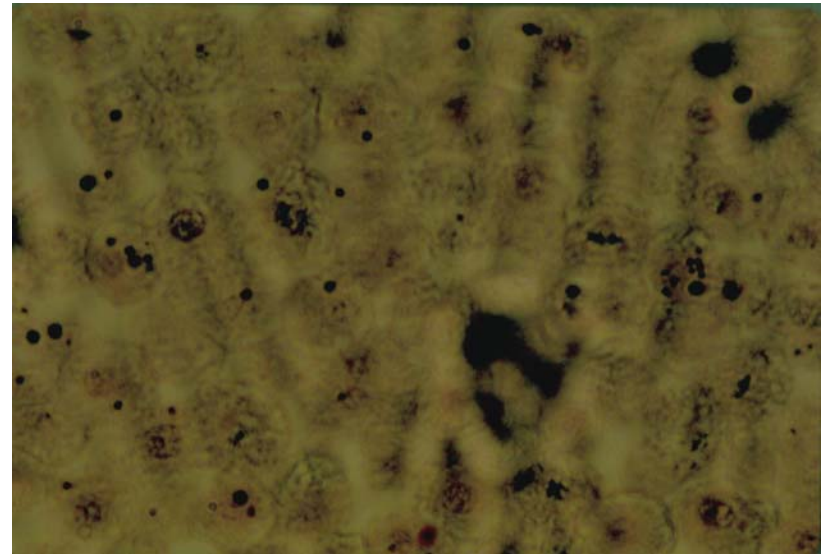
Prokaryotes

- Most abundant group
- Widely distributed
- Oldest organisms



Domain Eukarya

- Organelles
- Plasma membrane
- Cell wall, if present, made up of polysaccharides
 - Fungi : chitin
 - Plants/Algae: cellulose or pectins
 - Vertebrates: no cell wall



Eukaryotes vs. Prokaryotes

■ Eukaryotes

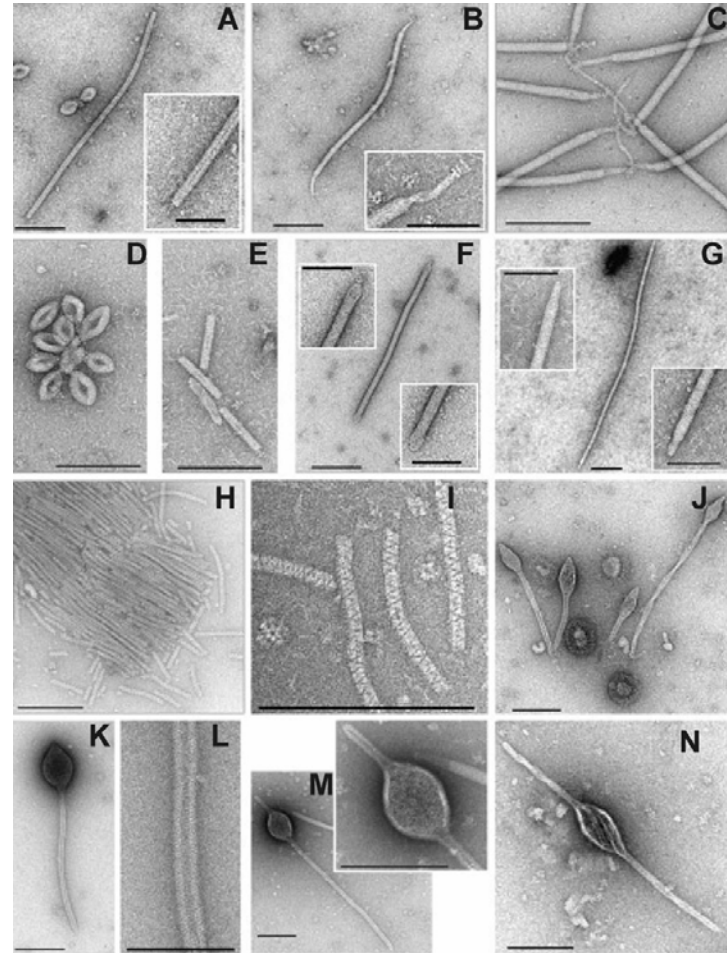
- DNA
 - Membrane, nucleus
 - Multiple chromosomes
 - Associated with histones
- Organelles
- Cell Walls
- Division
 - Sexual: Meiosis
 - Asexual: Mitosis
- Motility: Flagella whips

■ Prokaryotes

- DNA
 - Nonmembrane, nucleoid
 - One circular chromosome
 - No histones
- Organelles
- Cell Walls: peptidoglycan
- Division
 - Asexual
 - Binary Fission
 - Snapping
 - Budding
- Motility: Flagella spins

Domain Archaea

- Evolved from earliest cells
- Methanogens
 - Largest group
 - Use CO₂
- Extreme environment
 - Halophiles
 - Thermophiles
 - Psychrophiles
 - Acidophiles
 - Alkaliphiles



Domain Eukarya

■ Fungi

- Molds
- Yeasts
- Mushrooms

■ Protista

- Slime Molds
- Unicellular Algae
- Protozoa

■ Plantae

- Multicellular Algae
- Mosses
- Plants

■ Animalia

- Insects
 - Worms
 - Sponges
 - Vertebrates
-

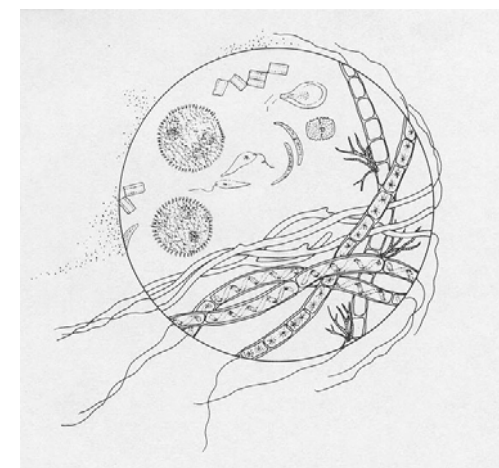
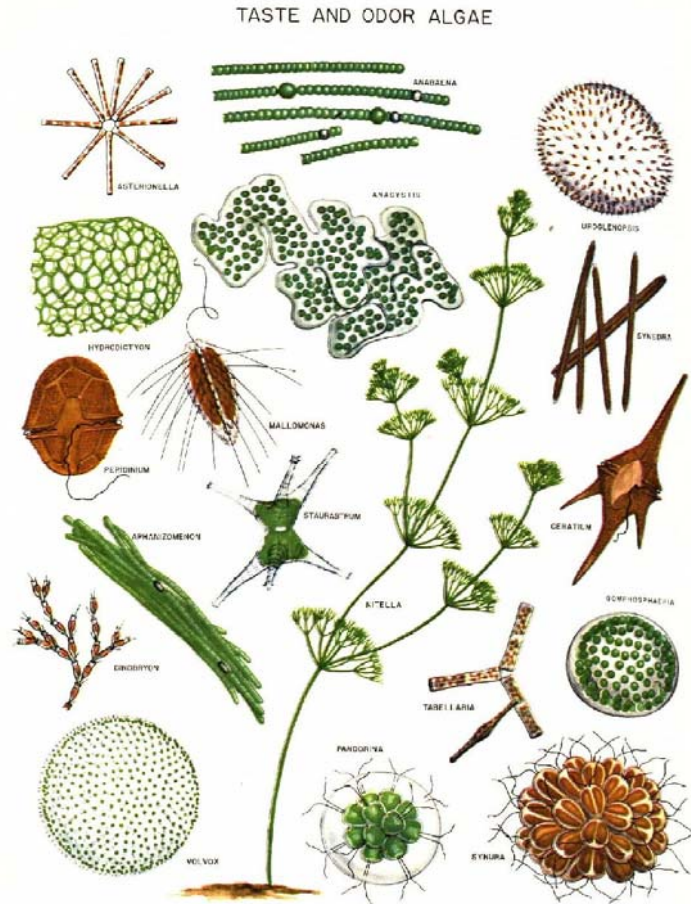
Fungi

- Eukaryotic
 - Unicellular = yeast
 - Multicellular = molds, mushrooms
 - Hyphae for nutrition from preformed matter
 - Chitin
 - Beneficial: decomposers
 - Pathogenic
 - Mycology
-

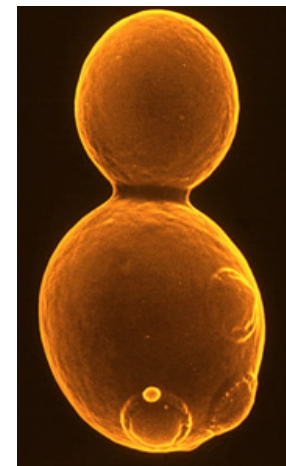
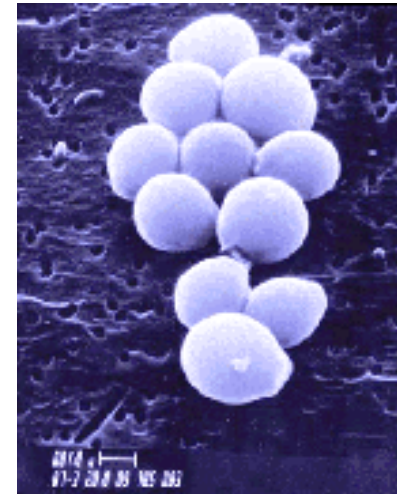
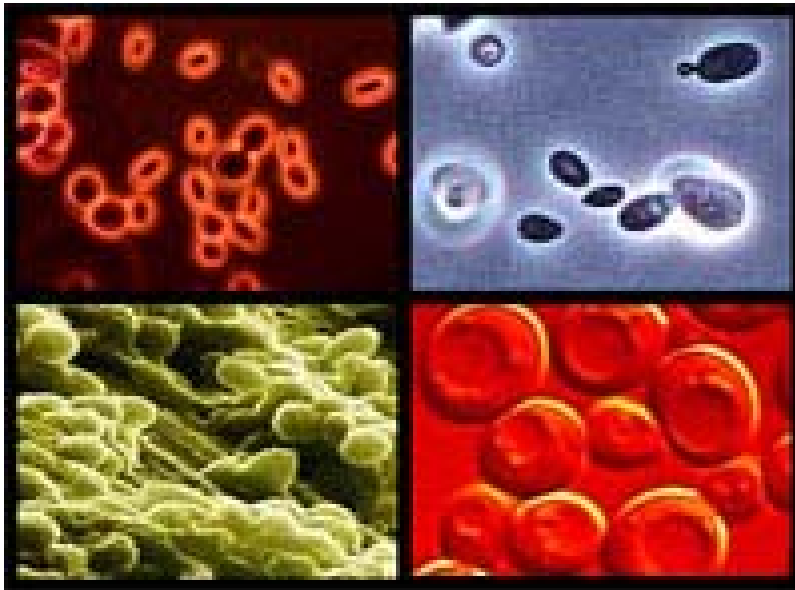
Fungi: Mushrooms



