Atypical Bacteria
Bacterial Taxonomy: How are these unicellular organisms classified?

• complex system of classification
  – based on shape & size; oxygen, pH, and temperature requirements; laboratory characteristics, biochemical analyses, serology tests, nucleic acid and protein analysis techniques ...

  – Classification is now based on similarities in nucleotide sequences in rRNA

  – The *Bergey’s Manual* is considered the official listing of all recognized bacteria
    • see appendix A in your text for the details (don’t memorize!)
Reminder

• The majority of Bacteria and Archaea have not been cultured
• Scientists estimate that only 1% of these microbes have been discovered!
• And…of more than 2600 species of bacterial names, fewer than ____ are human pathogens.
Some atypical bacteria

- *not* typical
- will discuss
  - 1. fungus-like bacteria
  - 2. acid fast bacteria
  - 3. Mycoplasmas
  - 4. Chlamydias
  - 5. Rickettsias
Fungus-like (filamentous) bacteria

- *myc* in word refers to fungus or something like a fungus (filamentous)
- *Streptomyces spp.*: most important source of antibiotics
  - More than half of our ____________ are produced by species of *Streptomyces*.
  - Antibiotics are substances produced by microbes that in small amounts inhibits another microbe.
<table>
<thead>
<tr>
<th>Microorganism</th>
<th>Antibiotic</th>
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</thead>
<tbody>
<tr>
<td><strong>Gram-Positive Rods</strong></td>
<td></td>
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<tr>
<td><em>Bacillus subtilis</em></td>
<td>Bacitracin</td>
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<tr>
<td><em>Paenibacillus polymyxa</em></td>
<td>Polymyxin</td>
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<tr>
<td><strong>Actinomycetes</strong></td>
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<tr>
<td><em>Streptomyces nodosus</em></td>
<td>Amphotericin B</td>
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<tr>
<td><em>Streptomyces venezuelae</em></td>
<td>Chloramphenicol</td>
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<tr>
<td><em>Streptomyces aureofaciens</em></td>
<td>Chlortetracycline and tetracycline</td>
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<tr>
<td><em>Saccharopolyspora erythraea</em></td>
<td>Erythromycin</td>
</tr>
<tr>
<td><em>Streptomyces fradiae</em></td>
<td>Neomycin</td>
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<td><em>Streptomyces griseus</em></td>
<td>Streptomycin</td>
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<tr>
<td><em>Micromonospora purpurea</em></td>
<td>Gentamicin</td>
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<tr>
<td><strong>Fungi</strong></td>
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<tr>
<td><em>Cephalosporium spp.</em></td>
<td>Cephalothin</td>
</tr>
<tr>
<td><em>Penicillium griseofulvum</em></td>
<td>Griseofulvin</td>
</tr>
<tr>
<td><em>Penicillium chrysogenum</em></td>
<td>Penicillin</td>
</tr>
</tbody>
</table>
Actinomyces

- branching filaments and spore-case (sporangium)
- *Actinomyces* spp.: cause actinomycosis (lumpy jaw)
  - large abscess in jaw
  - sulfur granules in pus
  - Figure 11.22
Actinomycosis

• Fungal-like bacterial disease
• Infection follows trauma to body tissues
• “lumpy jaw”
Actinomycosis
Actinomyces
sulfur granules
in pus
2. _______________bacteria

- gram positive bacilli with wax coat on cell wall
- wax increases survival in environment
- *Nocardia* spp. (weakly acid fast; require special acid-fast stain)
  - nocardioses: infection of lungs, skin or other tissue
- *Mycobacterium* spp.
  - *M. tuberculosis* (tuberculosis)
  - *M. leprae* (leprosy)
  - many other species
Mycobacterium tuberculosis

fig. 24.8
• Procaryotic, acid-fast, but grows much like a fungus
Nocardia:

- nocardiosis, mycetoma
- Follows penetration from the soil via a wound
• Nocardiosis growing back through ribs from lungs to skin
• When inhaled, the disease strikes the lungs, where multiple abscesses form.
• Symptoms can be similar to tuberculosis
• Reports of death from Nocardiosis have been linked to AIDS
Acid-fast stain: pp. 70-71, fig. 3.13

- Primary stain: ________________
- Mordant: heat or detergent (cold method we will use in lab) accompanying primary stain, to force stain through wax coat on cells
- Decolorization: acid alcohol
  - 3% HCl in 95% ethanol
  - acid-fast bacteria hold primary stain because wax resists acid alcohol
  - non acid-fast bacteria decolorize
- Counterstain: ________________
- red = acid-fast; blue = nonacid-fast
Mycobacterium leprae

- Red = acid-fast
**Mycobacterium ulcerans:** Buruli ulcer

- Reservoir = swamps & slow-flowing rivers
- Increasing in world
- Global threat to public health
- Page 594 in your text

![Map of Buruli ulcer distribution](image)

*A medium-size lesion on a man with Buruli ulcer.*
3. ________________

- smallest known cells ("submicroscopic")
- never have cell walls
- don’t rupture because of small size and tough cell membrane
- myco = filamentous; plasma = fluid
- pleomorphic = variable shape
- will grow on culture media “fried egg” colonies
- Genera: *Mycoplasma* and *Ureaplasma*
Mycoplasmas cause:

- pneumonia in humans and animals
  - walking pneumonia
  - 15-20% of cases human pneumonia
  - Can be severe
- mastitis in cows
- urethritis in humans
- stunting of plant growth
Mycoplasma pneumoniae

- attached to surface of host cells
4. Chlamydiases

- Submicroscopic
- Have cell walls: oval shape, gram negative
- Obligate intracellular parasites = will grow only inside of living host cells
  - energy parasites
- Genus *Chlamydia*
  - trachoma
  - genital chlamydia
  - Pneumonia

- *Chlamydophila psittaci*
  - In pathogen group 4
  
  figure 11.24
2 forms of chlamydia cells

- ________________:
  - 0.3 µm
  - rigid cell wall
  - can survive outside of host cell
  - Infectious

- ________________:
  - 0.5 to 1.0µm
  - fragile cell wall
  - Can’t survive outside of host cell
  - not infectious
  - adapted for growth
chlamydia reproduction
red = elementary body; green = reticulate body

- See figure 11.24
5. Rickettsias

• tiny oval to rod-shaped bacteria; just visible with light microscope
  – See figure 11.1 on page 304
• obligate intracellular parasites
  – But now widely separated from the chlamydia (see table 13.1 on page 368)
• most have arthropod vectors

• Genera *Rickettsia* and *Ehrlichia*
• Cause:
  – Rocky Mountain spotted fever (ticks are vectors)
  – Typhus fevers (various vectors)
  – Will study in pathogen group 9!
Rickettsia in host cell

• Figure 11.1
End of Unit 1 – Exam 1 Covers everything up to this point!