General Microbiology
2020-2021

Orientation to Gram Negative Bacteria of Medical Importance

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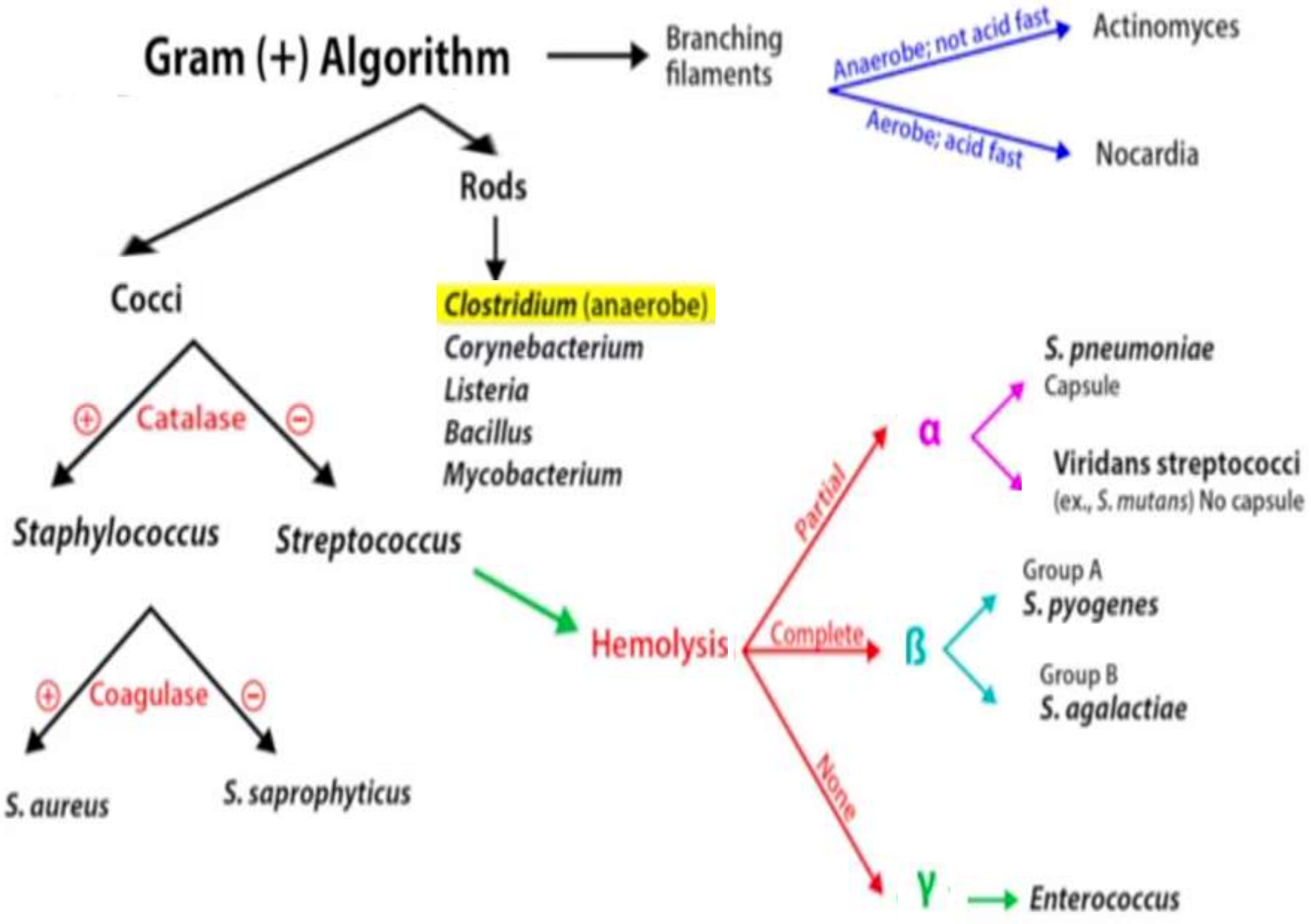

