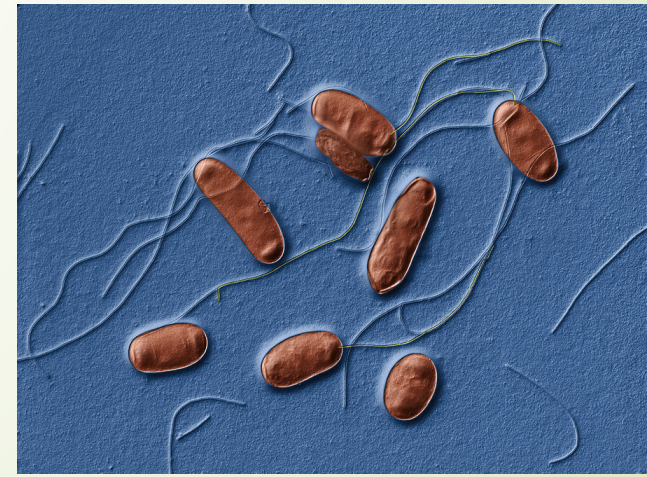


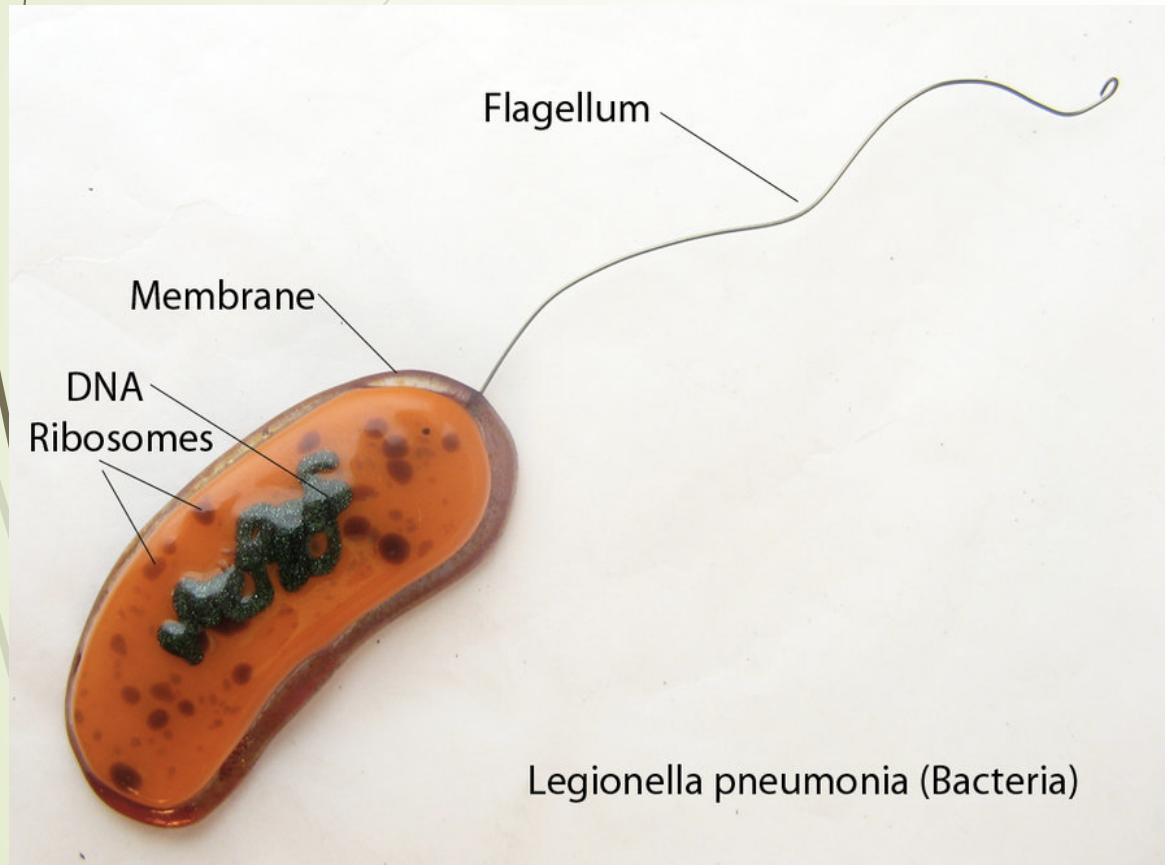
BODY SYSTEMS

PATH 417A

NESTOR CHEN

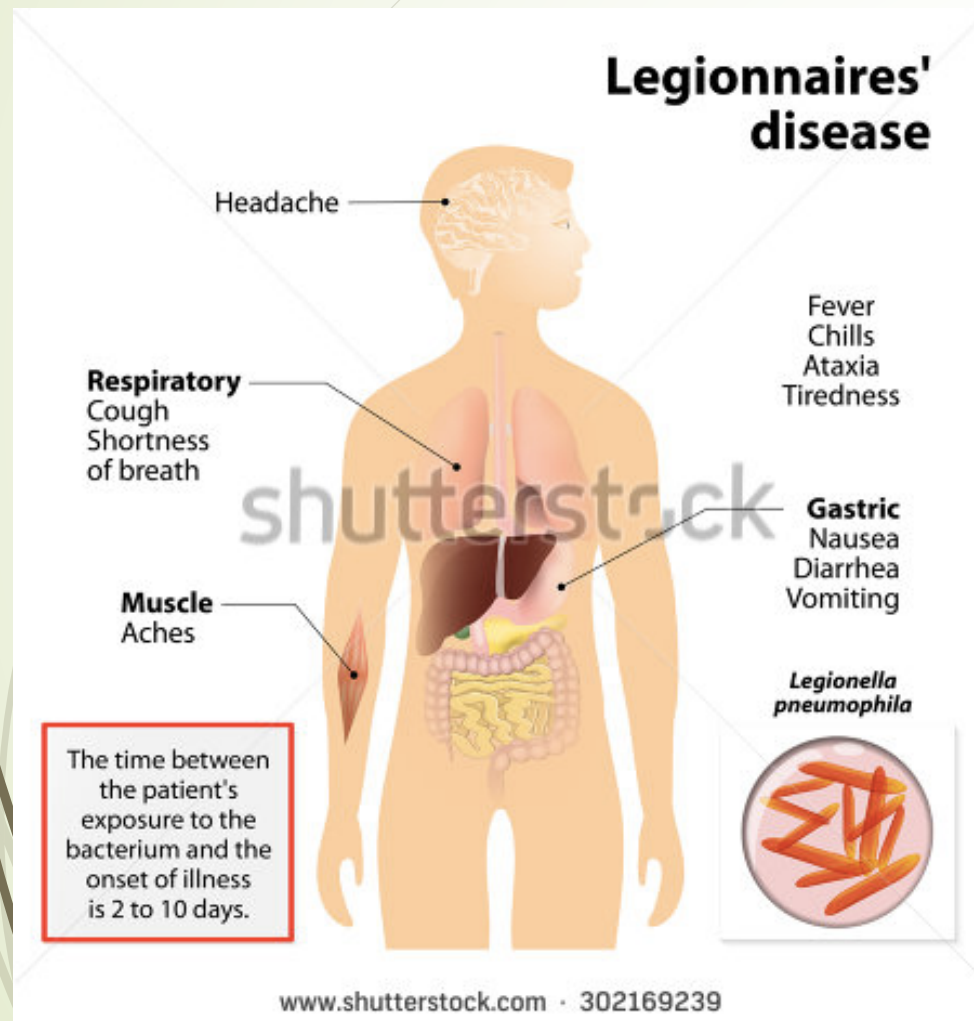


Bacteria: Legionella pneumophila



- Gram-negative, aerobic, flagellated bacterium of genus Legionella
- Naturally found in freshwater environments
- Transmission through inhalation of aerosolized droplets
- Primarily infects the respiratory system and resides in the lungs

Disease: Legionnaire's disease

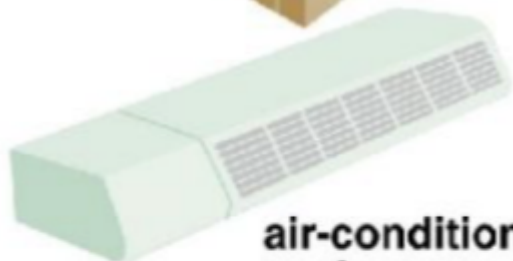
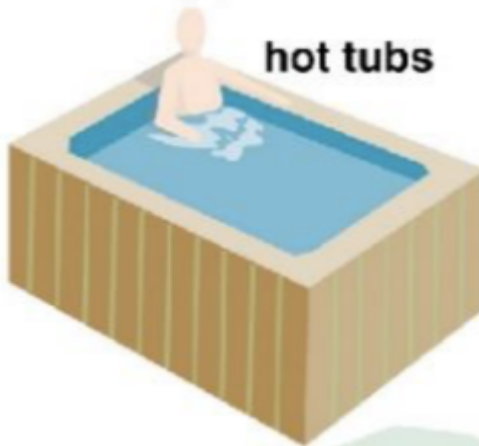


- Atypical pneumonia caused by any type of Legionella bacteria
- Characterized by lung inflammation
- Diagnosis is presumptive, revolving around clinical presentation
- Diagnostic tests include detection of bacteria in coughed up mucus and bacterial culture media
- Treatment with antibiotics

Legionnaires disease

Infection

Caused by bacteria which thrives in warm water and damp places like:

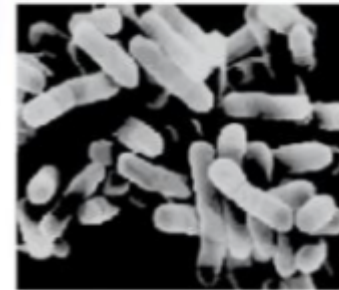


Symptoms



Similar to a severe flu and can include fever, chills, loss of appetite, headache, lethargy

