Microbial Diseases of the Lower Respiratory Tract

**Pertussis**
- *Bordetella pertussis*
- *Tracheal exotoxin* interferes with mucociliary escalator, leading to *paroxysmal stage*
- Greatest danger to young children; adult infection is often milder
- Controlled by vaccination

**Tuberculosis**
- *Mycobacterium tuberculosis*
- Acid-fast cell wall
  - Promotes environmental survival
  - Resists host defense
- Intracellular multiplication in macrophages
Pathogenesis of tuberculosis

- Infected macrophages may be activated, leading to destruction of the mycobacteria
- The host may isolate infected macrophages in a **tubercle**
- This may lead to the host containing the infection for long periods
- However, the bacteria may eventually break out, leading to **miliary tuberculosis**
Control of tuberculosis

- Tuberculosis is a disease of poverty. Nutrition is an important factor in control.
- *Bacille Calmette Guerin*, BCG, an attenuated vaccine, is of limited value
- Drug therapy
  - May require multiple drugs for extended periods; compliance remains a problem
  - Multiply drug-resistant (MDR) *M. tuberculosis* remains a worldwide problem

Bacterial pneumonias - *Pneumococcal pneumonia*

- *Streptococcus pneumoniae*
- Pathogenic *S. pneumoniae* is invariably encapsulated
- Often a disease of compromised persons
- May be controlled by capsular vaccines
- Drug resistance has become a problem
**Atypical bacterial pneumonias**

- **Mycoplasmal pneumonia**
  - *Mycoplasma pneumoniae*
  - Fairly common, persistent “walking pneumonia”

- **Legionellosis**
  - *Legionella pneumophila*
  - May be severe, but treatable
  - Always acquired from abiotic reservoirs
  - Only recognized since 1976, but may be fairly common

- **Psittacosis**
  - *Chlamydia psittaci*, an obligate intracellular bacterium
  - Usually transmitted from birds

- **Chlamydial pneumonia**
  - *Chlamydia pneumoniae*
  - Clinically similar to mycoplasmal pneumonia, may be transmitted between persons

- **Q fever**
  - *Coxiella burnetii*, also intracellular
  - Subsequent endocarditis is of greatest clinical concern
  - Occupational hazard of animal husbandry

- **Other bacteria may cause pneumonia**
  - *Staphylococcus aureus* and *Streptococcus pyogenes* pneumonias may be associated with widespread tissue damage
  - Pneumonia with Gram-negative bacteria, e.g., *Klebsiella pneumoniae*, common in compromised patients

**Viral pneumonias**

- Many viruses may cause pneumonia; most are not isolated and identified

- **Respiratory Syncytial Virus (RSV)**
  - Serious respiratory disease in infants and the elderly
  - Name reflects tendency for infected cells to develop fused syncytia

- **Severe Acute Respiratory Syndrome (SARS)**
  - Agent is a novel *coronavirus*
  - 2003 global outbreak led to its recognition, and it is carefully monitored

**Syncytia**
SARS-associated Coronavirus (SARS-CoV)

Influenza

- Enveloped virions with a segmented RNA genome
- Major surface antigens
  - Hemagglutinin
  - Neuraminidase
- Localized infection of respiratory epithelium; systemic symptoms are host response
- Most deaths are from secondary bacterial pneumonias

Influenza epidemiology

- Natural reservoir is most likely water fowl in Asia
- Evolution leads to genetic changes with time
  - These are monitored serologically for H and N proteins
  - *Antigenic shift*: Recombination of genome segments
  - *Antigenic drift*: Mutation of H and N alleles
- Prediction of dominant strains informs vaccine development
Fungal Diseases of the Lower Respiratory Tract

- **Histoplasmosis**
  - *Histoplasma capsulatum*, a dimorphic fungus
  - Inhalation of airborne conidia (spores) leads to growth of yeast form in the lungs

- **Coccidioidomycosis**
  - *Coccidioides immitis*, another dimorphic fungus
  - San Joaquin fever

- **Blastomycosis**
  - *Blastomyces dermatitidis*, another dimorphic fungus
  - May be very destructive

- **Pneumocystis pneumonia**
  - *Pneumocystis jiroveci*
  - High rate of asymptomatic carriage; clinical infection may be reactivation
  - One of the defining infections of AIDS