Welcome to Pathogen Group 4

- *Chlamydia trachomatis*
  - Trachoma
  - Genital chlamydia
- *Chlamydophila (Chlamydia) psittaci*
- *Bacillus anthracis*
- *Neisseria meningitidis*
- *Haemophilus influenzae, type B*
- *Helicobacter pylori*
**Chlamydia trachomatis**: Trachoma and Genital Chlamydia

- Characteristics of all chlamydias:
- Tiny, obligate intracellular parasites
- Oval cell walls
- Elementary bodies: smaller, stronger cell wall, transmit infections
- Reticulate bodies: larger, weak cell walls, actively reproducing form
Trachoma

- chronic infection of conjunctiva of eye
- transmitted by ocular discharges
- causes vascular invasion of cornea
- world’s #1 cause of blindness
- easily cured with antibiotic ointment
Genital chlamydia

- #1 STD in the United States
- chronic infection of urogenital membranes
- symptoms often slight or none
- if untreated: sterility in either sex; PID in female (pelvic inflammatory disease); increased risk of tubal pregnancy
- Coinfection with gonorrhea common
- Awesome CDC fact sheet
Chlamydia in neonate’s eyes
Chlamydia diagnosis

- A. Laboratory based:
  - Cell cultures (difficult)
  - Nucleic acid amplification (NAA) tests
  - Nucleic acid hybridization (NA probes)
  - Direct fluorescent antibodies (DFA)

- B. Point of care tests (faster, more expensive, less sensitive, less specific):
  - Enzyme labeled monoclonal antibodies
lymphogranuloma venereum (LGV)

- special strain of *C. trachomatis*
- enlarged lymph node
Chlamydophila (Chlamydia) psittaci: ornithosis

- other names: psittacosis, parrot fever
- reservoirs: birds (all kinds)
- usually transmitted by inhalation from feces or secretions of birds; person to person very rare
- systemic disease
- Form of pneumonia; flu-like symptoms (can be severe)
- fever, chills, headache, photophobia, cough, myalgia
- No vaccine
Bacillus anthracis: Anthrax

- Gram + bacillus
- spore forming
- capsule
- nonmotile
- aerobic
- formerly common; now rare in U.S.
- reservoir: wild or domestic animals
- spores survive long time in soil and on animal products
- many modes of transmission
• can start as skin lesion or lung or intestinal infection; may become systemic
• immunize animals and high-risk people
Anthrax update: Forms of anthrax

**Skin**
Though the cutaneous variety accounts for most anthrax cases, it’s the least deadly form of the disease.

**Contact**
Anthrax spores enter the skin through minor cuts and abrasions, where they grow into toxin-producing bacteria.

**Rash**
Starts with welt or swelling and progresses from a fluid-filled blister to a black, ulcerous lesion lasting up to two weeks.

**Attacks Skin**
Toxins strike surrounding tissue. Body responds, sending immune cells to consume invading microbes.

**From Skin**
Immune cells can carry microbes back to lymph nodes.

20% fatal
**Lung**
The deadliest form of anthrax and the most likely to result from exposure to airborne spores.

**INHALATION**
Airborne spores settle in tiny sacs of the lungs called alvioli. They can take up to 60 days before beginning to germinate.

**FLU**
Starts as a coldlike condition with fever and chest pains that can lead to breathing problems, shock, coma and death.

**ATTACKS LUNGS**
Anthrax bacteria multiply, releasing toxins that cause bleeding and deterioration of the central chest cavity.

**FROM LUNGS**
Immune cells sent to consume microbes transport some back to lymph nodes. 90% Fatality rate.
**GI Tract**
A rare variety that can strike the upper or lower reaches of the digestive tract, including the throat or gut.

**Ingestion**
Spores can enter the digestive tract through the undercooked, contaminated meat of goats, sheep, cows and other animals.

**Stomach Pain**
Can include nausea, vomiting, fatigue, loss of appetite and fever, followed by severe cramps and bloody diarrhea.

**Attacks Gut**
Bacteria and toxins eat away at intestinal lining, spreading to nearby tissue and prompting an immune-cell attack.