Potentially fatal form of pneumonia



Legionella bacteria

Can not be transmitted from person to person

Treatment

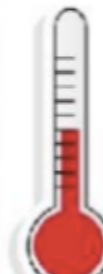
Antibiotics



No vaccine is currently available



Prevention



Water supply systems should be cooled below 20C or heated above 60C



Signs

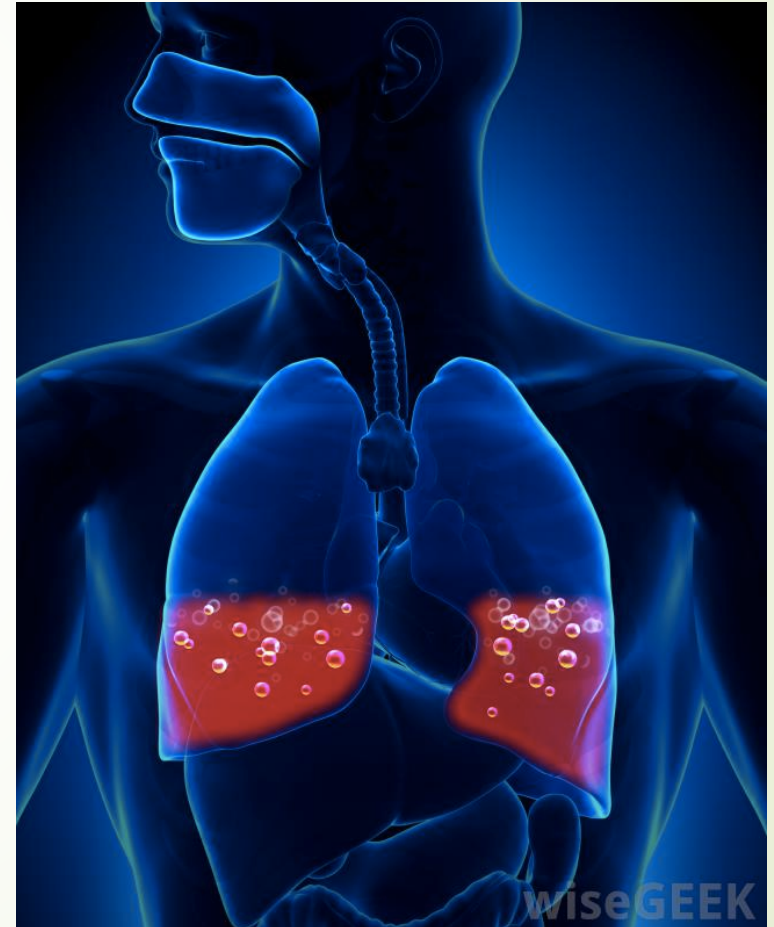
- Shortness of breath
- Cough
- High fever
- Fluid build-up in lungs
- Lung inflammation
- Bacteria in mucus

Symptoms

- Chest pain
- Coughing
- Headaches
- Muscles aches
- Nausea
- Fever / Chills

Disease Complications

- Lung failure
- Kidney failure
- Septic shock
- Multi-organ dysfunction
- Extra pulmonary complications (i.e. Myocarditis, pericarditis, peritonitis)
- Death

