Miscellaneous Bacterial Agents of Disease

Spirochetes
Gram negative human pathogens
- Treponema
- Leptospira
- Borrelia

Treponema
- Thin, regular, coiled cells
- Live in the oral cavity, intestinal tract, & perigenital regions of humans & animals
- Pathogenic species are strict parasites
- Require live cells for cultivation

Treponema pallidum
- Humans are the natural host
- Extremely fastidious & sensitive
- Causes syphilis
- Infectious dose is 57 organisms
- Primary syphilis - chancre appears
- Secondary syphilis - skin lesions; infectious
- Tertiary syphilis - neural + cardiovascular symptoms
- Treatment: penicillin G
Borrelia
- Large spirochetes, 3-10 coils
- Borrelioses transmitted by arthropod vector
- B. hermsii - relapsing fever
- B. burgdorferi - Lyme disease

B. hermsii - Relapsing Fever
- Mammalian reservoirs—squirrels, chipmunks, wild rodents
- Tick-borne
- After 2-15-day incubation, patients have high fever, shaking, chills, headache, & fatigue
- Progression to nausea, vomiting, muscle aches, abdominal pain; extensive damage to liver, spleen, heart, kidneys, & cranial nerves
- Parasite changes & immune system tries to control it; recurrent relapses
- Treat with tetracycline

B. burgdorferi - Lyme disease
- Transmitted by Ixodes ticks
- Complex 2-year cycle involving mice & deer
- Nonfatal, slowly progressive syndrome that mimics neuromuscular & rheumatoid conditions
- 75% get bull’s eye rash
- Fever, headache, stiff neck, & diziness
- If untreated can progress to cardiac & neurological symptoms, polyarthritids
- Tetracycline and amoxicillin are effective
- Vaccine for dogs
- Use insect repellent containing DEET or equivalent

Vibrio cholera
- Comma-shaped, possess unique O & H antigens
- One of the top 7 causes of morbidity and mortality
- Ingested with food or water
- Infectious dose $10^6$ cells
- Infects surface of small intestine, non-invasive
- Cholera toxin causes electrolyte & water loss through secretory diarrhea
- Resulting dehydration leads to muscle, circulatory, & neurological symptoms
- Treatment: oral rehydration, tetracycline
**Vibrio cholera**

*Image of Vibrio cholera*

**Helicobacter pylori**

- Curved cells discovered in 1979 in stomach biopsy specimens
- Causes 90% of stomach & duodenal ulcers
- People with type O blood have a 1.5-2X higher rate of ulcers
- Produces large amounts of urease
- Discoverers Robin Warren and Barry Marshall received Nobel Prize

**Rickettsia**

- Obligate intracellular parasites
- Gram-negative cell wall
- Among the smallest bacteria
- Non-motile pleomorphic rods or coccoholdi
- Ticks, fleas & lice are involved in their life cycle
- Bacteria enter vascular endothelial cells & cause necrosis of the lining – vasculitis, vascular leakage & thrombosis
- Treat with tetracycline & chloramphenicol

**4 Types of Rickettsioses**

1. Epidemic typhus – *R. prowazekii* carried by lice; starts with a high fever, chills, headache, rash; Brill-Zinsser is a chronic, recurrent form
2. Endemic typhus – *R. typhi*, harbored by mice & rats; occurs sporadically in areas of high flea infestation; milder symptoms
3. Rocky Mountain spotted fever – *R. rickettsii* zoonosis carried by dog & wood ticks; most cases on eastern seaboard; distinct spotted rash; may damage heart & CNS
4. Ehrlichia genus contains 2 species of rickettsias; tickborne bacteria cause human monocytic & granulocytic ehrlichiosis
Chlamydia

- Obligate intracellular parasites
- Small, gram-negative cell wall
- Alternate between 2 stages
  - elementary body – small metabolically inactive, extracellular, infectious form
  - reticulate body – grows within host cell vacuoles

Chlamydia trachomatis

Trachoma – attacks the mucous membranes of the eyes, genitourinary tract & lungs
  - ocular trachoma – severe infection, deforms eyelid & cornea, may cause blindness
  - inclusion conjunctivitis – occurs as babies pass through birth canal, prevented by prophylactics
  - STI – urethritis, cervicitis, salpingitis (PID), infertility, scarring
  - Treat with tetracyclines
- Lymphogranuloma venereum – disfiguring disease of the external genitalia & pelvic lymphatics

Mycoplasma

- Naturally lack cell walls, highly pleomorphic
- Require special lipids from host membranes
- Treat with tetracycline, erythromycin
- M. pneumoniae – primary atypical pneumonia; pathogen slowly spreads over interior respiratory surfaces, causing fever, chest pain & sore throat
- M. hominis & Ureaplasma urealyticum – weak sexually transmitted pathogens

Bacteria in Dental Disease

- Oral cavity is a complex, dynamic ecosystem, containing 400 species
- Dental caries – slow progressive infection of irregular areas of enamel surface
  1. Begins with colonization by slime-forming species of Streptococcus & cross adherence with Actinomyces
  2. Thick, adherent material forms (plaque) that harbors masses of bacteria which produce acid that dissolves enamel
**Dental Caries - Continued**

3. If plaque is allowed to stay, secondary invaders appear - *Lactobacillus, Bacteroides, Fusobacterium, Porphyromonas, Treponema*

4. Effect of acid on enamel can lead to eventual exposure of tooth pulp

**Peridontal Disease**

- Soft tissue disease
- Occurs when plaque becomes calcified into calculus above and below the gingiva
- Gingiva is irritated, causing inflammation - gingivitis
- Pockets between tooth & gingiva are invaded by bacteria (spirochetes & gram-negative bacilli)
- Tooth socket may be involved (periodontitis)
- Tooth may be lost