

General Microbiology

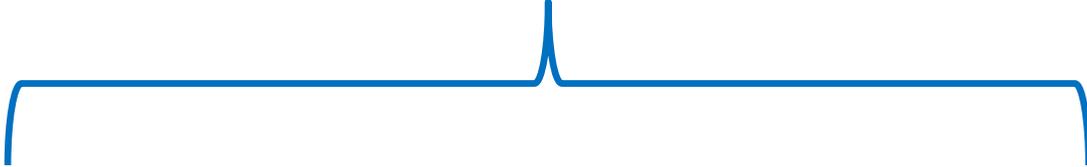
2023-2022

Orientation to Gram Negative Bacteria of Medical Importance

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Department of Microbiology and Pathology
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Medically Important Gram-Positive Cocci

Gram Positive



Gram Positive Bacilli

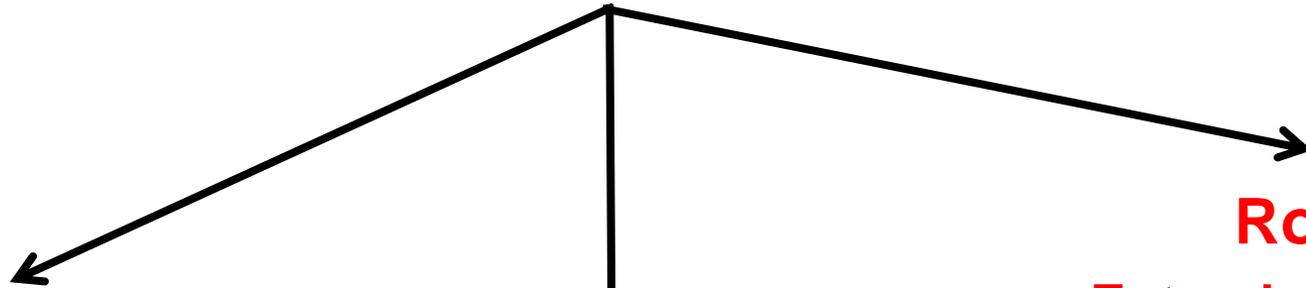
- **Bacillus** :
 - anthracis (anthrax)
 - cereus
- **Clostridium**:
 - botulinum
 - difficile
 - perfringens
 - tetani
- **Non-spore forming**
 - *Listeria monocytogenes*
 - *Corynebacterium diphtheriae*
 - *Mycobacterium*

Gram Positive cocci

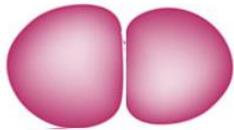
- **Staphylococcus aureus**
- **Streptococcus** :
 - Group A: *pyogenes*
 - Group B: *agalactiae*
- **pneumoniae (diplococci)**