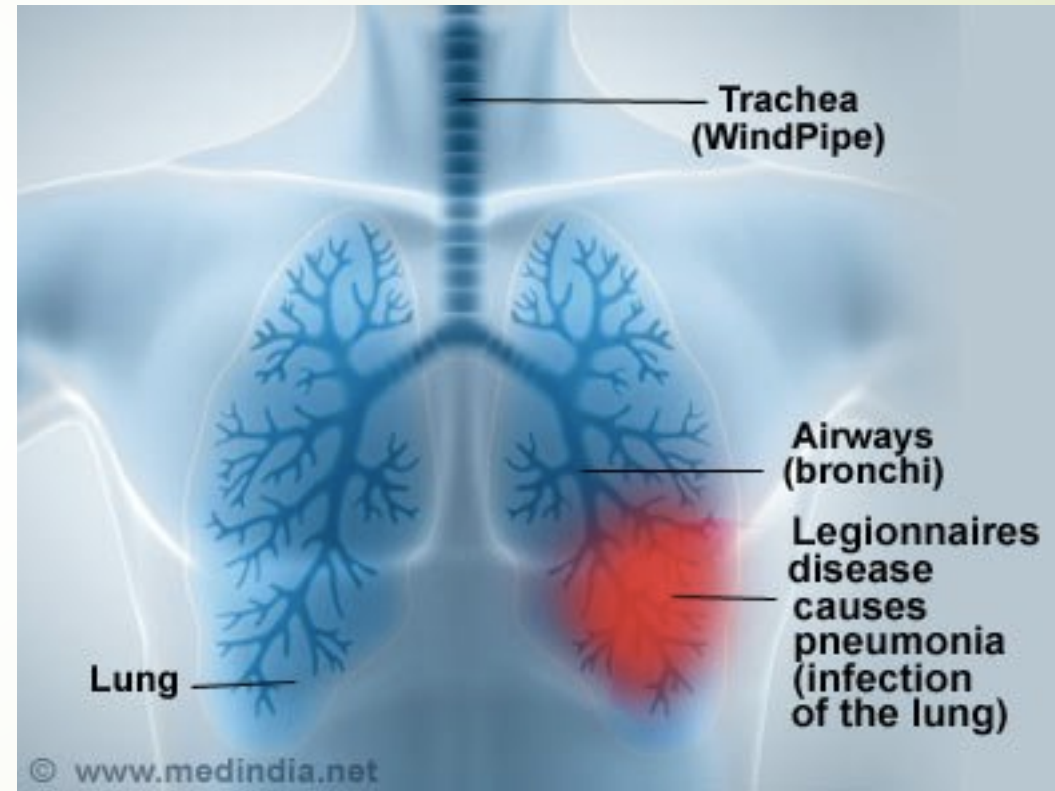




DISTURBANCE

Body Systems Affected

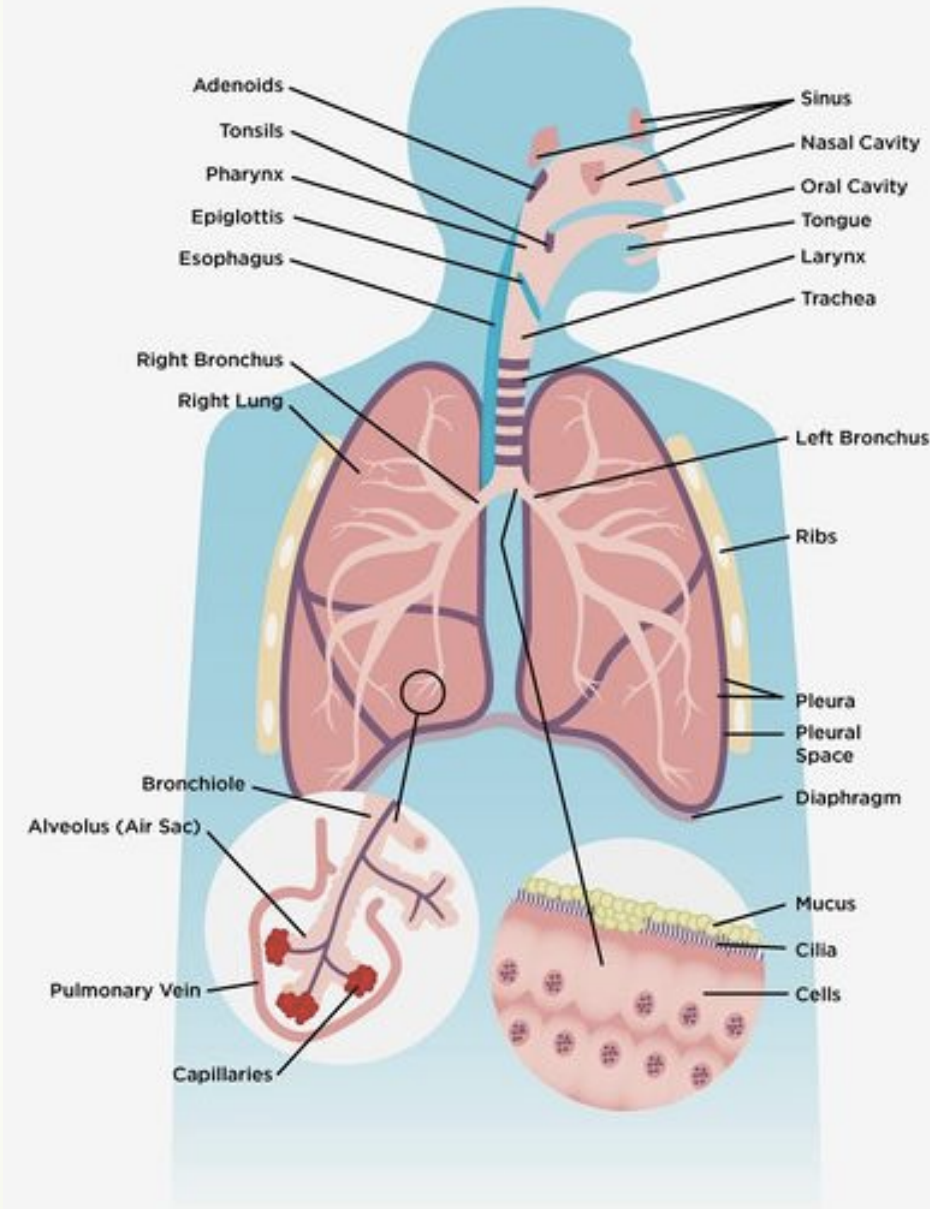
- Entry through inhalation of aerosolized droplets contaminated with Legionella bacteria
- When mucociliary clearance is compromised, bacteria can move past the upper respiratory tract and into the lungs
- Infection primarily infects the respiratory tract, particularly the alveolar macrophages of the lungs



Respiratory Tract

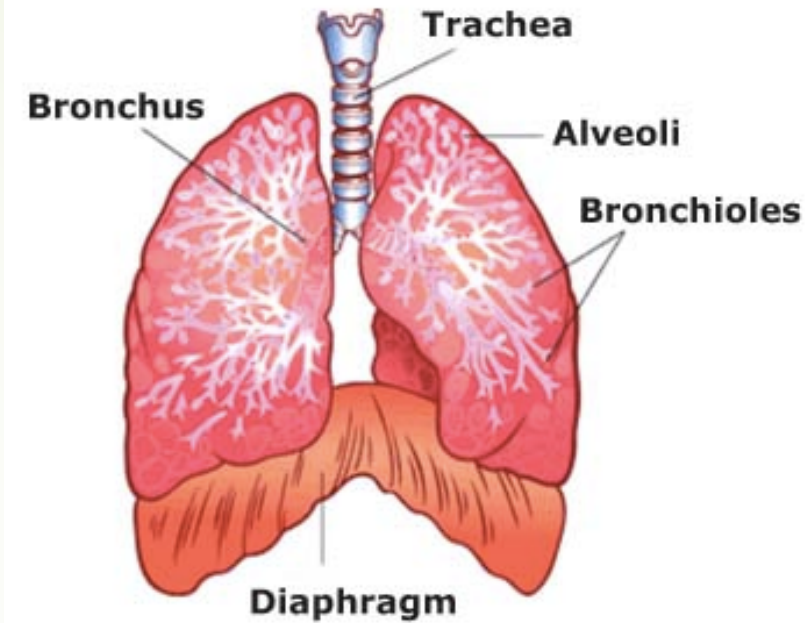
- Primary function: respiration through gas exchange (facilitate the flow of oxygen into the body and carbon dioxide out)
- Main organs included: nose, mouth, nasal and oral cavity, pharynx, larynx, trachea, bronchi, bronchioles, lungs, and alveoli