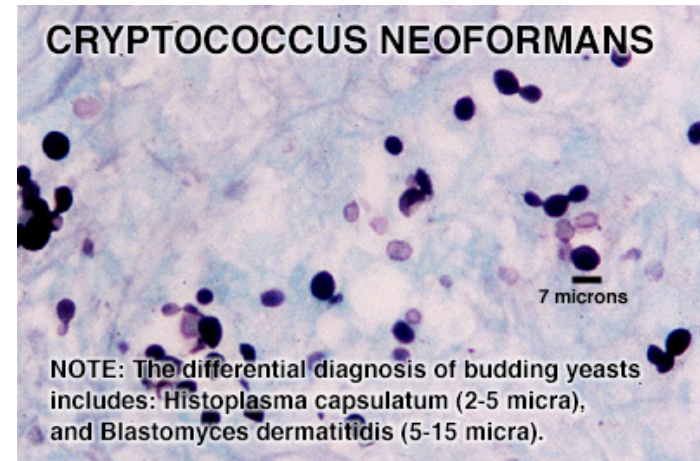
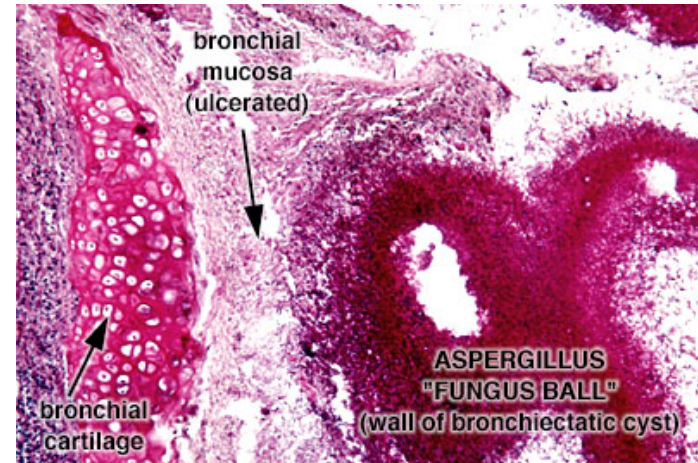
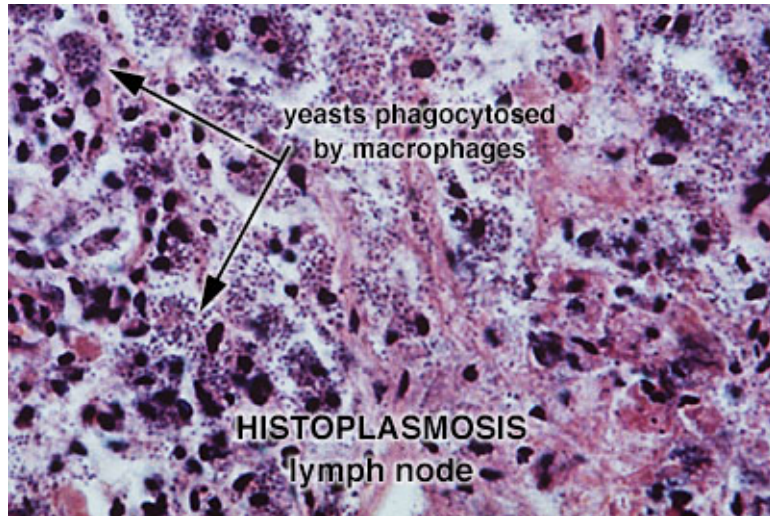
Fungi: Algae



Fungi: Yeast



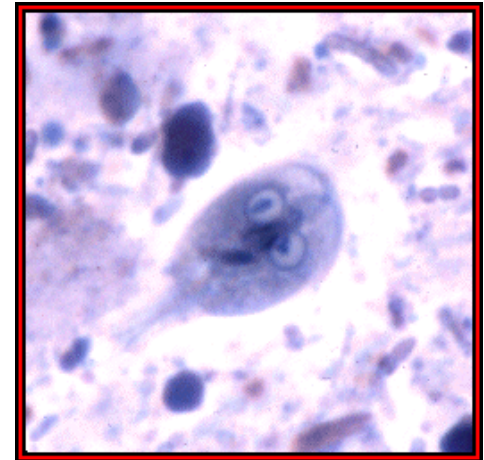
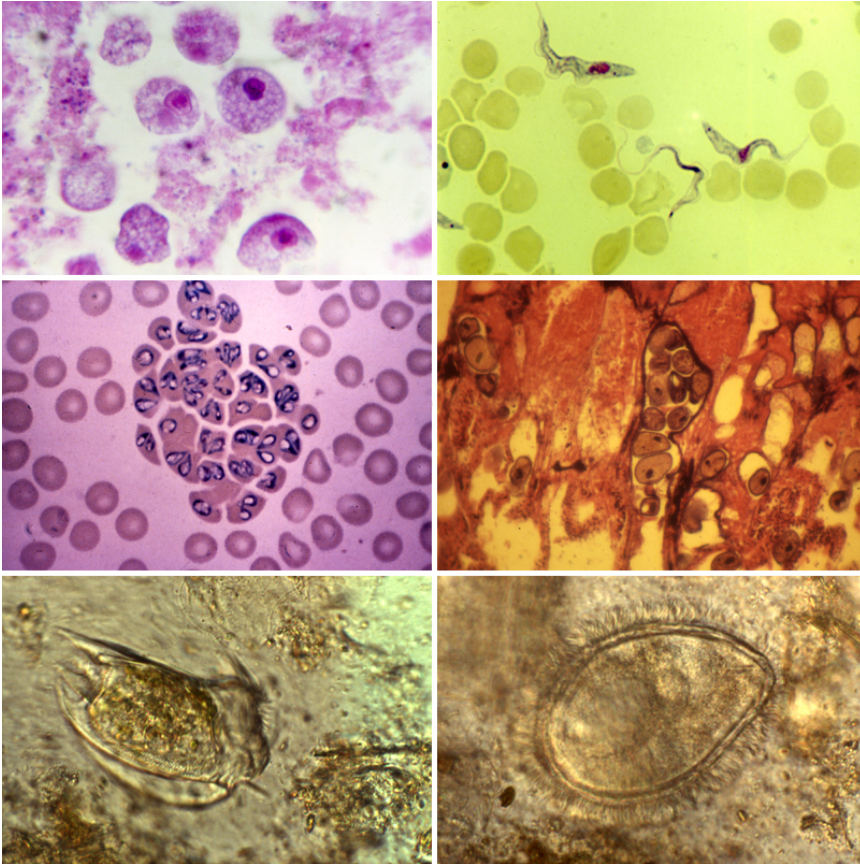
Pathogenic Fungi



Protista

- Eukaryotic
 - Unicellular
 - Lack cell wall
 - Classified based on movements
 - Ciliates
 - Flagellates
 - Pseudopods
 - Beneficial: decomposers
 - Pathogenic
-

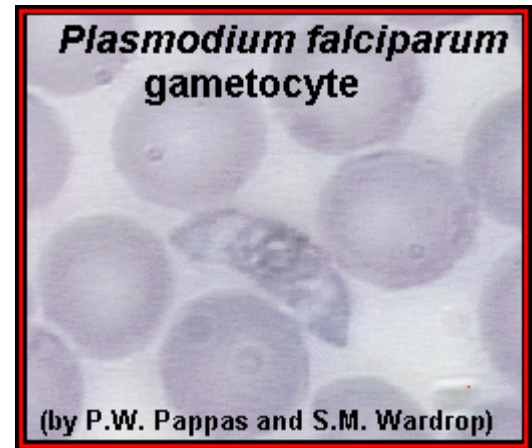
Parasitic Protozoa



Isospora oocyst



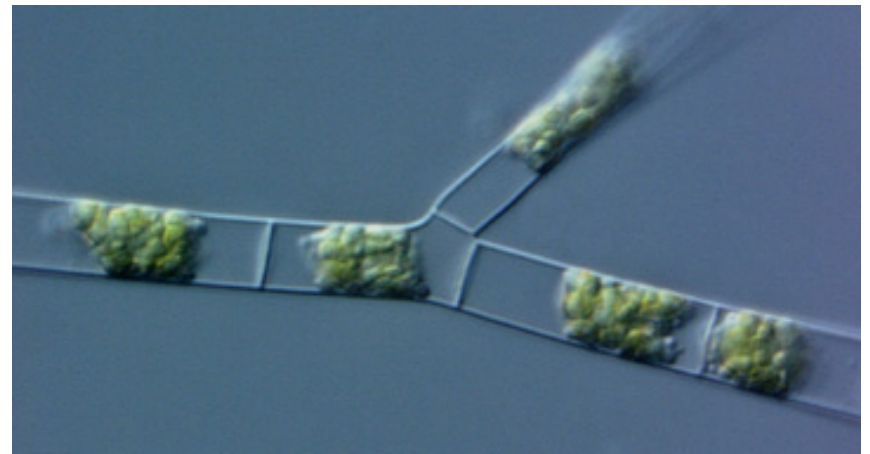
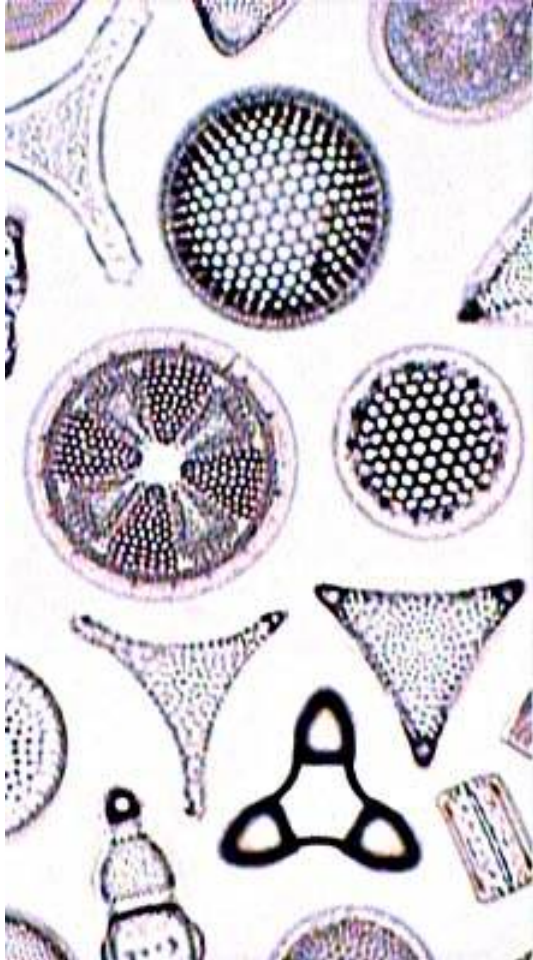
(by P.W. Pappas and S.M. Wardrop)



Plasmodium falciparum
gametocyte

(by P.W. Pappas and S.M. Wardrop)

Plantae



Animalia



Eubacteria

- Prokaryotic
 - Unicellular
 - Shapes
 - Vary in size
 - Taxonomy: Bergey's Manual
 - Low G+C Gram Positive
 - High G+C Gram Positive
 - Gram Negative Proteobacteria
 - Nonpathogenic: environmental contributions
 - Pathogenic
-