Medically Important Gram-Negative Bacteria

Gram-Negative Bacteria



Diplococci



Neisseria gonorrhoeae
Neisseria meningitidis

Coccoid Rods



Bordetella pertussis
Haemophilus influenzae
Brucella

Rods

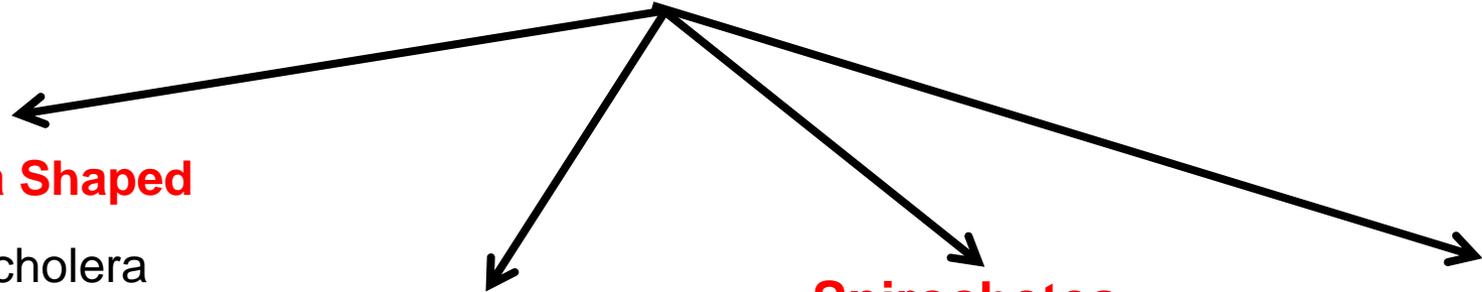
Enterobacteriaceae



Shigella
Escherichia coli
Salmonella
Yersinia enterocolitica
Klebsiella
Proteus
Citrobacter
Serratia
Pseudomonas
Enterobacter

Medically Important Gram-Negative Bacteria

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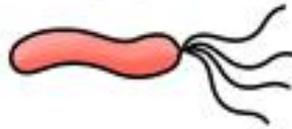
Comma Shaped