Gram (+) Algorithm
Branching filaments
Anaerobe; not acid fast
Actinomyces
Aerobe; acid fast
Nocardia
Rods
Cocci
Clostridium (anaerobe)
Corynebacterium
Listeria
Bacillus
Mycobacterium
Catalase
Staphylococcus
Streptococcus
Coagulase
S. aureus
S. saprophyticus
Hemolysis
Partial
α
S. pneumoniae
Capsule
Viridans streptococci
(ex., S. mutans) No capsule
Complete
β
Group A
S. pyogenes
Group B
S. agalactiae
None
γ
Enterococcus

Medically Important Gram-Positive Cocci

Gram Positive

Gram Positive Bacilli

- **Bacillus** :
  - anthracis (anthrax)
  - cereus
- **Clostridium**:
  - botulinum
  - difficile
  - perfringens
  - tetani
- **Non-spore forming**
  - Listeria monocytogenes
  - Corynebacterium diphtheriae
  - Mycobacterium

Gram Positive cocci

- **Staphylococcus aureus**
- **Streptococcus** :
  - Group A: pyogenes
  - Group B: agalactiae
- **pneumoniae (diplococci)**

Medically Important Gram-Negative Bacteria

Gram-Negative Bacteria

Diplococci

Neisseria gonorrhoeae
Neisseria meningitidis

Coccoid Rods

Bordetella pertussis
Haemophilus influenzae
Brucella

Rods

Enterobacteriaceae

Shigella
Escherichia coli
Salmonella
Yersinia entercolitica
Klebsiella
Proteus
Citrobactor
Serratia
Pseudomonas
Enterobacter