The Respiratory System

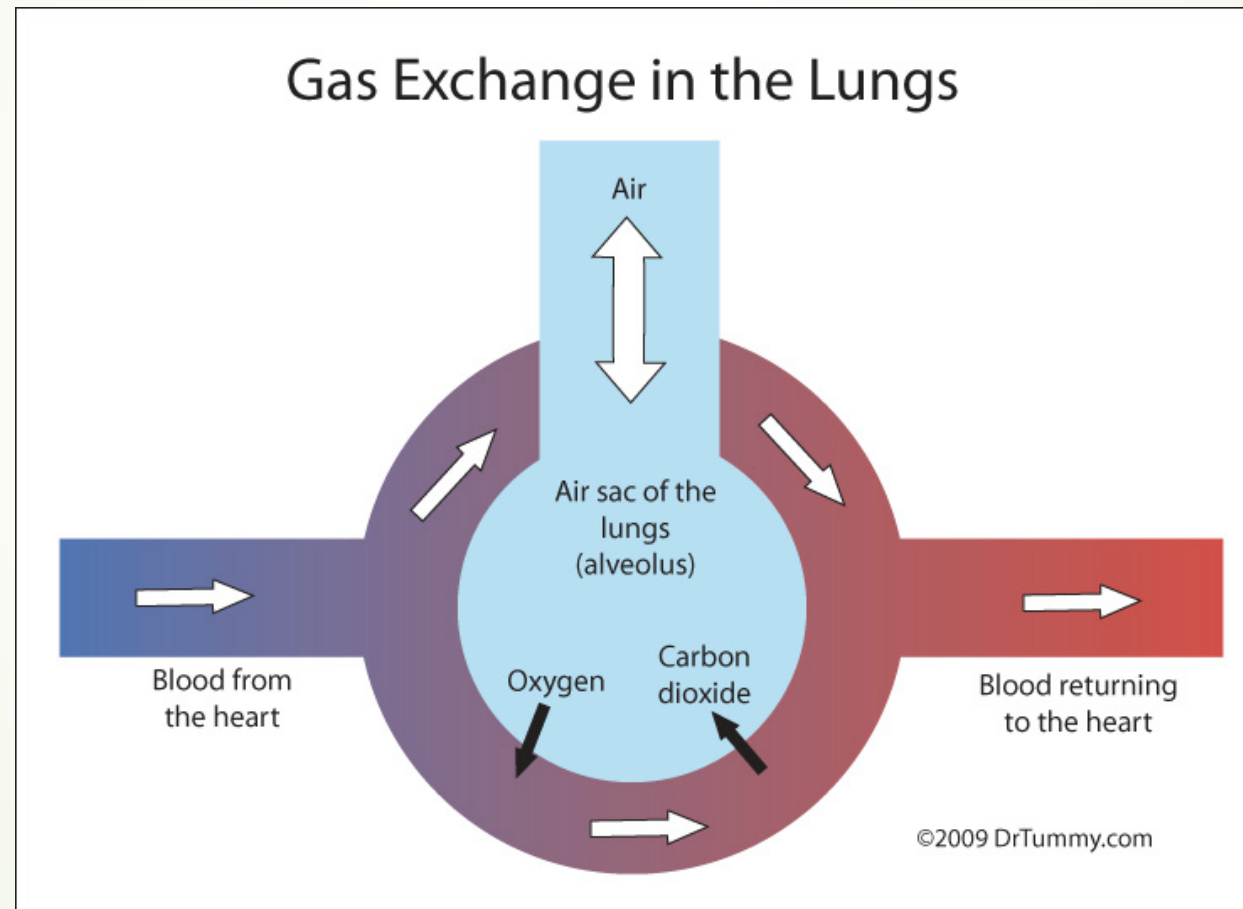


Lungs

- Primary organ of the respiratory system responsible for gas exchange
- Also monitors blood pH and maintains blood pressure
- Alveoli:
 - Tiny sacs at the ends of bronchioles inside lungs
 - Facilitates the entry of oxygen into the blood and carbon dioxide out of the blood
 - Very large total surface area to support effective gas exchange
 - Innervated by capillaries