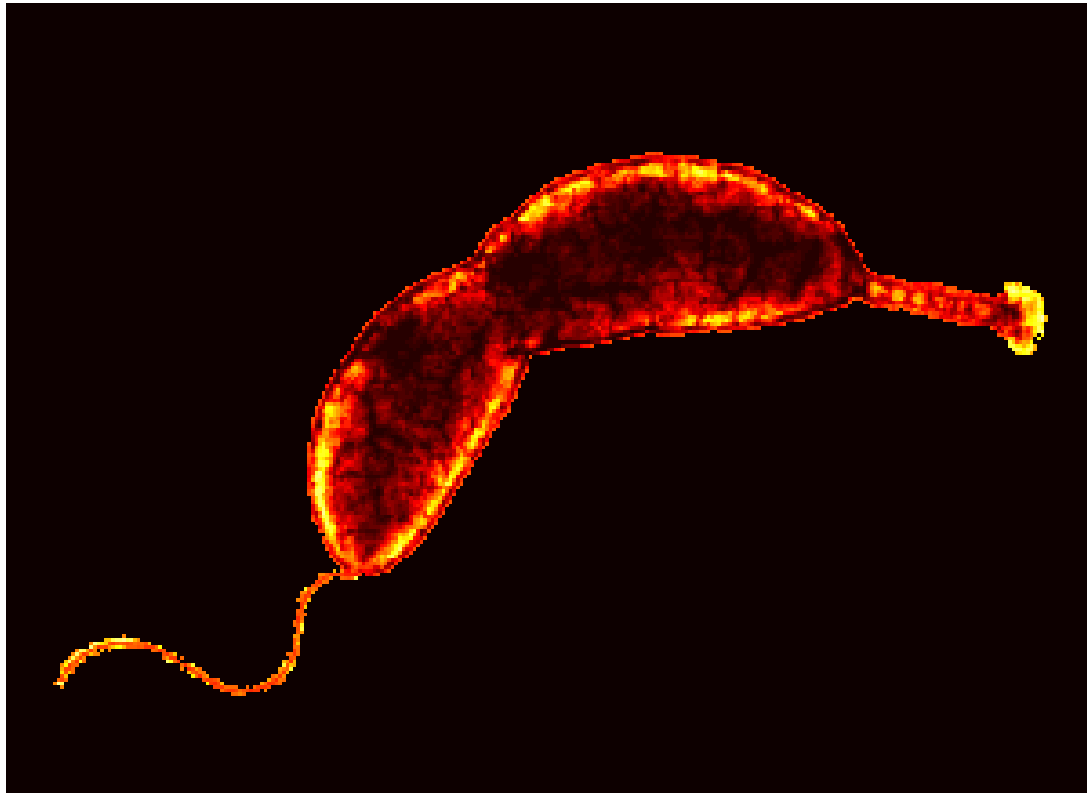
Bacterial Shapes

- Result of Asexual Reproduction
 - Binary Fission
 - Cross wall divides
 - Daughter cells +/- separate
 - Snapping Division
 - Inner cell wall divides
 - Daughter cells hinged
 - Budding
 - Outgrowth of original cell
-

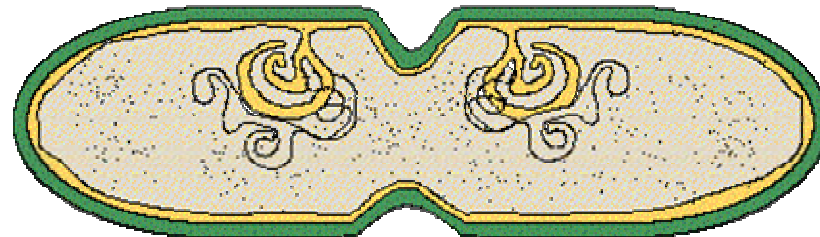
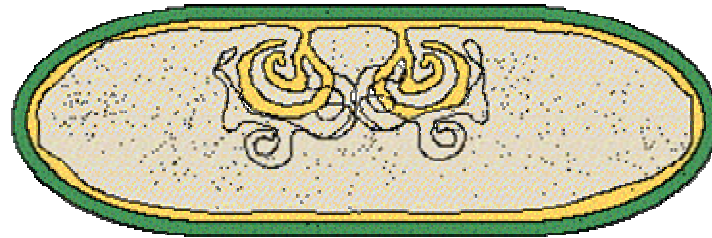
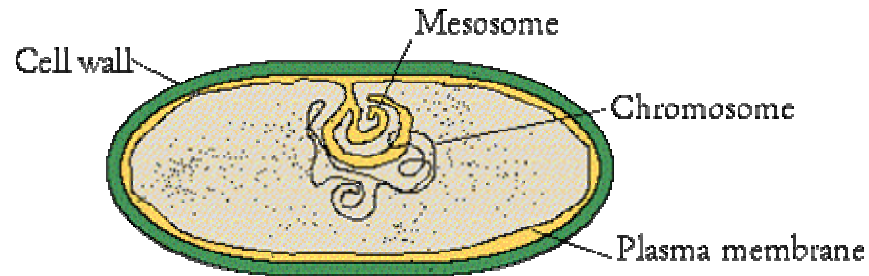
Budding



Snapping Division



Binary Fission



Binary Fission Results

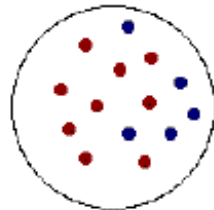
■ Cocci

- Pairs
- Chains
- Tetrads
- Cubes
- Clusters

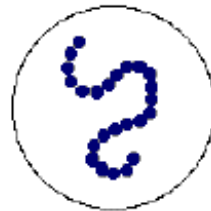
■ Bacillus

- Separate
 - Pairs
 - Chains
-

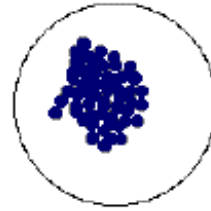
Bacterial Shapes



Cocci (1000X)



Streptococci (1000X)



Staphylococci (1000X)



Bacilli (1000X)



Streptobacilli (1000X)



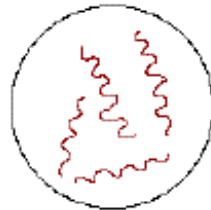
Diplococci (2000X)



Vibrios (1000X)

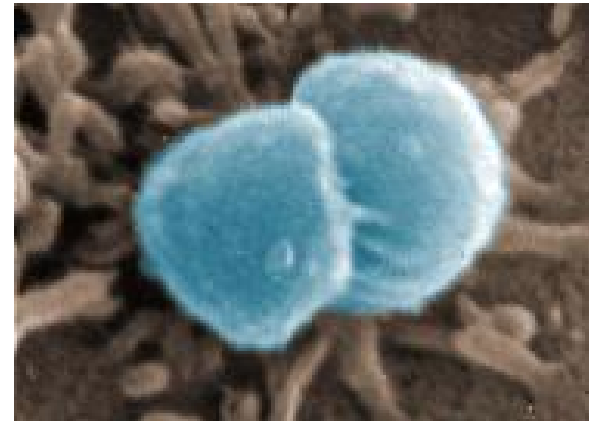
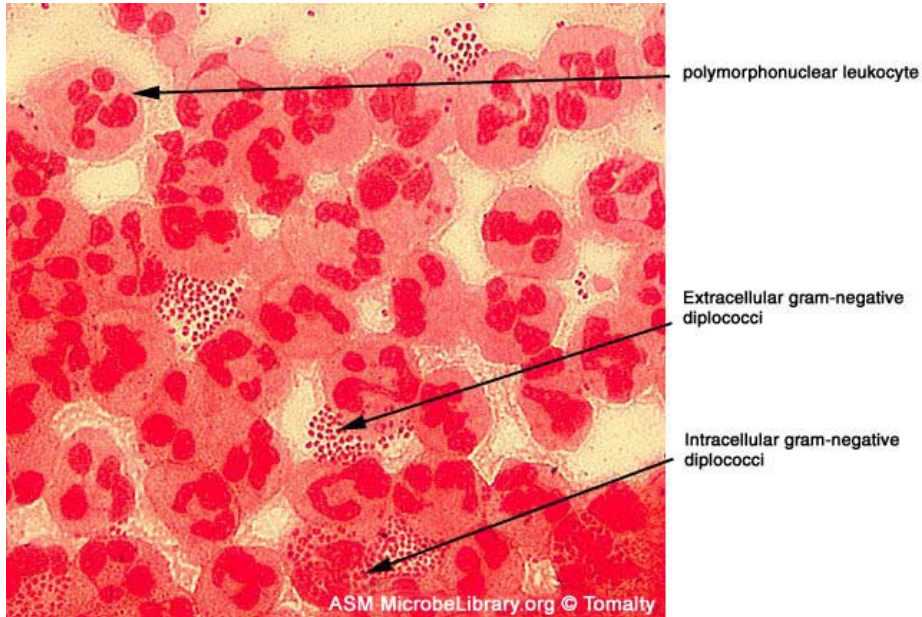


Spiral Bacteria (1000X)



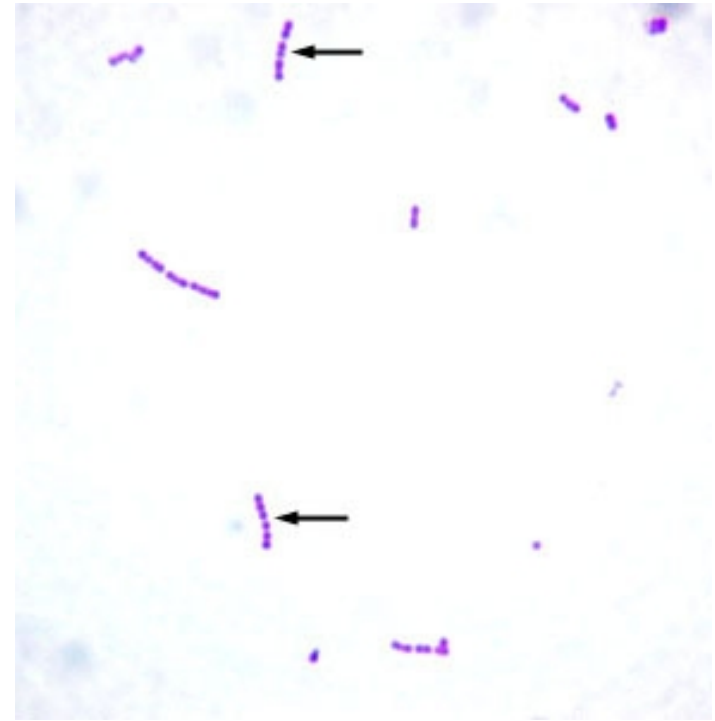
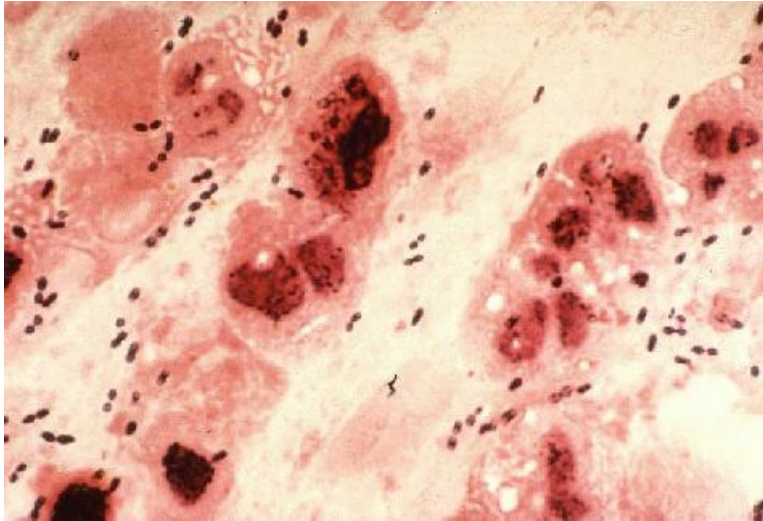
Spirochaetes (2000X)