Medically Important Gram-Negative Bacteria

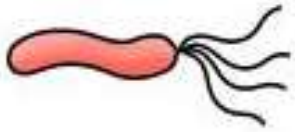
Gram-Negative Bacteria

Comma Shaped

Vibrio cholera

Spirillum

Helicobacter pylori



Campylobacter jejuni

Spirochetes

Treponema

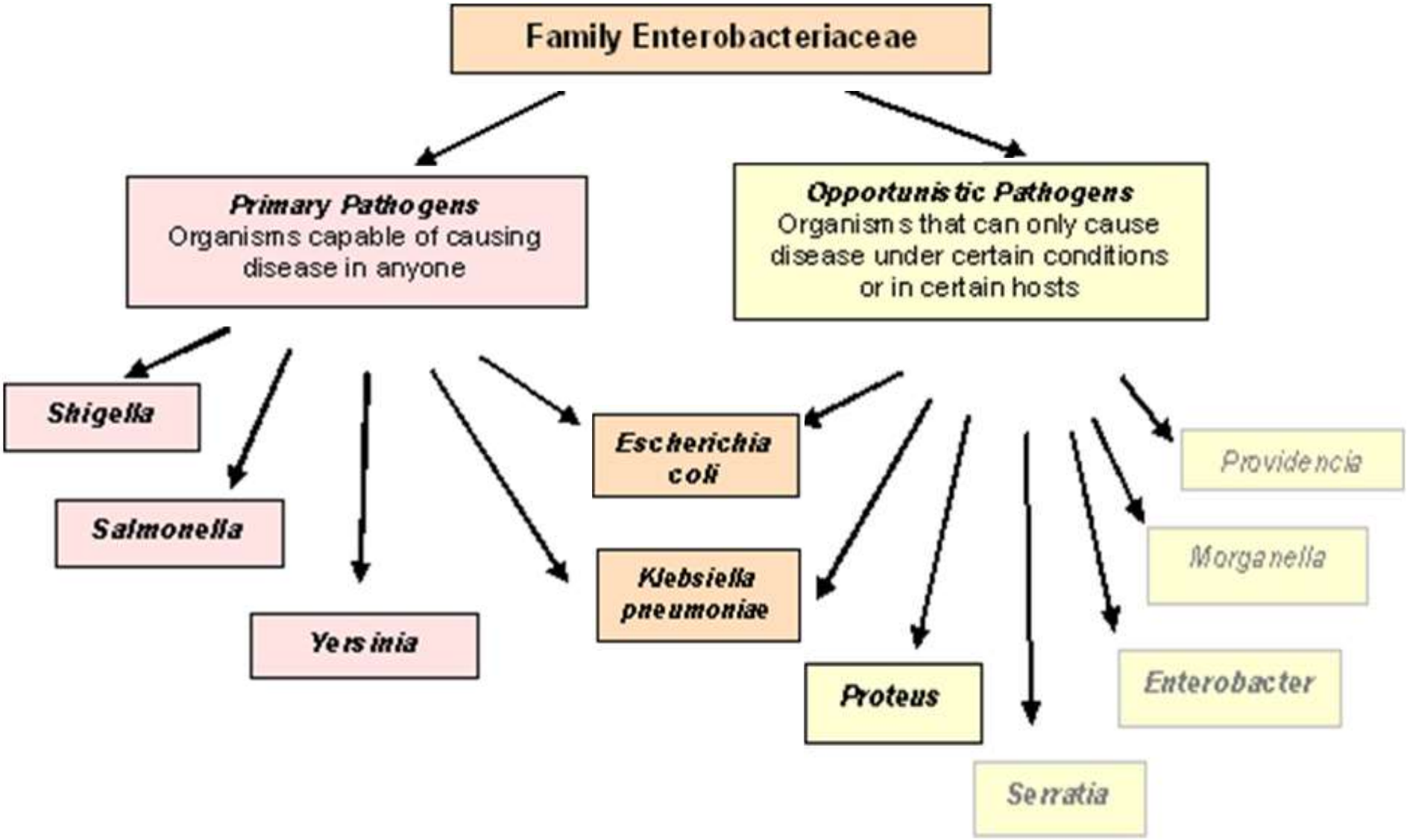
Obligate intracellular

Chlamydia

Rickettsia

Coxiella

Enterobacteriaceae and disease



Enterobacteriaceae

- **Ubiquious (they are everywhere)** - soil, water, vegetation, normal intestinal flora
  - ~40 genera, 150 species
- Members of family commonly associated with human disease:
  - ***Escherichia***
  - ***Salmonella***
  - ***Shigella***
  - ***Yersinia***
  - ***Klebsiella***
  - ***Serratia***
  - ***Proteus***

Common" organisms associated with enteric infections

	I	II	III
Mechanism:	**Non-inflammatory** (enterotoxin)	**Inflammatory** (invasive, cytotoxin)	**Penetrating** (invasive, spread)
Location:	proximal small bowel	colon	distal small bowel
Illness:	**Diarrhea**	**Dysentery**	**Enteric fever**
Stool exam:	no fecal leukocytes	blood, fecal leukocytosis	Fecal leukocytosis
Example organisms:	*V. cholerae* ***E. coli*** *Campylobacter*	***Shigella*** **Invasive *E. coli*** ***S. enteritidis***	***S. typhi*** ***Y. enterocolitica***

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Shigella

- Shigella a Highly Infectious Bacteria.
- Shigella is one of the most infectious of bacteria and ingestion of as few as 100- 200 organisms will cause disease.
- Most individuals are infected with shigella when they ingest food or water contaminated with human fecal material.
- Outbreaks of Shigella infection are common in places where sanitation is poor.
- Shigella can survive up to 30 days in milk, eggs, cheese

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Pseudomonads

- Gram-negative, aerobic bacilli.
- Ubiquitous in soil, decaying organic matter, and almost every moist environment.
- Problematic in hospitals because they can be found in numerous locations.
- Opportunistic pathogens.