Vibrio cholera



Spirillum

Helicobacter pylori



Campylobacter jejuni



Spirochetes

Treponema



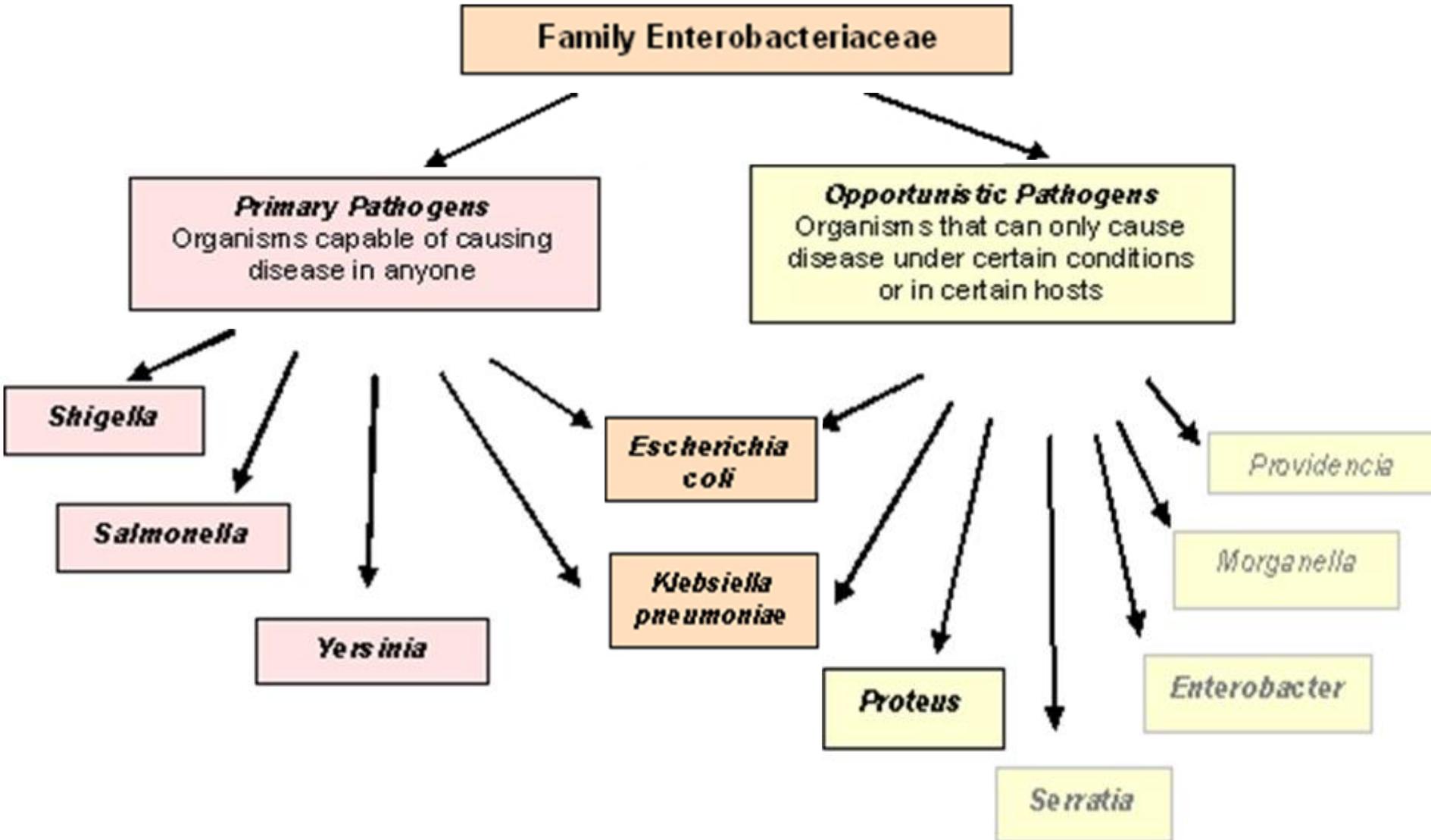
Obligate intracellular

Chlamydia

Rickettsia

Coxiella

Enterobacteriaceae and disease



Enterobacteriaceae

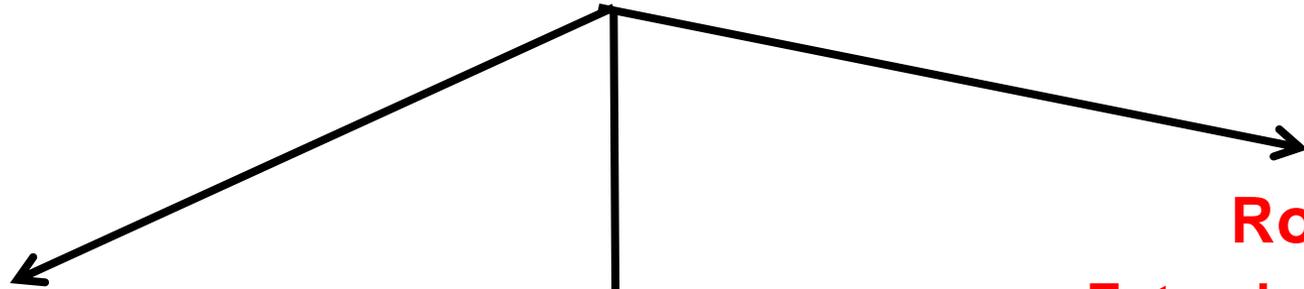
- **Ubiquitous (they are everywhere)** - soil, water, vegetation, normal intestinal flora
 - ~40 genera, 150 species
- Members of family commonly associated with human disease:
 - *Escherichia*
 - *Salmonella*
 - *Shigella*
 - *Yersinia*
 - *Klebsiella*
 - *Serratia*
 - *Proteus*

Common” organisms associated with enteric infections

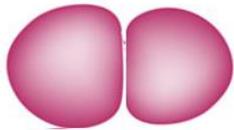
	I	II	III
Mechanism:	Non-inflammatory (<i>enterotoxin</i>)	Inflammatory (<i>invasive, cytotoxin</i>)	Penetrating (<i>invasive, spread</i>)
Location:	<i>proximal small bowel</i>	<i>colon</i>	<i>distal small bowel</i>
Illness:	Diarrhea	Dysentery	Enteric fever
Stool exam:	<i>no fecal leukocytes</i>	<i>blood,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

