The vibrios

- Gram negative curved bacilli, motile [has a polar flagellum], **aquatic bacteria,** present in *salty water* [sea water] and food inside it
- **Halotolerant** [can tolerate a certain concentration of NaCl], some of them are **halophilic** [require NaCl for their growth like **V parahaemolyticus**]
- **V cholerae**

1- **O1** [biotypes: El tor, Classical. Serotypes: Inaba, Ogawa, Hikojima] **and O139** cause cholera epidemics and pandemics in humans

2- **non-O1 and non-O139** cause cholera-like disease, mild gastroenteritis

- **V parahaemolyticus** is the most common cause of *Sea-foodborne* gastroenteritis in Asia
- **V vulnificus "wound maker"** cause wound infection and sepsis
- Route of transmission is **feco-oral**
- **they tolerate alkaline pH** → we put them in peptone alkaline water [pH 8-9] that will favor the growth of vibrio and inhibit the growth of other bacteria
- **They are acid sensitive** and can be killed by the acidity of the stomach → need a large inoculum to establish infection and **that depends on**: if you ingest it with water => need very large inoculum. If you ingest it with food / take drugs like PPIs / suffer from disease like achlorhydria => reduce the inoculum needed to establish infection
- Vibrios grow well on **thiosulfate-citrate-bile-sucrose (TCBS) agar [selective agar]** and produce yellow colonies (sucrose fermented)
- To differentiate V cholerae from other Enterobacteriaceae => **V cholerae is oxidase positive**

- To differentiate it from Aeromonas => 1- **V cholerae is sensitive to the compound O/129,** while Aeromonas are resistance to it
  2- **most vibrios are halotolerant, some vibrios are halophilic**, while Aeromonas live in fresh water

- V cholerae O group 1 doesn't make capsule, O group 139 makes capsule

Vibrio cholerae Enterotoxin

- Consists of 1 subunit A and 5 subunit B

- **Subunit B** => for binding to receptor on enterocytes [ganglioside] / **subunit A** => internalized, affect G stimulatory proteins to increase cAMP and result in prolonged hypersecretion of water and electrolytes

Pathogenesis

- **The toxin-coregulated pilus (TCP),** so named because its synthesis is regulated in parallel with that of cholera toxin, is essential for V. cholerae to survive and multiply in (colonize) the small intestine

Clinical Findings

-The burden of disease is often greatest during "**cholera seasons**" associated with **high temperatures, heavy rainfall**, and flooding, but cholera can occur year-round

- V cholerae causes the most dramatic diarrhea, fluid loss is very high [1liter/h] causing dehydration, metabolic acidosis, hypokalemia, cardiac arrhythmia, sudden death.
- **rice water** diarrhea contains mucus, epithelial cells and large numbers of vibrios

-the mortality rate without treatment reaches up to 50%

infection doesn't always mean disease, there is **Infection: disease ratio**.
It is a multifactorial process, it depends on the bacteria, the serogroup, the antigen, the toxin and the host factors like the immunity…
The infection: disease ratio with cholera is 5% that means **only 5% who are infected with vibrio will develop the disease.**

Diagnostic Laboratory Tests

- The diagnosis of a full blown case of cholera presents no problem in the presence of an epidemic.
- However, **sporadic or mild cases are not readily differentiated from other diarrheal diseases**.
- The El Tor biotype tends to cause milder disease than the classic biotype.
- Specimens+ culture: alkaline peptone water → TCBS agar
- V cholerae organisms are further identified by slide agglutination tests using anti-O group 1 or group 139 antisera and by biochemical reaction patterns.

Treatment

- **Aggressive** water and electrolytes replacement
- Antibacterial agents [secondary role]: **tetracyclines and doxycycline**
- <u>For children and pregnant women</u>: **erythromycin**

Prevention

- Improvement of sanitation especially with water and food, the patient should be isolated…
- Oral inactivated/ heat-killed **vaccines** <u>*have very limited protection*</u>:

1- **WC-rBS [Sweden]** -> V cholerae O1 / has toxin B subunit 2- **BivWC [India]** -> V cholerae O1 + O139 / without toxin B subunit

- **Vaxchora** vaccine is a live attenuated vaccine -> V cholera O1 Inaba serotype

Campylobacter

- Gram negative bacilli, with comma, S, or "**gull wing**" shapes. They have a polar flagellum "**darting motility** (quick movement)"
- They grow well at **42°C** under microaerophilic conditions. They are facultative anaerobes [with reduced O2 (**5% O2**) with added CO2 (**10% CO2**)].
- incubation at 42°C **prevents growth of most of the other bacteria present in feces**, thus simplifying the identification of Campylobacter
- One of the differential diagnosis of invasive bacteria [**bloody diarrhea**]
- **commonest cause of bacterial enteritis in developed world**
- Reservoir: animals especially poultry and dietary products
- Infection: disease ratio falls with age == the older the person gets, the less common to develop campylobacter disease
- **Campylobacter fetus and venerealis** – extraintestinal/ systemic infections [common in immunocompromised patients]
- **Helicobacter cinaedi, and Helicobacter fennelliae** – intestinal bacteria
- **Campylobacter lari** -- mostly isolated from seagulls
- **Campylobacter upsaliensis** -- mostly isolated from dogs
- **C jejuni and C coli** cause infections that are clinically indistinguishable