Lungs: Gas exchange

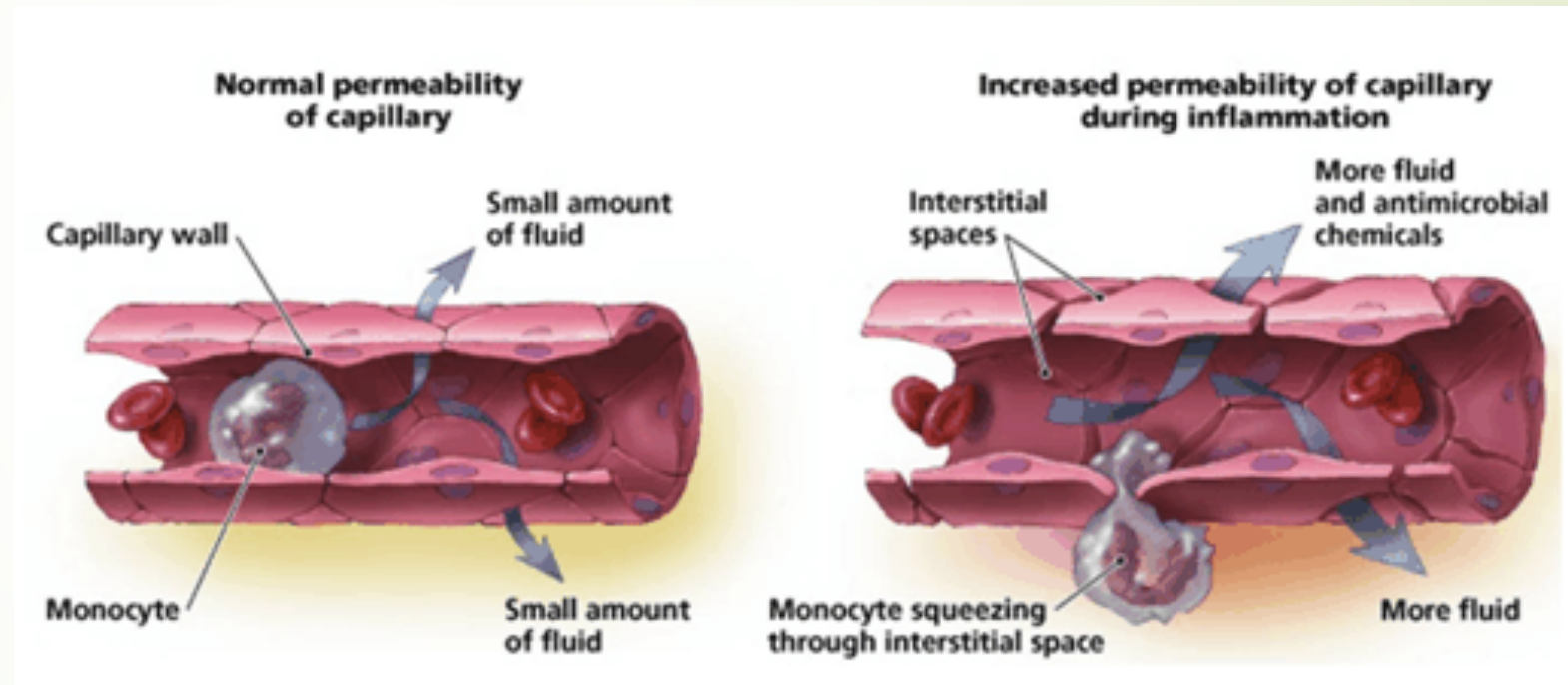
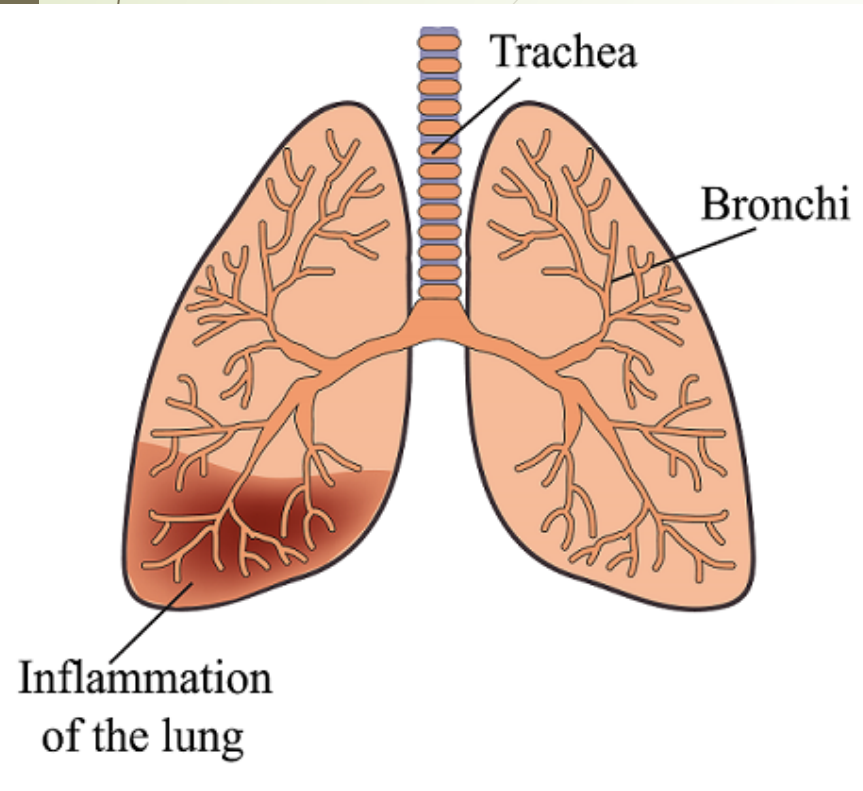