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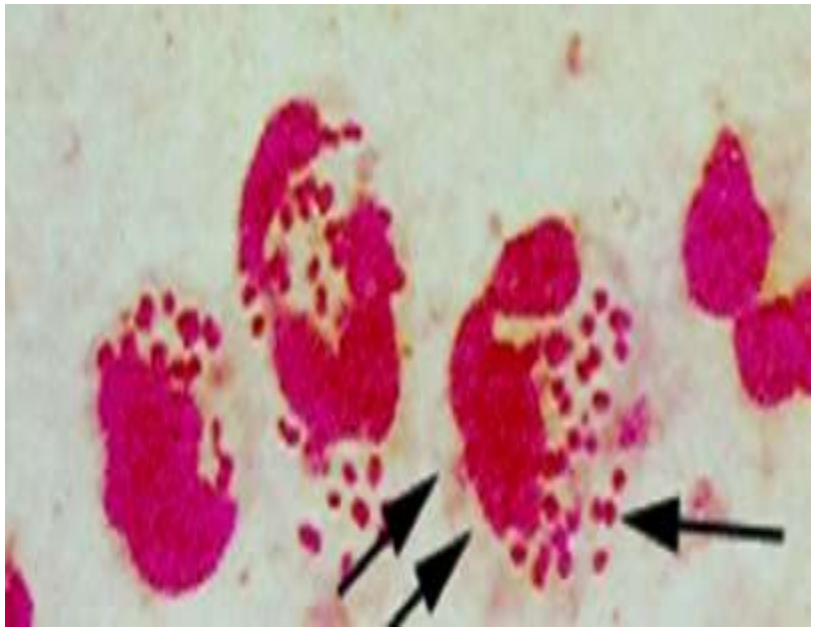
Neisseria

- Gram-negative intracellular diplococcus
- Two major pathogenic species
  - ***N. gonorrheae:***
    - associated with Sexually Transmitted Diseases (STDs).
  - ***N. meningitidis:***
    - associated with respiratory and CNS infections.



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Haemophilus influenzae

Haemophilus: Blood –Loving Bacilli

- Fastidious: require some chemicals from blood for their metabolism
- *H. influenzae*: bacterial meningitis: children 3 months to 5 years: antibiotic, vaccine

Haemophilus influenzae

- Most strains have a polysaccharide capsule that resists phagocytosis.
- Colonize the mucous membranes of humans and some animals.
- *H.influenzae* type b is the most significant
  - Was the most common form of meningitis in infants prior to the use of an effective vaccine
  - Use of the Hib vaccine has eliminated much of the disease caused by *H.influenzae* b

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Bordetella

- Small, aerobic, nonmotile coccobacillus
- *B. pertussis:*
  - Causes pertussis, also called whopping cough.
  - Most cases of disease are in children.
  - Bacteria are first inhaled in aerosols and multiply in epithelial cells.
  - Then progress through three stages of disease.

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Brucella

- Causes Brucellosis in man following ingestion of contaminated milk or cheese from goats and cows.
- Clinical manifestations range from subclinical, to chronic with low grade symptoms of low fever and muscular stiffness, to acute with fever and chills.

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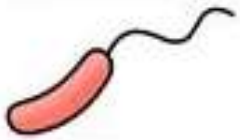
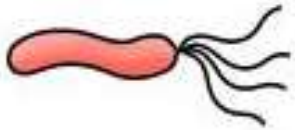
Vibrio cholera



Spirillum

Helicobacter pylori



Campylobacter jejuni

Spiochetes

Treponema

Obligate intracellular

Chlamydia

Rickettsia

Coxiella

Vibrio

- Members of this genus share many characteristics with enteric bacteria such as *Escherichia* and *Salmonella.*
- *Vibrio cholerae* is the most common species to infect humans:
  - Causes cholera.
  - Humans become infected with *V. cholerae* by ingesting contaminated food and water.
  - Found most often in communities with poor sewage and water treatment.