**From Intestines**
Immune cells carry microbes to lymph nodes.

25% to 60% Fatality rate
Anthrax update

- Testing suspicious powders

1. Powder is visually inspected. Anthrax usually appears in a very fine powder.
• Testing suspicious powders

2. The powder is placed in a small vial with water. Anthrax spores disperse, making a milky solution. If powder sinks or floats, it is likely not anthrax.
• Testing suspicious powders

3. The acidity is tested. If the powder in water is very acidic or very basic, it is not anthrax.
• Testing suspicious powders

4. Workers then use a chemical or test strip to see if the substance is an oxidizer. If the powder oxidizes, or causes the chemical or strip to change color, it is not anthrax.
• Testing suspicious powders

5. A drop of water containing powder is placed on a test strip containing specific antibodies for detecting anthrax. Similar to a pregnancy test, two red lines will show up if it is possibly anthrax.
• Testing possibly exposed individuals

1. Nasal swabs are sent to public health lab for further analysis. In suspected cases of cutaneous anthrax, a biopsy is sent.
• Testing possibly exposed individuals

2. Samples are placed in petri dishes and incubated for 1 to 3 days.
• Testing possibly exposed individuals

3. Anthrax has a distinctive boxcar shape under the microscope. Special dyes will also bind to it and color it.
• Testing possibly exposed individuals

4. Antibody proteins can be used to see if they bind to it, further indication that it is anthrax.
• Testing possibly exposed individuals

5. The ultimate confirmation comes from DNA analysis.
Other threats

- In city of 500,000 residents
- Also smallpox

### Deadly Scenarios

Estimates of casualties from hypothetical biological attacks:

<table>
<thead>
<tr>
<th>AGENT</th>
<th>CASUALTIES</th>
<th>DEATHS</th>
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<tbody>
<tr>
<td>Anthrax</td>
<td>125,000</td>
<td>95,000</td>
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<tr>
<td>Tularemia</td>
<td>125,000</td>
<td>30,000</td>
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<tr>
<td>Typhus</td>
<td>85,000</td>
<td>19,000</td>
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<td>Tick-borne encephalitis</td>
<td>35,000</td>
<td>9,500</td>
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<td>Brucellosis</td>
<td>125,000</td>
<td>500</td>
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<tr>
<td>Rift Valley fever</td>
<td>35,000</td>
<td>400</td>
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<tr>
<td>Q fever</td>
<td>125,000</td>
<td>150</td>
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Pathogens of meningitis

Comparisons of infection by
*Haemophilus influenzae* vs.
*Neisseria meningitidis*

According to Age Group, 1996

- **Haemophilus influenzae**
- **Neisseria meningitidis**

Reported Cases

<table>
<thead>
<tr>
<th>Age Group (Years)</th>
<th>&lt;1</th>
<th>1-4</th>
<th>5-9</th>
<th>10-14</th>
<th>15-19</th>
<th>20-29</th>
<th>30-39</th>
<th>40-49</th>
<th>50-59</th>
<th>60+</th>
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Graph showing the distribution of reported cases of meningitis by age group, comparing *Haemophilus influenzae* and *Neisseria meningitidis*. The highest reported cases are seen in the 1-4 and 20-29 age groups, with a notable increase in cases for *Neisseria meningitidis* in the 50-59 age group.
*Neisseria meningitidis*: meningococcal meningitis

- gram - diplococcus
- “the meningococcus”
- healthy carriers
- droplet transmission
**meningococcus**

- sudden onset: fever, intense headache, stiff neck, nausea, petechial rash
- Petechial rash = intradermal hemorrhages
- delirium, coma
- need for prompt treatment
- Meningococcal Conjugate Vaccine (MCV4)
  - Minimum age = 2 years (as of 2011)
N. meningitidis

• fatal case
Haemophilus influenzae, type B (HIB)

- gram - bacillus
- also causes various local infections, bacteremia, pneumonia
- routine infant immunization
HIB in cerebrospinal fluid (meningitis)
HIB in sputum (pneumonia)
Helicobacter pylori

- See pp. 718-720 + figure 25.13 in your textbook 10th ed.

- Organisms survive the acidity of stomach juices by producing a powerful urease. Upon reaching the layer of mucus, they penetrate to the epithelial surface, where bacterial products incite an inflammatory response. Thinning of the mucus layer occurs, and 10% to 20% of infected individuals develop ulcerations. Only a small percentage develop cancer, but more than 90% of individuals with stomach cancers are infected with this bacterium.