Pathogenic gram negative

Neisseria
Enterobacteriaceae
Bordetella
Vibrio
Gonorrhea

*Neisseria gonorrhoeae* - Gram Negative cocci

- Diplococci
- Aerobic
- Fimbriae
- Capsules
- Antigen: Lipooligosaccharide
- Need all three for virulence
- Needs blood agar and prefers 5% CO₂ atmosphere
- Susceptible to drying and extreme temperatures
- Highly variable surface antigens
Epidemiology
Pathogenesis - Asymptomatic to Acute

Urethritis and cervicitis within 7 days
Males discharge/pain (2-5 days); females asymptomatic
Untreated - fallopian tubes, PID, infertility
Associated with conjunctivitis in newborn infants
Prevention and Control
Second most common infectious disease in US
250,000-500,000 cases annually
Use of condoms effective
EXTREME penicillin antibiotic resistance, so…
Second line antibiotics such as ciprofloxacin
Penicillin Cures Gonorrhea

The Great Crippler and Sterilizer

[Bar chart showing percentage of penicillinase-producing strains of N. gonorrhoeae from 1980 to 1990]
Enterobacteriaceae

- Facultative anaerobic bacilli
- Intestinal microbiota
- 150 species in 41 genera
- Ubiquitous in soil, water, decaying vegetation
- Proteus: 44% patients w/catheter had proteus growing. Utilizes urea, form kidney stones

Enterobacter  E. coli
Pathogenicity

- Lipid A: causes fever, vasodilation, inflammation,
- Capsules
- Fimbriae
- Exotoxins
- Iron binding proteins
- Hemolysins
- Type III secretions: disrupt cell metabolism
Coliforms

• E. coli
• O157:H7
• Enterotoxins: Shiga like toxin, inhibits protein synthesis, spread on surface of neutrophils
**Salmonellosis - Salmonella**  
**Gram Negative rods**

**Pathogenesis - Acute**
1-2 days - headache, diarrhea, no blood  
Agent enters intestinal cells - crosses mucosa  
Moves into blood stream - septic, systemic  
Endotoxin, exotoxin, pili - 2000+ strains  

Typhoid fever:
Salmonella attaches to epithelial cells lining small intestine

Salmonella triggers endocytosis

Salmonella multiplies within food vesicle

Salmonella kills host cell, inducing fever, cramps, and diarrhea

Bacteremia: Salmonella moves into bloodstream

Blood vessel
Prevention and Control

40,000+ cases in US/year, millions worldwide

Properly store and use eggs, dairy products

Properly prepare meat, eggs, produce, dairy

Wash hands - frogs, reptiles, dogs, cats, birds…

Fluid replacement, no antibiotics in most cases
Yersinia

- Bubonic plague (Black Death)
- Pneumonic infect lungs

Buboes on lymph nodes
Bordetella pertussis

- Whooping cough
- Gram neg aerobic
- Interferes with cilia
- Adhesins: filamentous hemagglutinin and pertussis toxin (increased mucus production)
- Dermonecrotic toxin: hemorrhage blood vessels
Epidemiology

- Pediatric disease
- Most cases in children under 5
- 60 million worldwide each year
- Attenuated vaccine, now acellular
- Increase in US
Incubation
No symptoms

Catarrhal
Rhinorrhea, sneezing, malaise, fever

Paroxysmal
Repetitive cough with whoops, vomiting, exhaustion

Convalescent
Diminishing cough, possible secondary complications

Relative number of bacteria involved in interaction

Time in weeks

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Cholera

Vibrio cholera - Gram Negative curved rods

Infection Pathogenesis -
Acute
Halophilic - shellfish or water-associated
Exotoxin MASSIVE salt and fluid loss, no blood
Small and large intestines - “rice water stools”
V. cholera

- Only vibrio that can survive in fresh water
- Needs a large inoculum, $10^8$ cells to survive stomach environment
Prevention and Control
Regulate ship bilges, cook shellfish, clean water
Water replacement reduces mortality to 1%
Pandemic, endemic - SE Asia, S. America
US cases 5-10/year - shellfish associated
Available vaccine made using killed whole cells

1991 data from Peru - 500,000 sick, 4500 dead.