Disease: Disturbance to Lungs

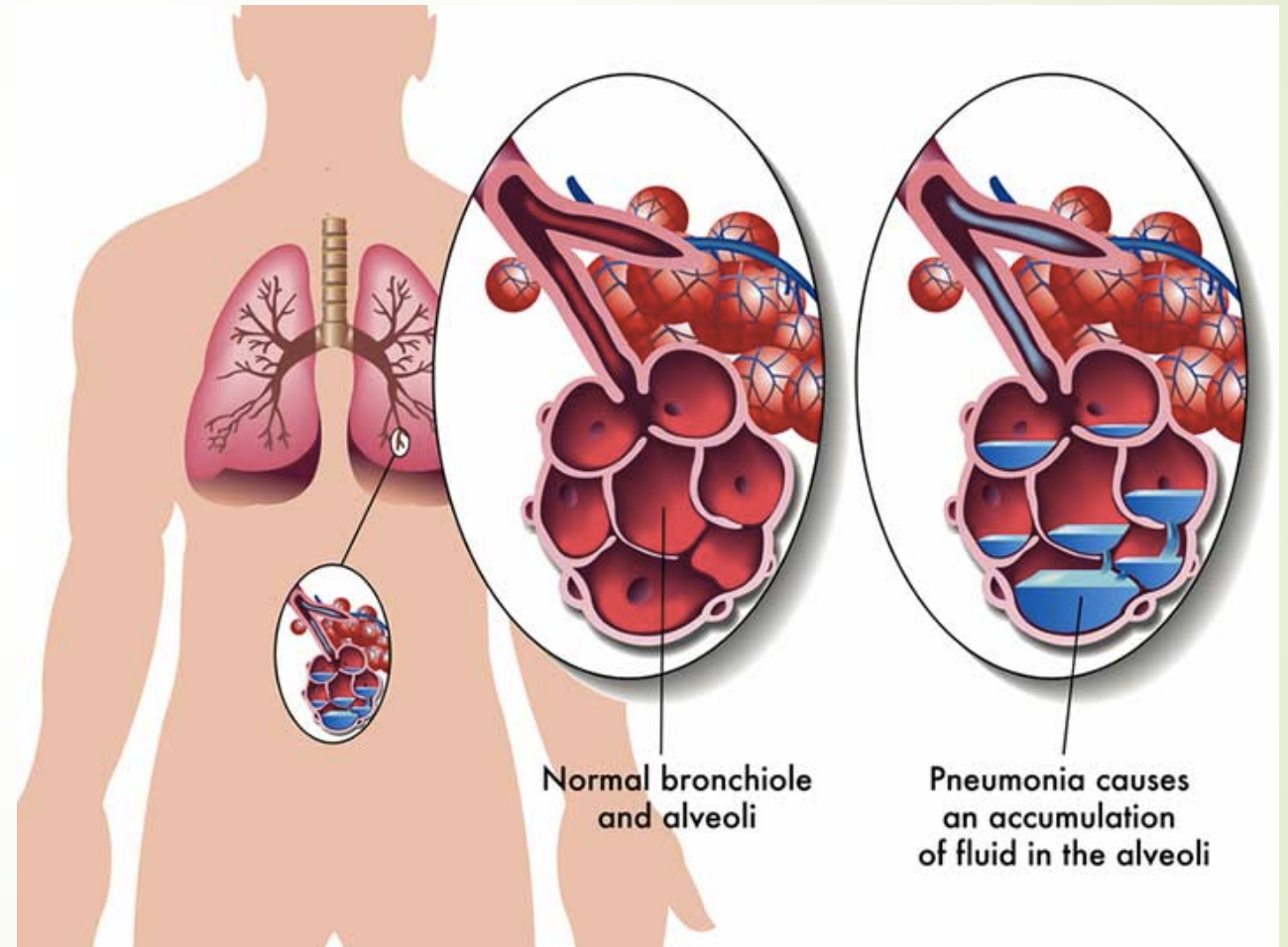
- Infection starts when Legionella make it into the lungs
- Inflammatory response is triggered, causing blood vessels to dilate and become leaky
- Leaky blood vessels result in a buildup of fluid inside the lungs
- Fluid, mucus, and immune cells clog up the lungs, impairing gas exchange
- Flow of oxygen into the bloodstream and flow of carbon dioxide out becomes inefficient
- Decreased flow of oxygen causes decreased function of cells and organs