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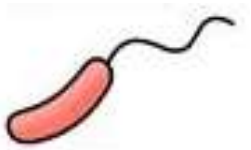

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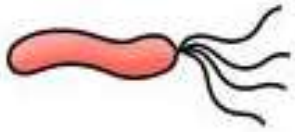

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Helicobacter pylori

- Slightly helical, highly motile bacterium that colonizes the stomach of its hosts.
- Causes most (if not all) peptic ulcers.
- *H.pylori* produces numerous virulence factors that enable it to colonize the stomach.
- Coffee drinking, smoking, and drinking alcohol increase your risk for an ulcer.
- Simple blood, breath, and stool tests can determine if you are infected with H. pylori.
- The most accurate way to diagnose is through upper endoscopy.

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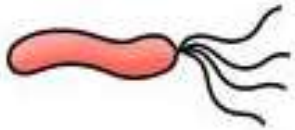

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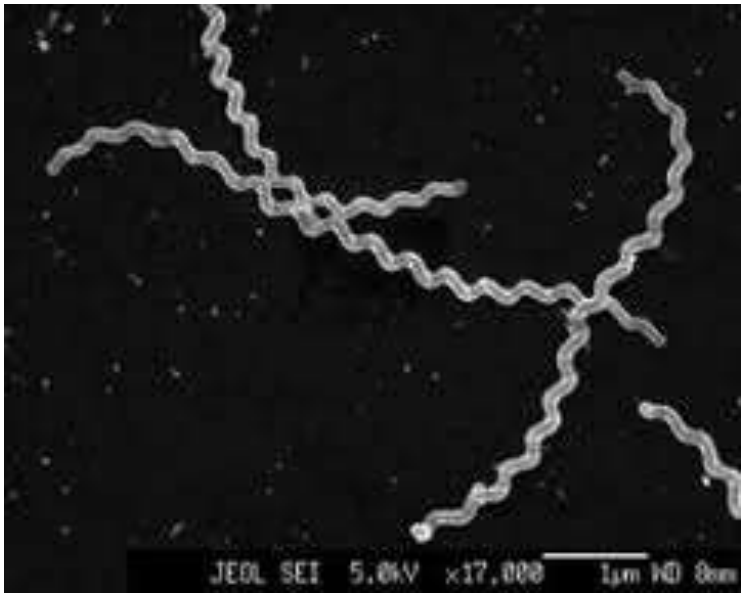
Spirochetes

- Thin, tightly coiled, helically shaped bacteria
- Moves in a corkscrew fashion through its environment
  - This movement is thought to enable pathogenic spirochetes to burrow through their hosts' tissues
- 3 genera cause human disease
  - *Treponema*, *Borrelia*, and *Leptospira*



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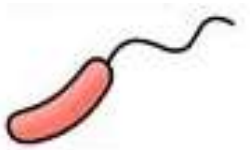

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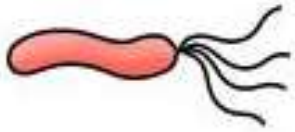

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Chlamydia

- Grow and multiply only within the vesicles of host cells
- Causes two main types of disease
  - Sexually transmitted diseases:
    - Causes the most common sexually transmitted disease in the United States.
  - Ocular disease called trachoma:
    - Occur particularly in children.
    - Endemic in crowded, poor communities with poor hygiene, inadequate sanitation, and inferior medical care

Rickettsias

- Extremely small (not much bigger than a smallpox virus)
- Obligate intracellular parasites
  - Unusual because they have functional genes for protein synthesis, ATP production, and reproduction
- *Rickettsia* causes disease in humans.

Legionella pneumophila

- Aerobic, Gram negative bacilli.
- Universal inhabitants of water.
- Humans acquire the disease by inhaling the bacteria in aerosols from various water sources.
- Causes Legionnaires' disease
  - Results in pneumonia
  - Immunocompromised individuals are more susceptible