Cocci: Pairs



- Division in one plane
 - Diplococci
 - *Neisseria*

Cocci: Chains

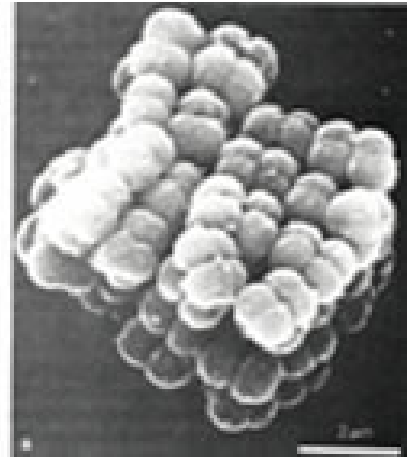
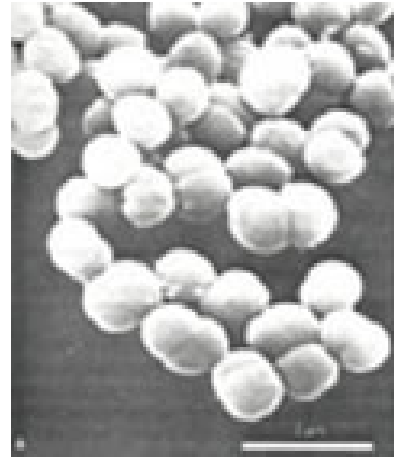


- Division in 2 Planes
 - *Streptococcus*



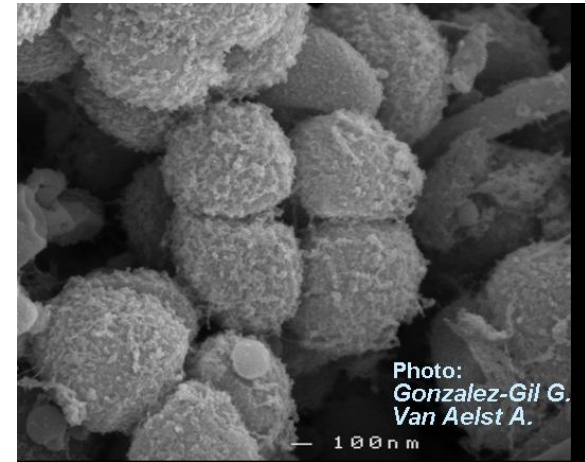
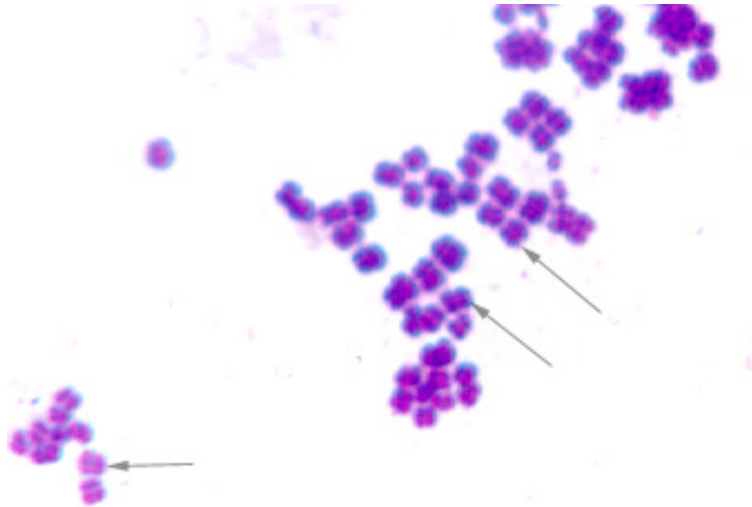
Cocci: Tetrads

- Division in three planes
 - *Micrococcus*



Cocci: 8-cell group

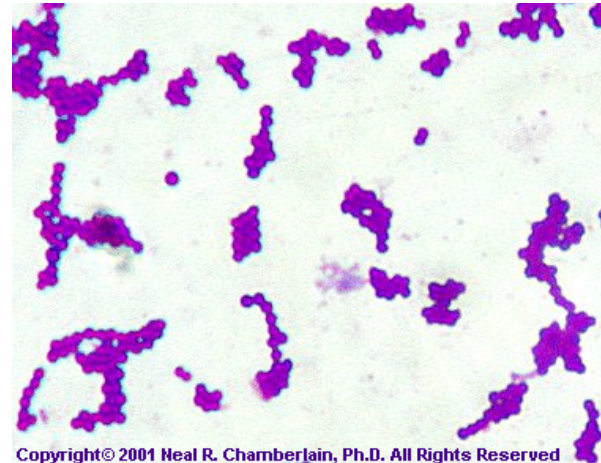
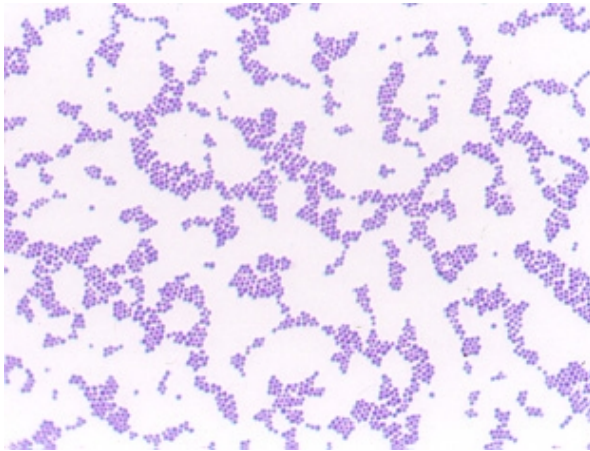
- Divides in 3 planes
 - *Sarcina*



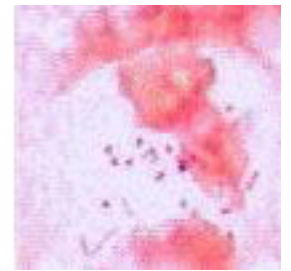
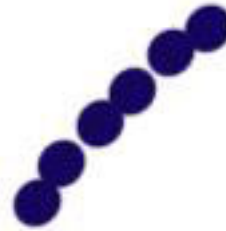
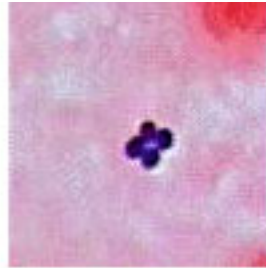
Cocci: Clusters



- Division in 3 planes
 - *Staphylococcus*

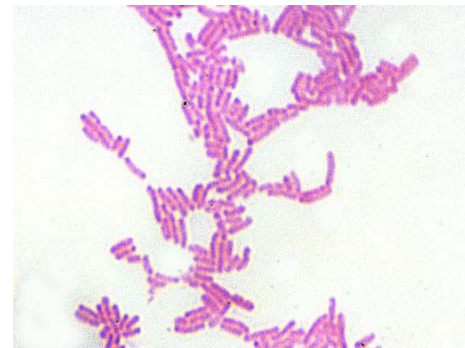
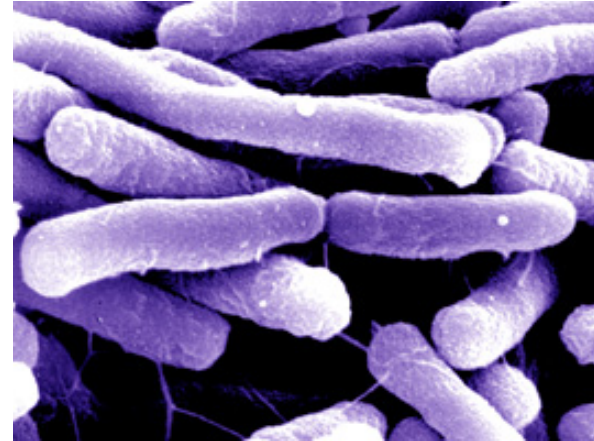
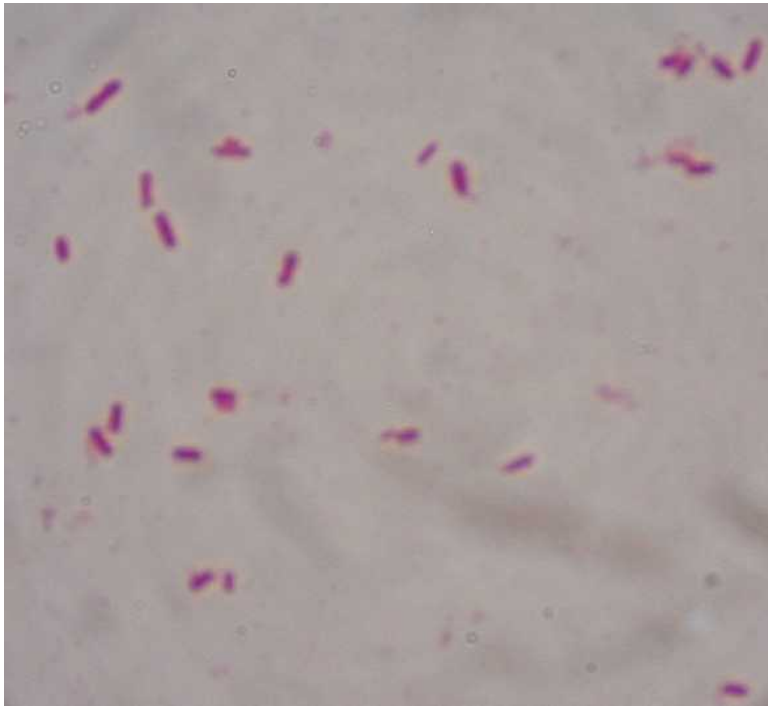