Medically Important Gram-Negative Bacteria

Gram-Negative Bacteria



Diplococci



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Enterobacteriaceae



Shigella

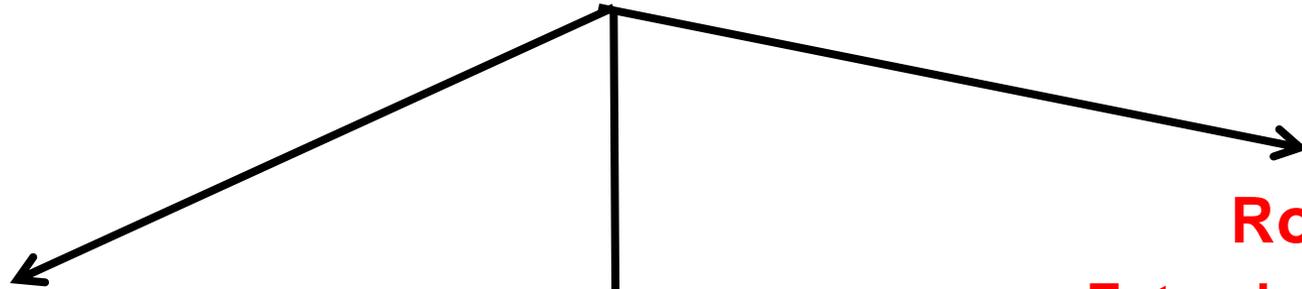
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Shigella

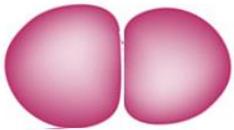
- Shigella a Highly Infectious Bacteria.
- Shigella is one of the most infectious of bacteria and ingestion of as few as 100- 200 organisms will cause disease.
- Most individuals are infected with shigella when they ingest food or water contaminated with **human fecal material.**
- Outbreaks of Shigella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

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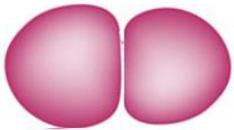
Pseudomonads

- 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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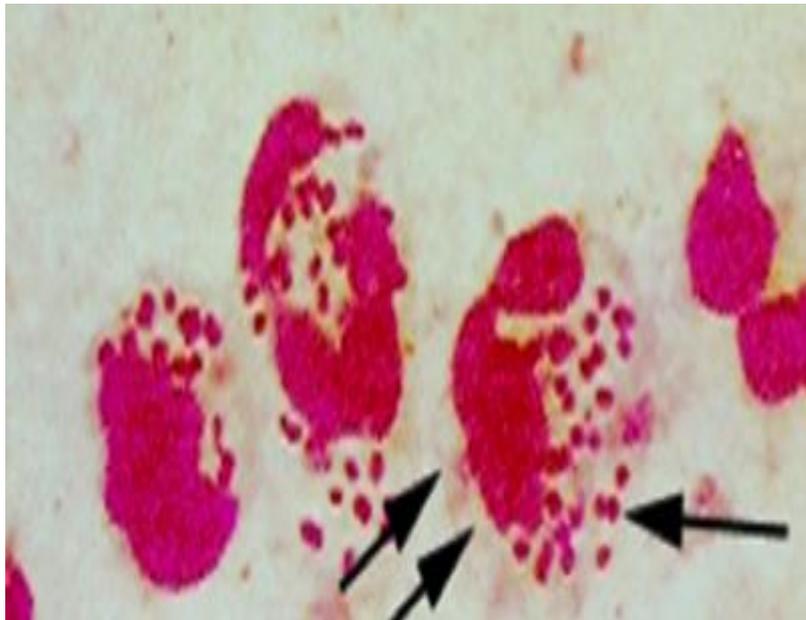
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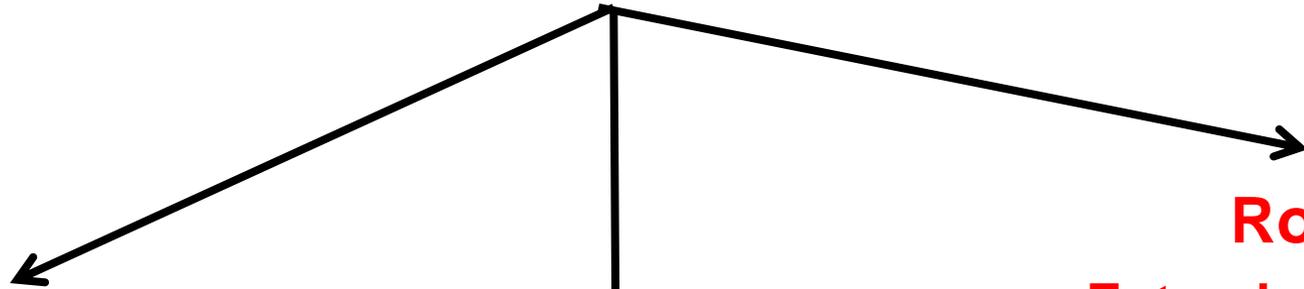
Neisseria

