Vibrios, short curved rods

We are accustomed to characterizing bacteria as **coci** (spheres), **bacilli** (rod-shaped), or **spirillum** (cork-screw shaped). However, we have noted **spirochetes** as curved with special motility, now we see that some short rods are curved, the **vibrios** (vibrate or shake) are more like spirilla than bacilli.
Initial studies on Cholera

- Cholera a major problem in London
- John Snow: Court physician to Queen Victoria
  - First epidemiology study
  - Broad St Pump
Vibrio cholerae

Gram-rod-shaped curve, with vibrating motility a major historical killer of humans, still a problem
**Vibrio cholerae**

- The disease cholera is due principally to a classical A/B toxin produced by specific strains of the O-Group of *V. cholerae*.
- A major cause of epidemics and pandemics over human history, but continuously endemic in Bangladesh and West Bengal.
- Presently, we are experiencing a pandemic of cholera that has reached into Mexico.
- Many organisms become “dormant”, non-vegetative, associated with copepods, found in natural water sources, bays, etc.
Epidemiology of Cholera

- Classical water-borne disease
- Vibrios naturally in water, estuaries, marine: also in shell-fish, shrimp, crabs, etc (O.T. proscription against eating shell-fish?)
- Endemic in India, Bangladesh, etc
- Also person to person transmission
Shell fish, Shrimp
Crabs, Raw fish

Feces > water > shell fish, or humans
Cholera

• Toxin-induced diarrhea
• (Cholera = Greek for “rain gutter”)
  – severe dehydration
  – circulatory collapse
  – serious mortality
• Prior to 1980s >70% mortality
  – Oral Rehydration Therapy now <1%
• Classical and “El Tor”
  – slower to develop
  – present pandemic is *V.ch.* 0139, a relative of El Tor

Rwandan refugees fill water jugs and wash clothes with cholera victim, 1994
Pathogenesis of Cholera

- **Cholera toxin (CT)**
  - Classical AB toxin
  - Toxin causes disease without bacteria
  - **B domain** to mucosal brush-border
  - **A domain** reverses ion flow
    - NaCl is not absorbed
    - Cl⁻ ions secreted
    - genes from B-phage*
  - Severe diarrhea
    - hypotension & tachycardia
    - generally afebrile

- Other enterotoxins may be involved
- Cholera toxin may stimulate crypt cells to secrete chloride ions
- “Rice-water” (mucus containing) stools
  - up to 1 liter/hour
  - circulatory collapse??
- 70% mortality without treatment
- <1% fatal with treatment
Pathogenesis of Cholera Toxin:

Fluid loss can approach 1L/hour; an untreated patient can lose up to 50% of their body weight during the disease. cAMP drives ion pump with loss of electrolytes and water.
“Rice-water stools of Cholera, several liters per day!!
The “Cholera cot”, just add the bucket (and oral rehydration solution, antibiotics and wait for cure)
Cholera Treatment

- **Oral Rehydration Therapy (ORT)**
  - NaCl 3.5g/L
  - NaHCO3 2.5g/L
  - KCl 1.5g/L
  - Glucose 20.0g/L

- Administer 4-8 oz/hr over 6 hrs.
- Antibiotics clear bacteria from gut
- check for sunken eyes and skin turgor
Campylobacter

Small curved or S-shaped flagellated rods, microaerophilic, a major cause of diarrheal disease worldwide (may be spread by homosexual practices)
Campylobacter jejuni

- Normal flora of animals, especially wild & domestic birds et al.
  - Generally, a zoonosis
  - oral/fecal transmission
  - animal waste
  - contaminated water
  - sick pets (dogs, et al.)
  - unpasteurized milk
  - undercooked poultry
- Travelers beware
  - India, 40% have
### % Chickens Contaminated With:

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**Note:** In January of 1988, a new inspection system, The Hazard Analysis and Critical Control Points Program (HAACCP), was initiated by USDA.

**Source:** *Consumer Reports*; October, 1998, P 27.
Helicobacter pylori

curved or spiral cell
**Helicobacter pylori**

- Causes gastritis and implicated in >90% of stomach and duodenal ulcers; also been shown to be an important cofactor in a common stomach cancer (adenocarcinoma).
- First detected by J. Robin Warren in 1979 in stomach biopsies from ulcer patients.
- Occurs in the stomachs of 25% of healthy middle-aged adults and >60% of adults >60.
- Uses ‘O’ Ag on gastric cells as one receptor (incidence of ulcers in Type O about 2X higher)
- Many other spp have it, but not a zoonosis
Like the other vibrios, *H. pylori* is a flagellated curved rod. Initially described as a *Campylobacter*, but is not genetically related so a new genus was formed.
Helicobacter pylori:

Potent urease

Treated with clarithromycin and Peptobismo, et al.
Epidemiology

- World wide distribution, but more common in developing world where 60-70% of children have before age 10
- Incidence of stomach cancers are up in developing world, but down in USA
- Not related to stress, alcohol or Aspirin
- Linked to at least 3 different cancers in the stomach
  - considered by WHO as a class-1 carcinogen
Treatment

• In old days Histamine2 blockers (Tagamet, Pepsid AC, etc) could cure but only if taken continuously@$60-100/mon.
  – with 95% recurrence rate
  – Antibiotic treatment=12% recurrence
• If treated with antibiotics and Pepto-Bismol, the rate is less than 10%
• Antibiotic treatment will often reduce tumor size in stomach cancers!