Cocci Summary

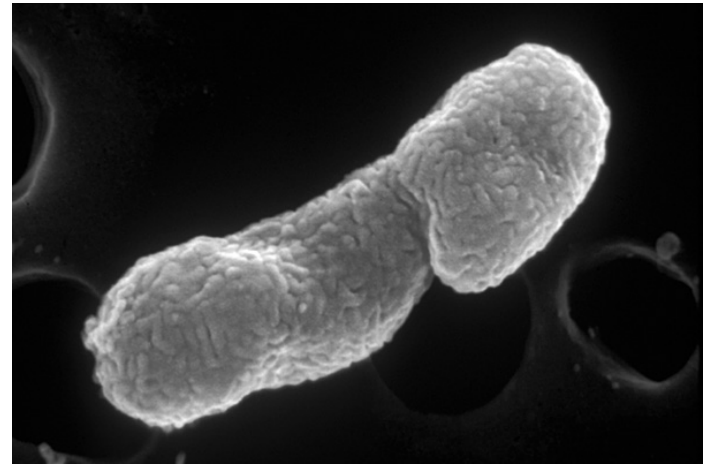
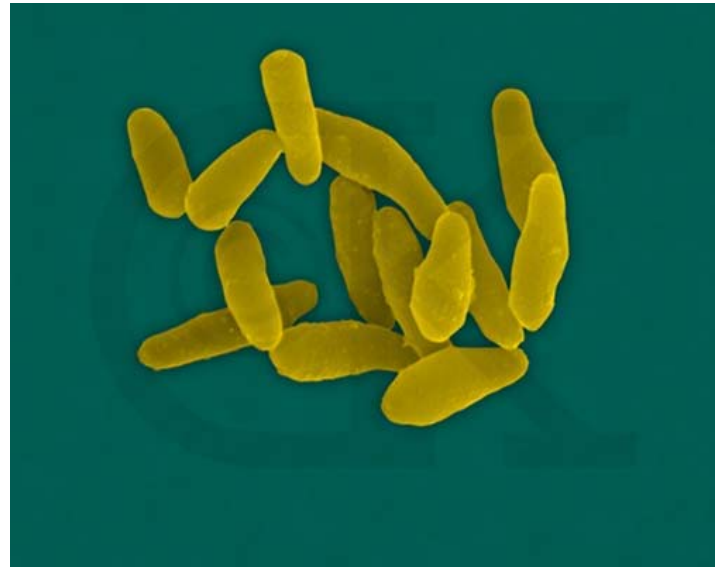
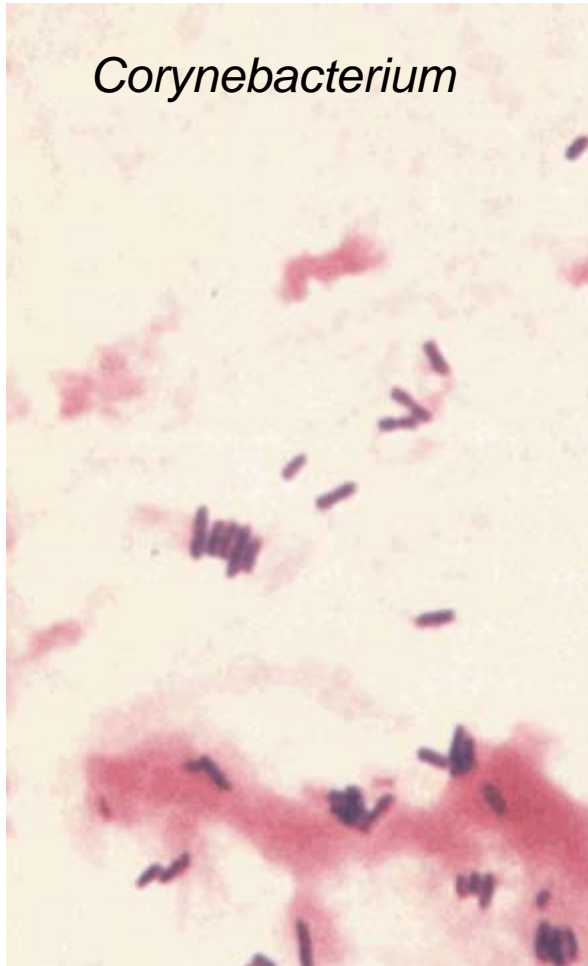


Rods: Straight

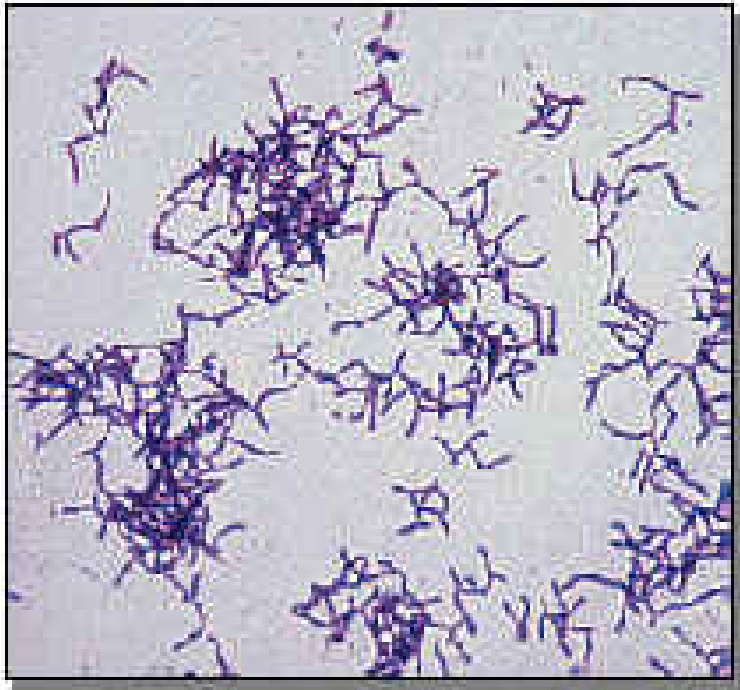
E. coli



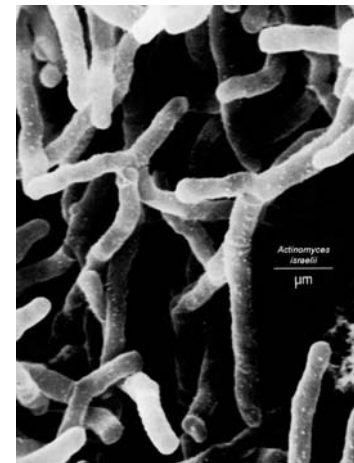
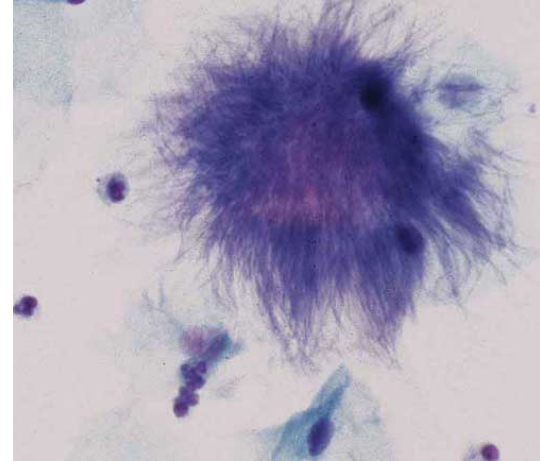
Rods: Club-Shaped



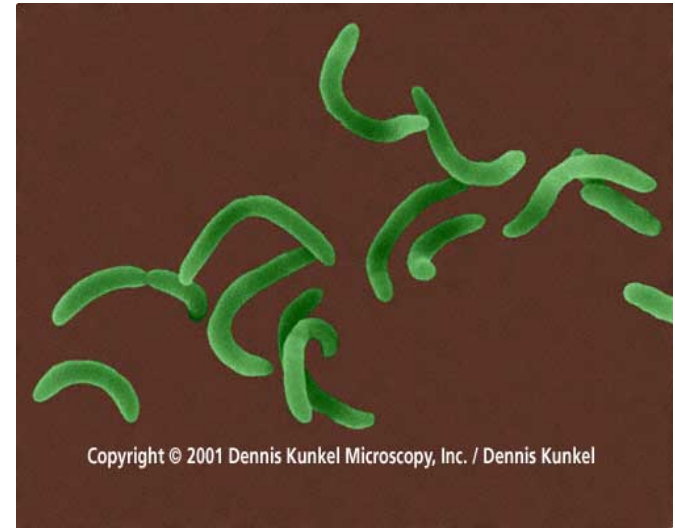
Rods: Branching



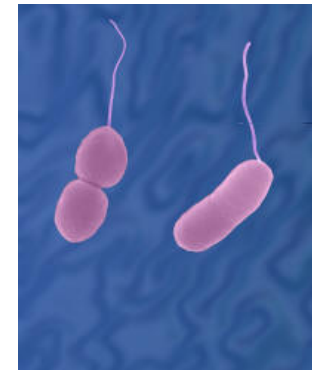
Actinomyces



Rods: Comma form

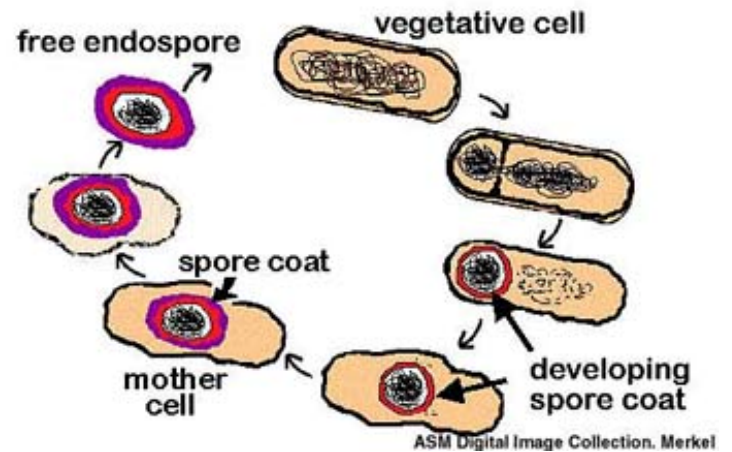
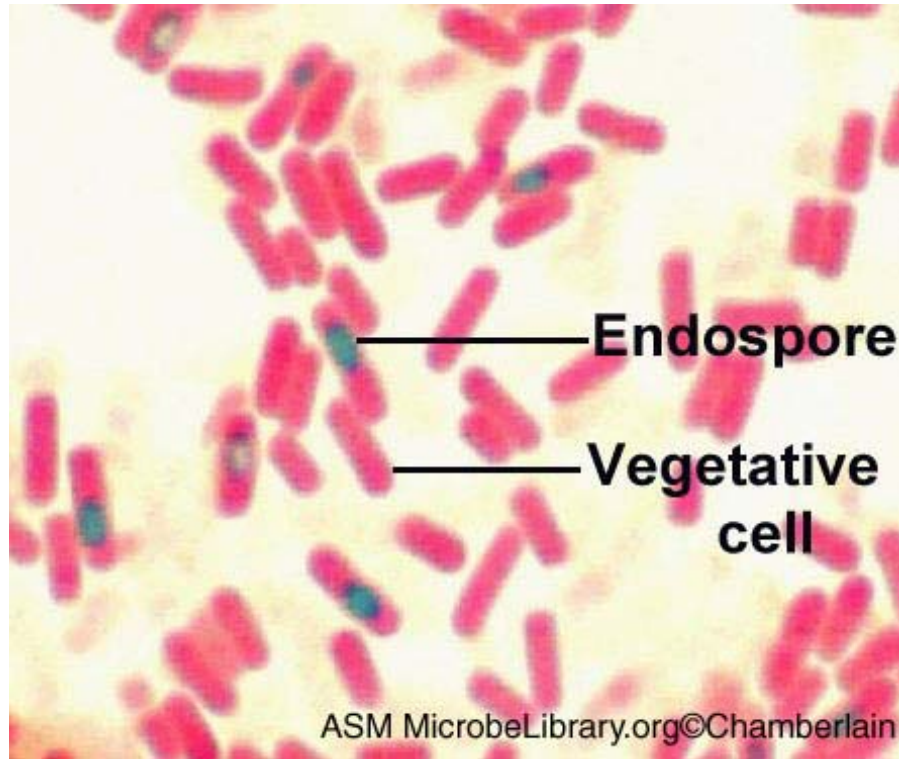


Vibrio

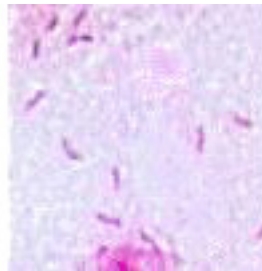
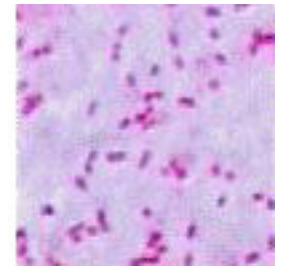