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

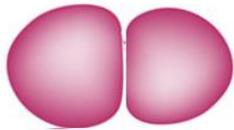


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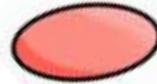


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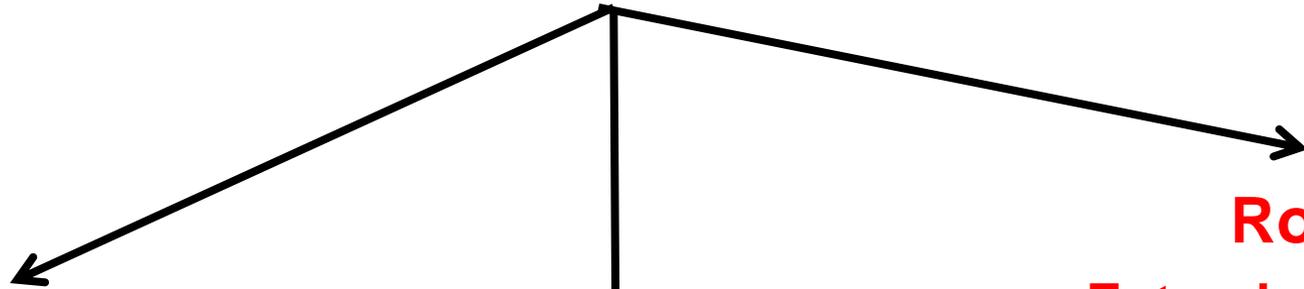
Haemophilus influenzae

Haemophilus: Blood –Loving Bacilli

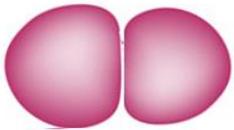
- Fastidious: require some chemicals from blood for their metabolism
- *H. influenzae*: bacterial meningitis: children 3 months to 5 years: antibiotic, vaccine.
- Most strains have a polysaccharide capsule that resists phagocytosis.
- Colonize the mucous membranes of humans and some animals.
- *H. influenzae* 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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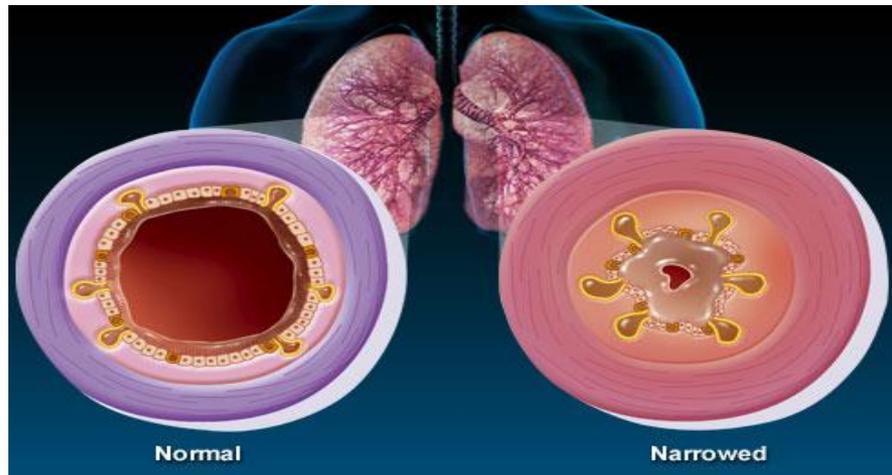
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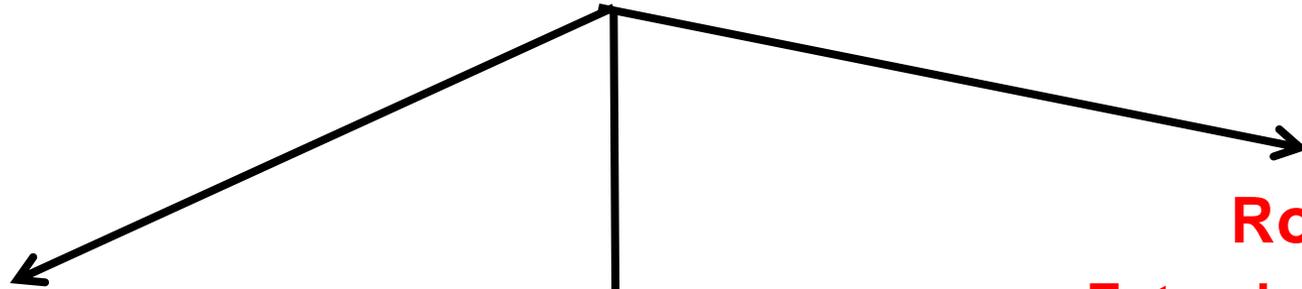
Bordetella