Pathogenesis

- They produce enterotoxin and cytolethal distending toxin [secondary role]
- The main pathogenesis: invasion of the mucosa and submucosa

- trigger **Reiter's syndrome** (reactive arthritis with conjunctivitis, polyarthritis and urethritis)
- They are also associated with **Guillain-Barre syndrome**, acute demyelinating disease, form of ascending paralytic disease, because of developing antibodies against neuronal epitopes after Campylobacter infection [appears after 1 month]

Clinical Findings

- Incubation period: less than a week
- Low-grade fever, abdominal pain, cramps, nausea, vomiting, **bloody diarrhea**
- Self- limited to a period of 5-8 days
- Local suppurative complications of infection include cholecystitis, pancreatitis, and cystitis; distant complications include meningitis, endocarditis, arthritis, peritonitis, cellulitis, and septic abortion. All these complications are rare, except in **immunocompromised hosts**

Diagnostic Laboratory Tests

- Under microscope -> S, comma shaped bacilli with **darting motility**
- **42°C** under microaerophilic conditions
- selective media (Skirrow's, Butzler's, Blaser's, Campy-BAP and Preston media)

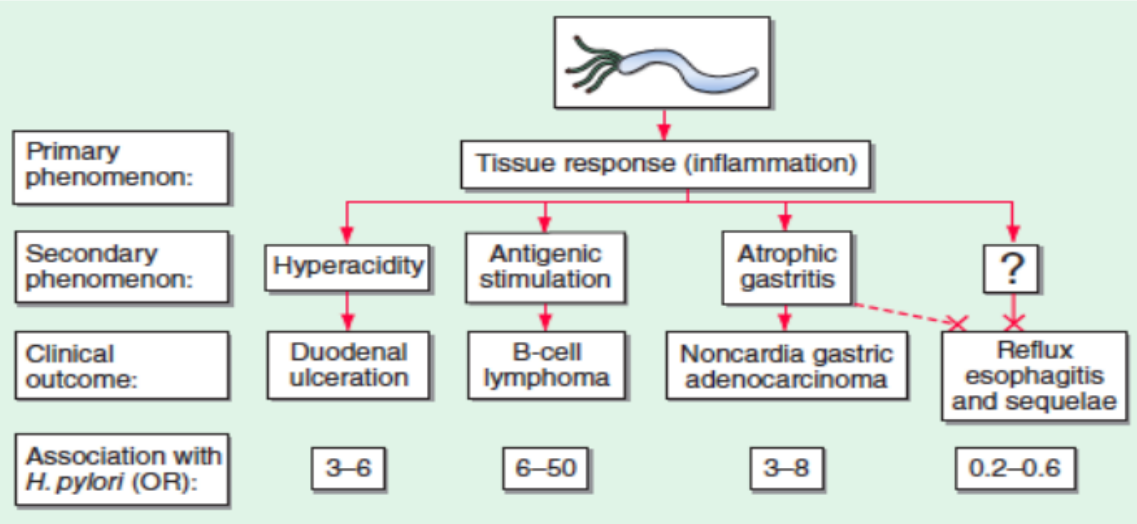
Treatment

- Fluid and electrolyte replacement
- Antibiotics [secondary role] -- erythromycin

Helicobacter pylori

- Gram negative bacilli, spiral shaped, multiple flagella at one pole "**corkscrew motility**"
- Causes acute gastritis -> chronic gastritis -> peptic ulcer disease [85% of gastric + 95% of duodenal ulcers] + adenocarcinoma of the stomach + non- Hodgkin's B cell lymphoma
- **urease positive [**urea → ammonia**] + motile** to move to less acidic environment [from the lumen of the stomach to a deeper sites]
- produces two toxins: **Cag-A (cytotoxin associated gene), Vac-A (vacuolating cytotoxin)**
- found to be <u>protective</u> against GERD and esophagus adenocarcinoma
- Colonization is usually life-long [colonize 50% of developed world and 80% of developing world]
- Transmission is **feco-oral**

Relationships between colonization with Helicobacter pylori and diseases of the upper gastrointestinal tract



Diagnostic Laboratory Tests:

- Epigastric / burning sensation
- Endoscopy –> biopsy + microscopy / culture
- Catalase positive
- The more preferred techniques are the **non-invasive => urea breath test** [13 C- or 14 C labeled urea is ingested by the patient. If H pylori is present, the urease activity generates **labeled CO2** that can be detected in the patient's exhaled breath.] or **stool antigen test** [usually done to confirm the complete eradication of H pylori with treatment]

Treatment

<u>Triple therapy</u> with amoxicillin, clarithromycin and PPIs for 7-10 days, with a cure rate of more than 90%.

<u>quadrable regimen</u> includes PPIs, metronidazole, amoxicillin and bismuth subsalicylate for 10 days

Plesiomonas and Aeromonas

- Uncommon gram negative bacteria
- common in tropical and subtropical areas
- **They live in fresh water and are resistance to the compound O129**
- Mild gastroenteritis → systemic infection [especially in immunocompromised]
- Can't be grown on TCBS agar
- Plesiomonas are positive DNase while Aeromonas are not

Treatment

- Aeromonas and Plesiomonas are susceptible to fluoroquinolones (e.g. ciprofloxacin) and cephalosporins, but **they develop resistance very rapidly**, because Aeromonas can produce β-lactamases, including carbapenems, thus treatment should be guided by antibiotic susceptibility tests.