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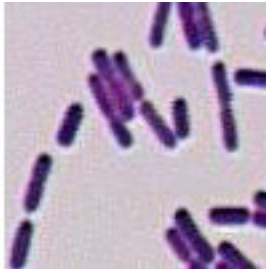
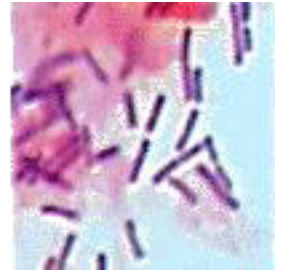
Rods: Spore Formers



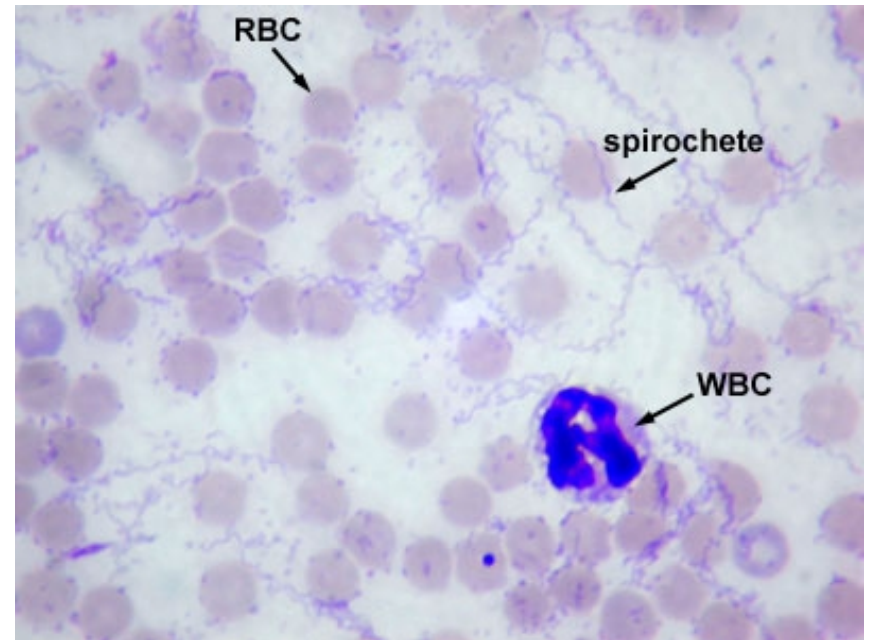
Gram Negative Rod Summary



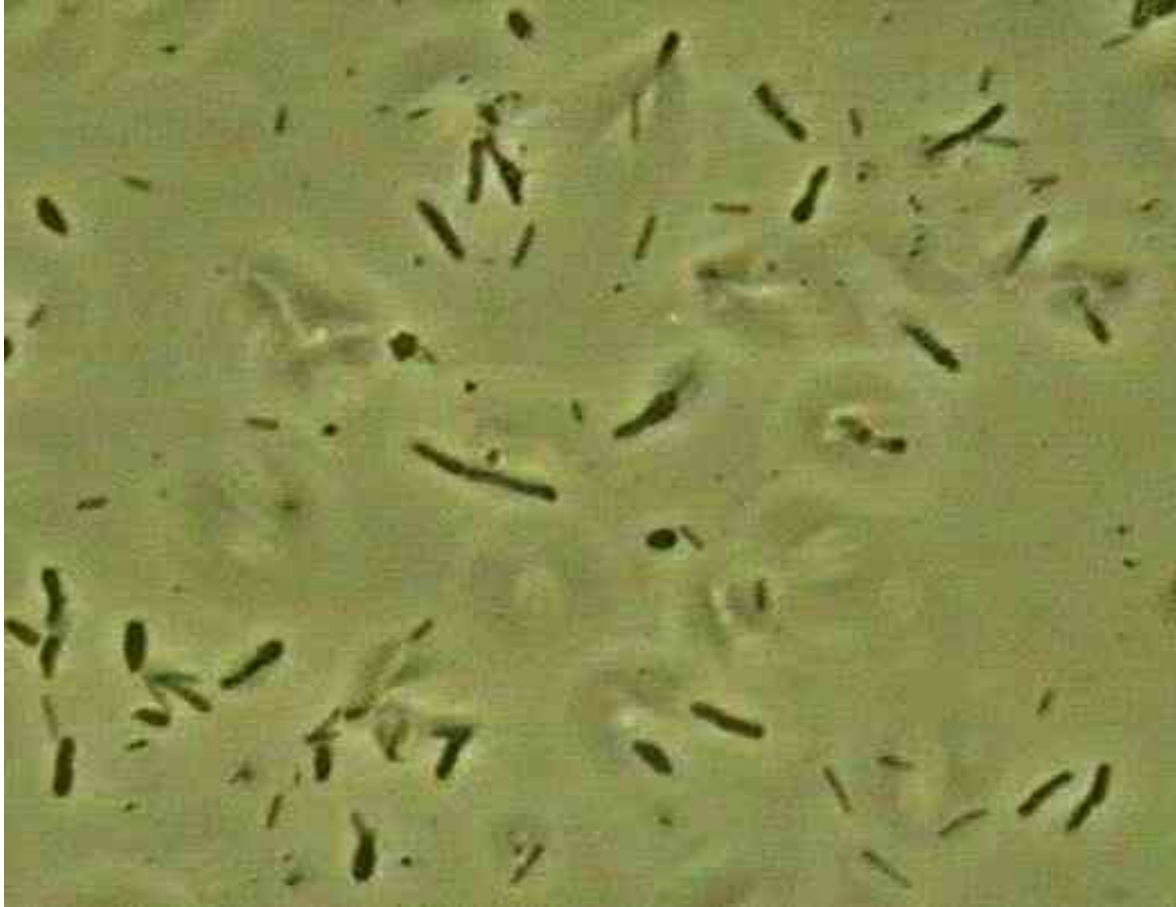
Gram Positive Rod Summary



Spiral Forms

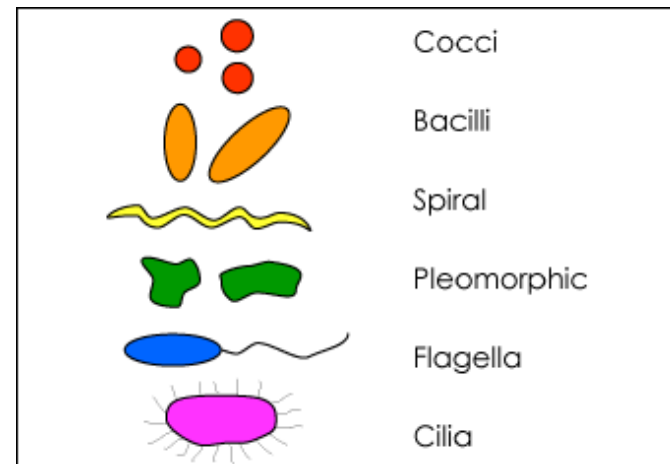
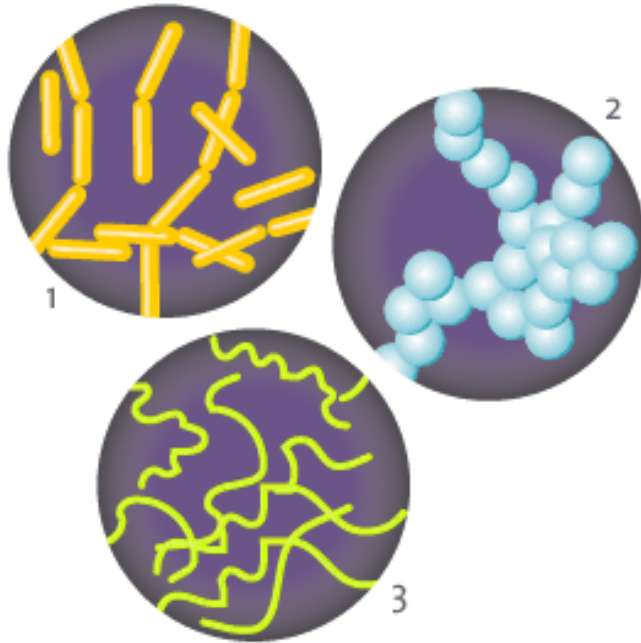