- Small, aerobic, nonmotile coccobacillus
- *B. pertussis*:
 - Causes pertussis, also called whooping cough.
 - Most cases of disease are in children.
 - Bacteria are first inhaled in aerosols and multiply in epithelial cells.
 - a build-up of thick mucus – which causes the intense attacks of coughing as your body tries to expel it
 - swollen airways – which makes breathing more difficult and causing the "whoop" sound as you gasp for breath after coughing

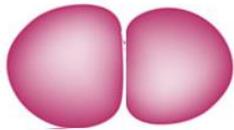


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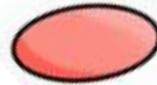


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Brucella

- 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



Spirochetes

Treponema



Obligate intracellular

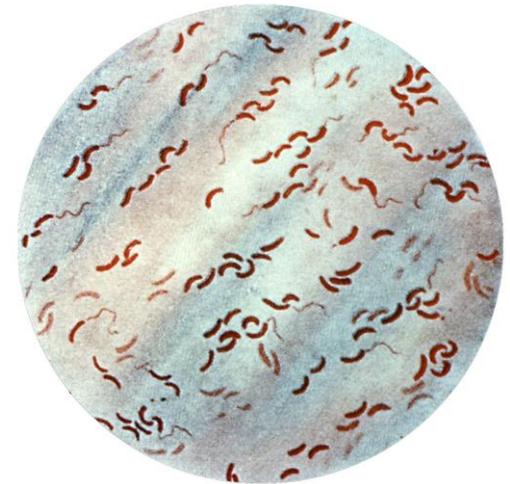
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Rickettsia