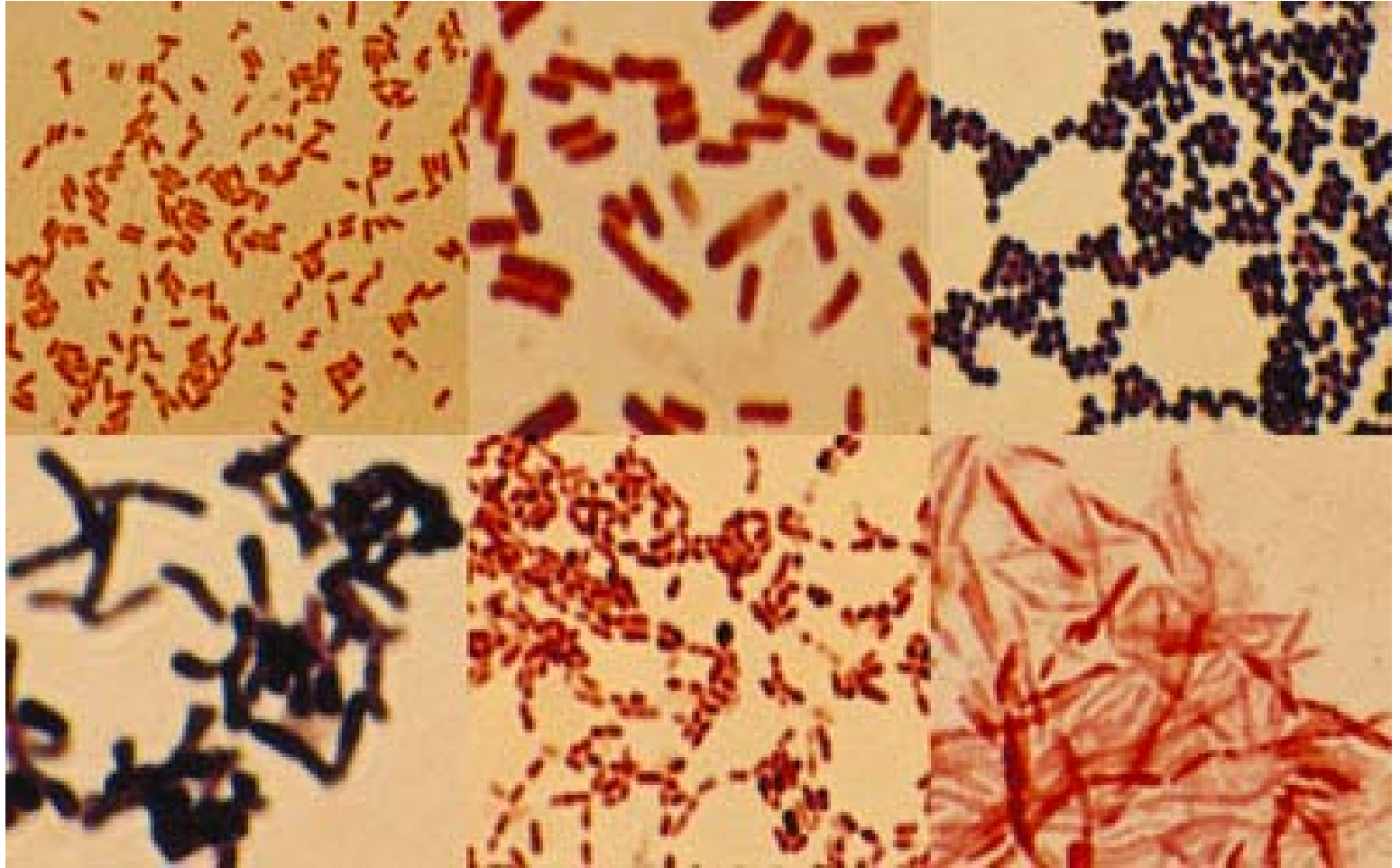
Pleomorphic



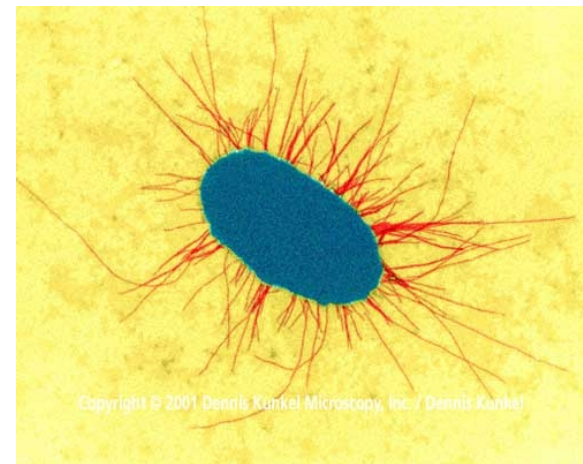
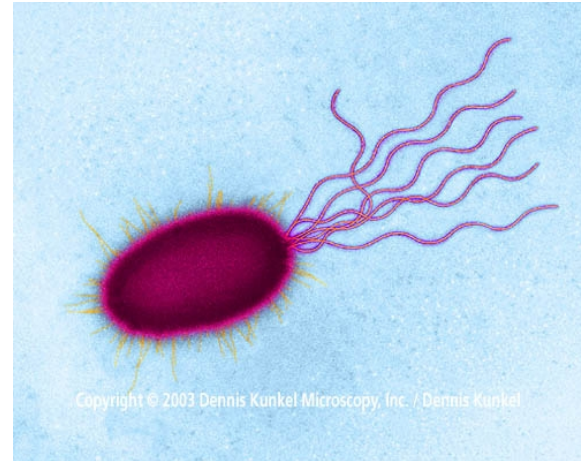
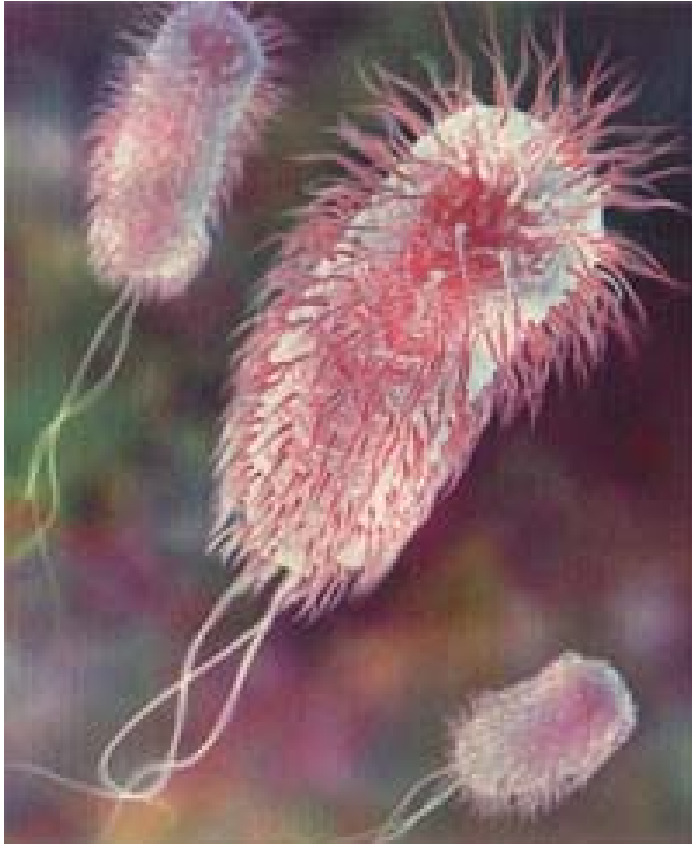
Bacterial Shapes Review

Bacteria





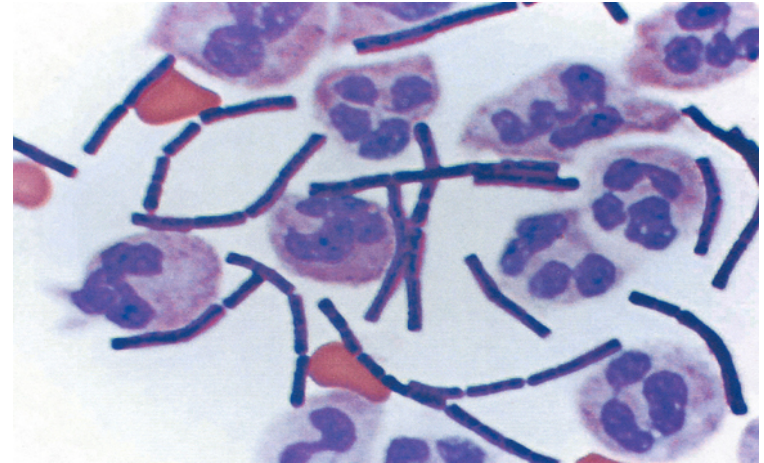
Motility



Low G+C Gram Positive Organisms

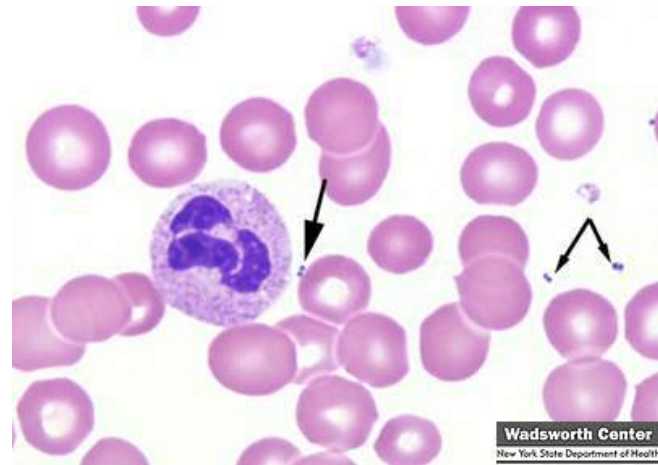
■ Rods

- Clostridia
- Mycoplasmas
- Bacillus
- Listeria
- Lactobacillus



■ Cocci

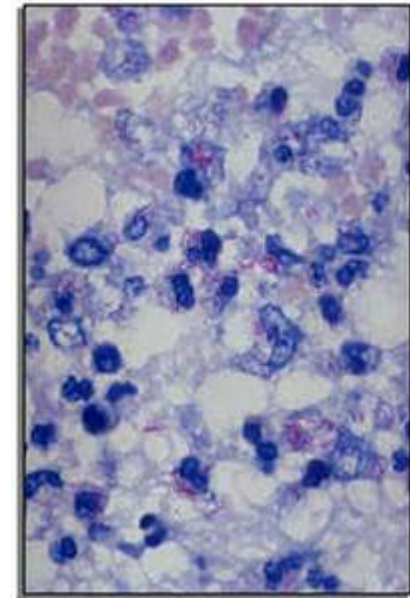
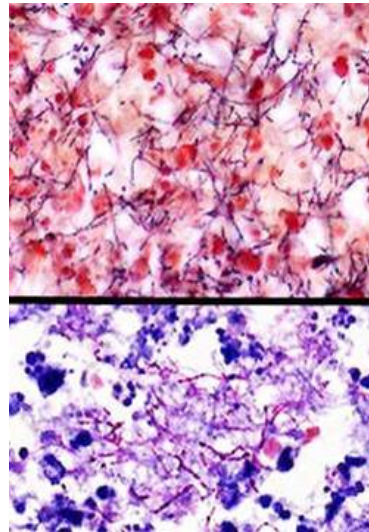
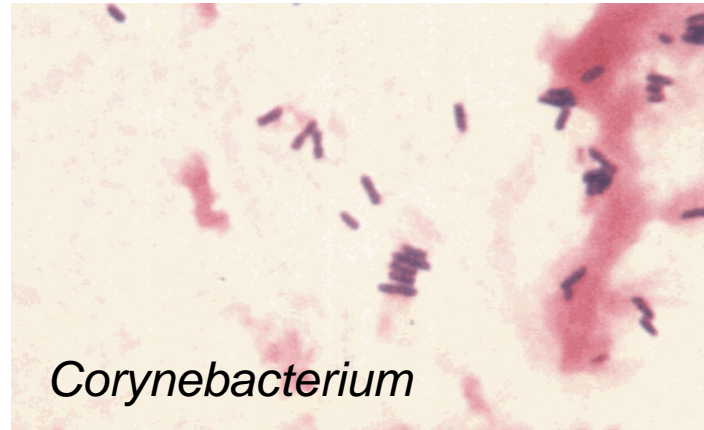
- Streptococcus
- Enterococcus
- Staphylococcus



High G+C Gram Positives

- Rods

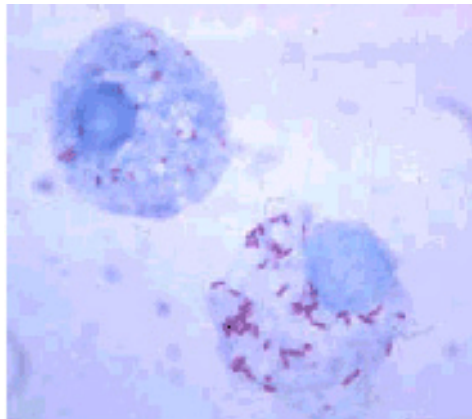
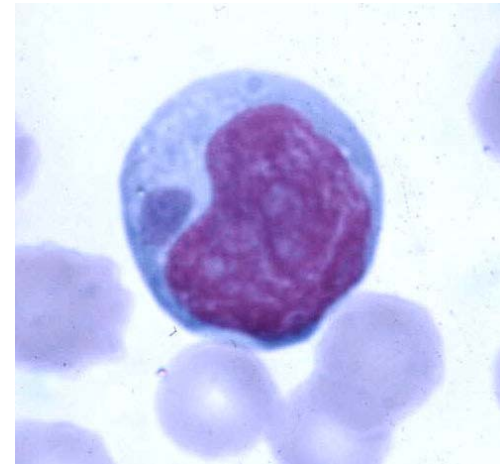
- Corynebacterium
- Mycobacterium
- Actinomycetes
 - Actinomyces
 - Nocardia
 - Streptomyces



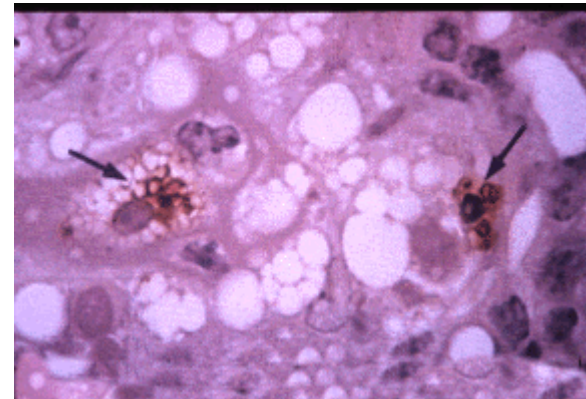
Gram Negative Alpha Proteobacteria

- Pathogenic
 - Rickettsia
 - Brucella
 - Ehrlichia

Ehrlichia

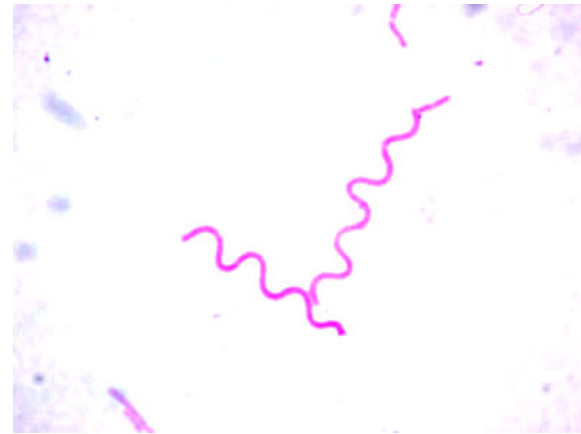
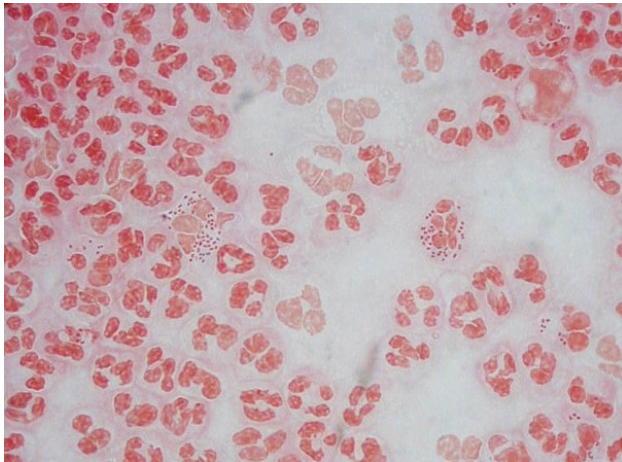
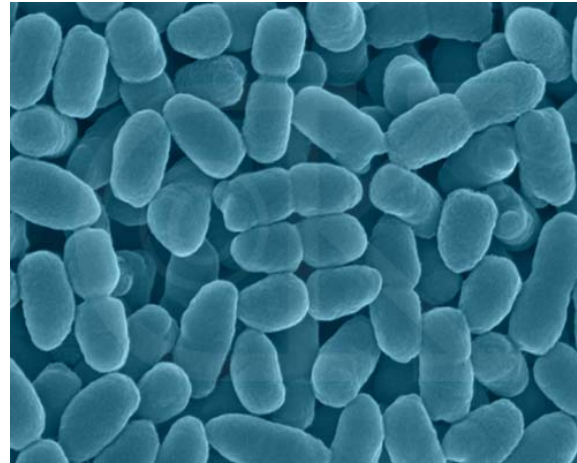


Gimenez stain of tick hemolymph cells infected with *R. rickettsii* CDC



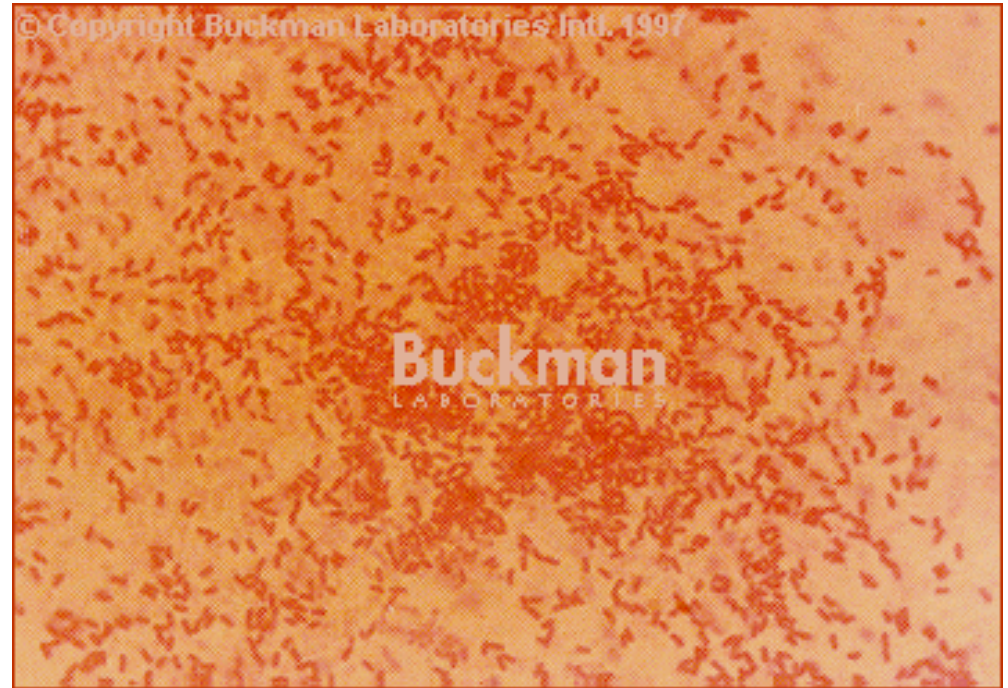
Gram Negative Beta Proteobacteria

- Pathogenic
 - Neisseria
 - Bordetella
 - Spirillum
 - Burkholderia



Gram Negative Gamma Proteobacteria

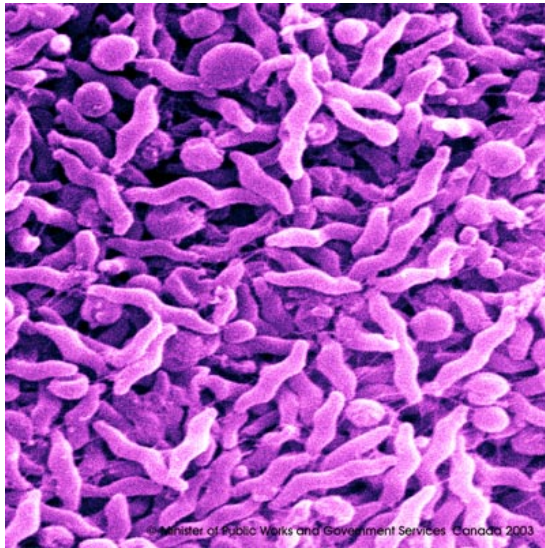
- Pathogenic
 - Legionella
 - Coxiella
 - Pseudomonads
 - Enterobacteriaceae
 - E. coli
 - Salmonella
 - Shigella
 - Proteus
 - Yersinia
 - Enterobacter
 - Serratia



Pseudomonas

Gram Negative Epsilon Proteobacteria

- Pathogenic
 - Campylobacter
 - Helicobacter



Helicobacter

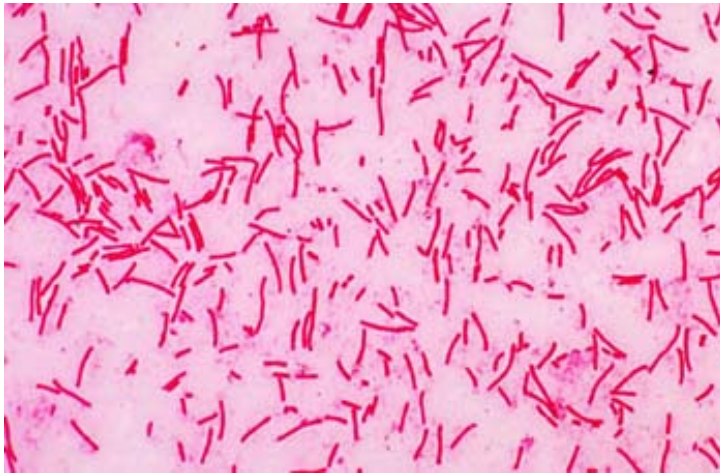


Campylobacter

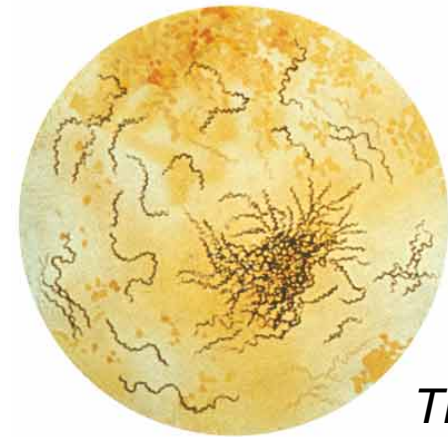
Other Bacteria

- Pathogenic
 - Chlamydia
 - Spirochetes
 - Treponema [syphilis]
 - Borrelia [Lyme ds]

Chlamydia



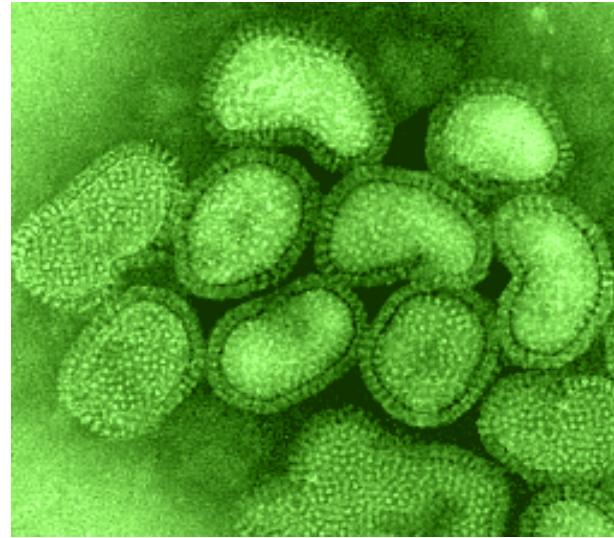
Borrelia



Treponema

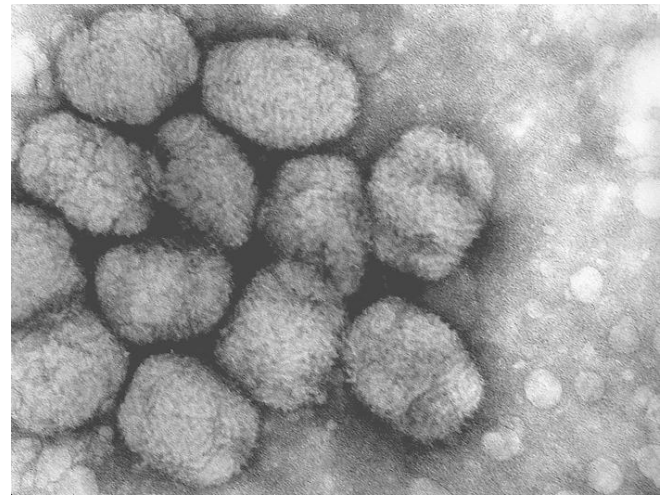
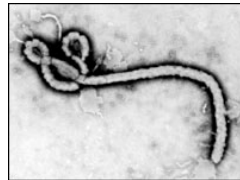
Virus

- Acellular
- Nucleic acid core
- Protein coat
- Envelope [+/-]



- Modifications

- Viroids: RNA virus
- Virions : outside host
- Prions: proteins



Microbes and the Immune System