Coxiella

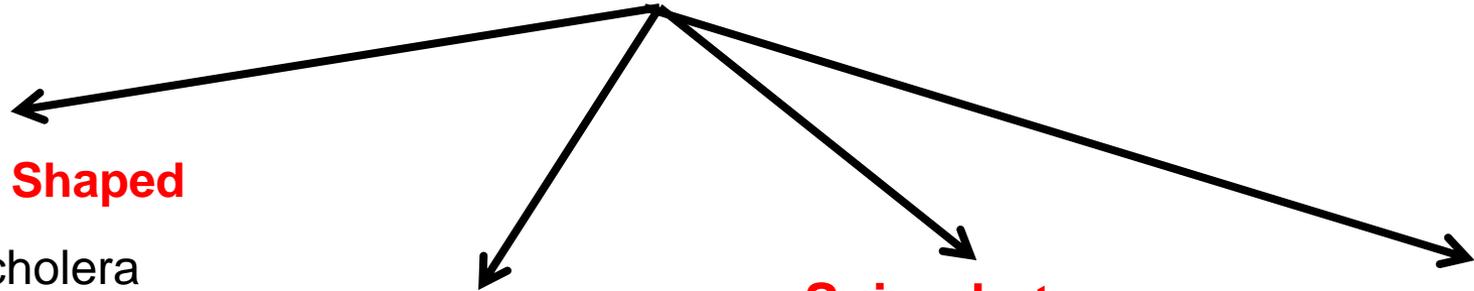
Vibrio

- *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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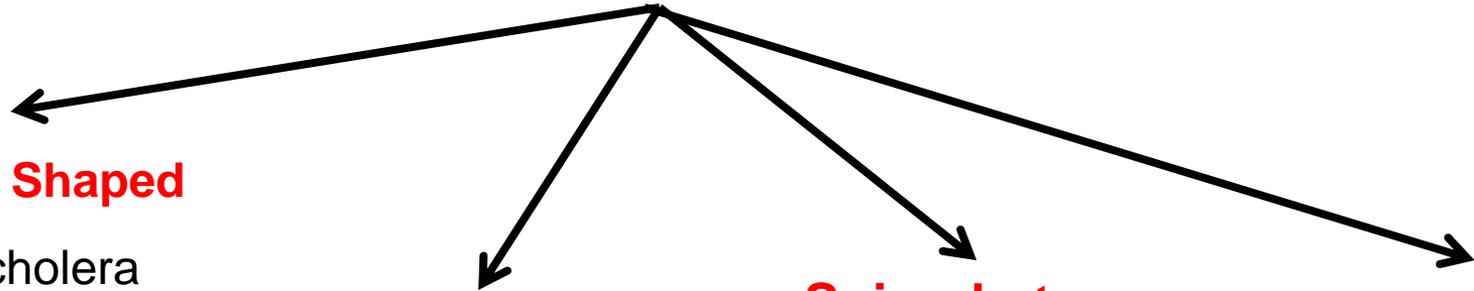
Coxiella

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.

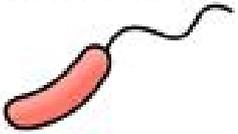
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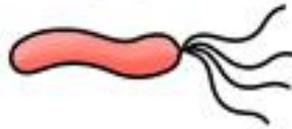
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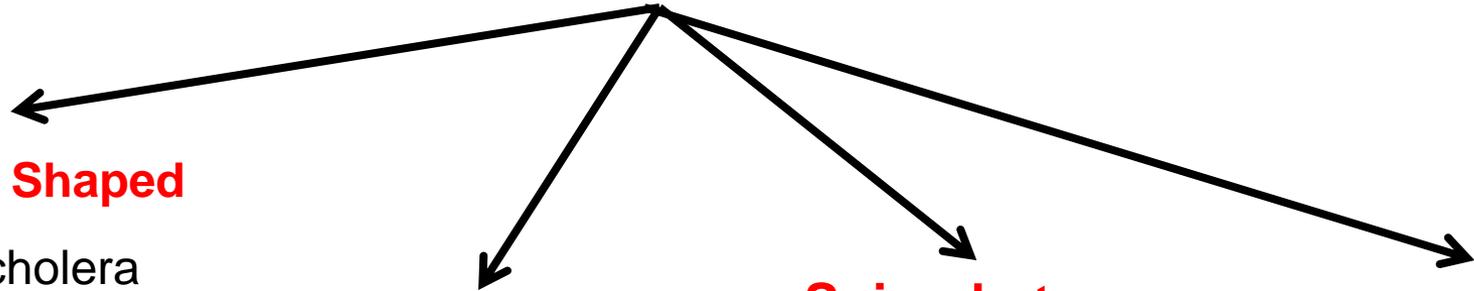
Spirochetes

- 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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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