Disease: Disturbance to Lungs

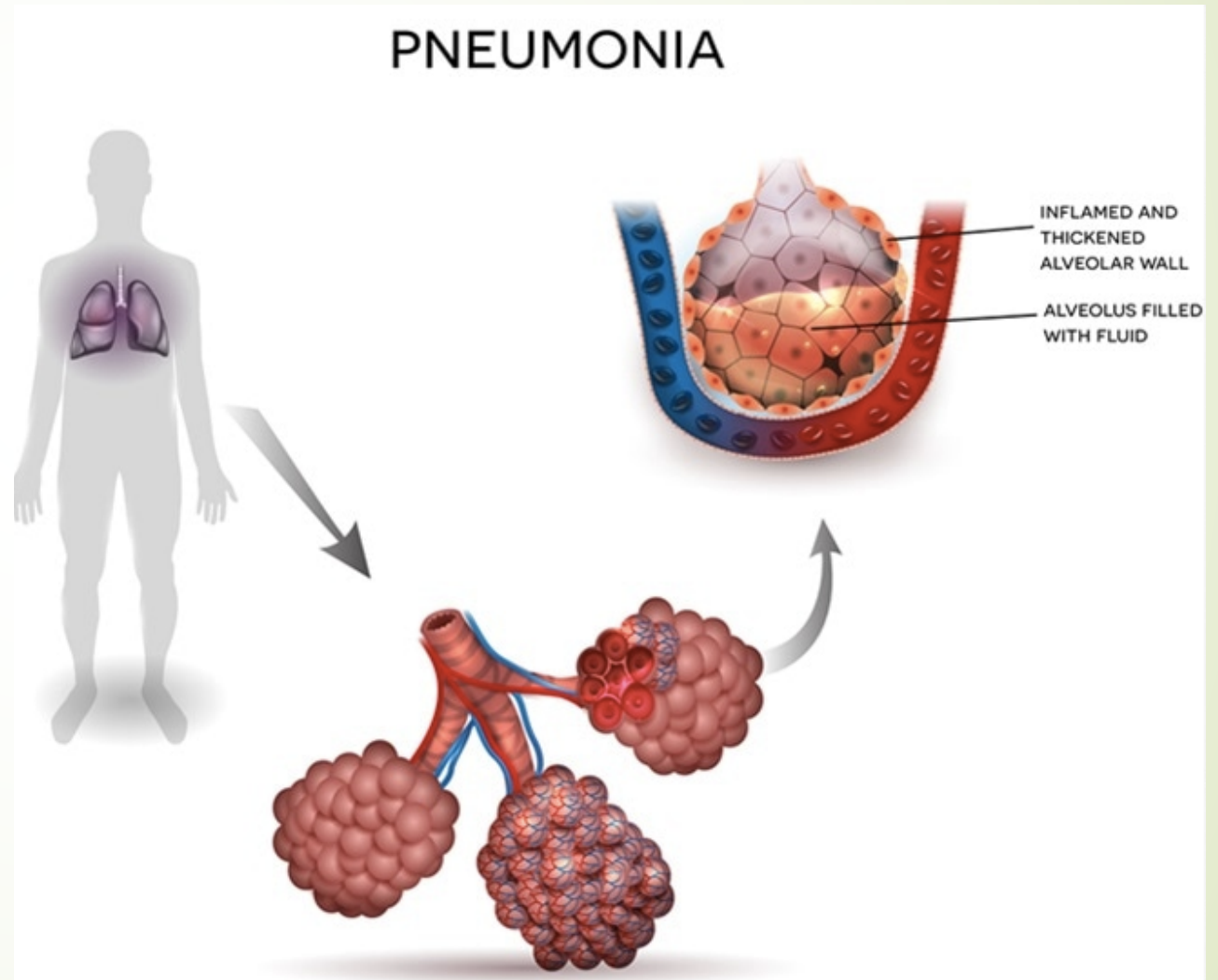
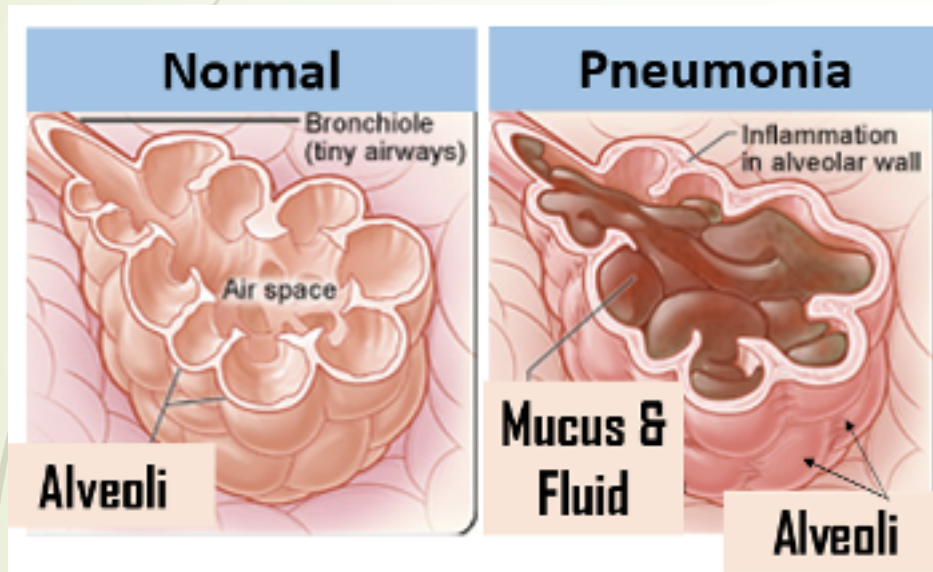


Disease: Disturbance to Alveoli

- Legionella organisms invade alveolar macrophages
- Pneumonia ensues, causing the alveolar sacs to fill up with fluid
- Results in impaired gas exchange and poor oxygenation to blood

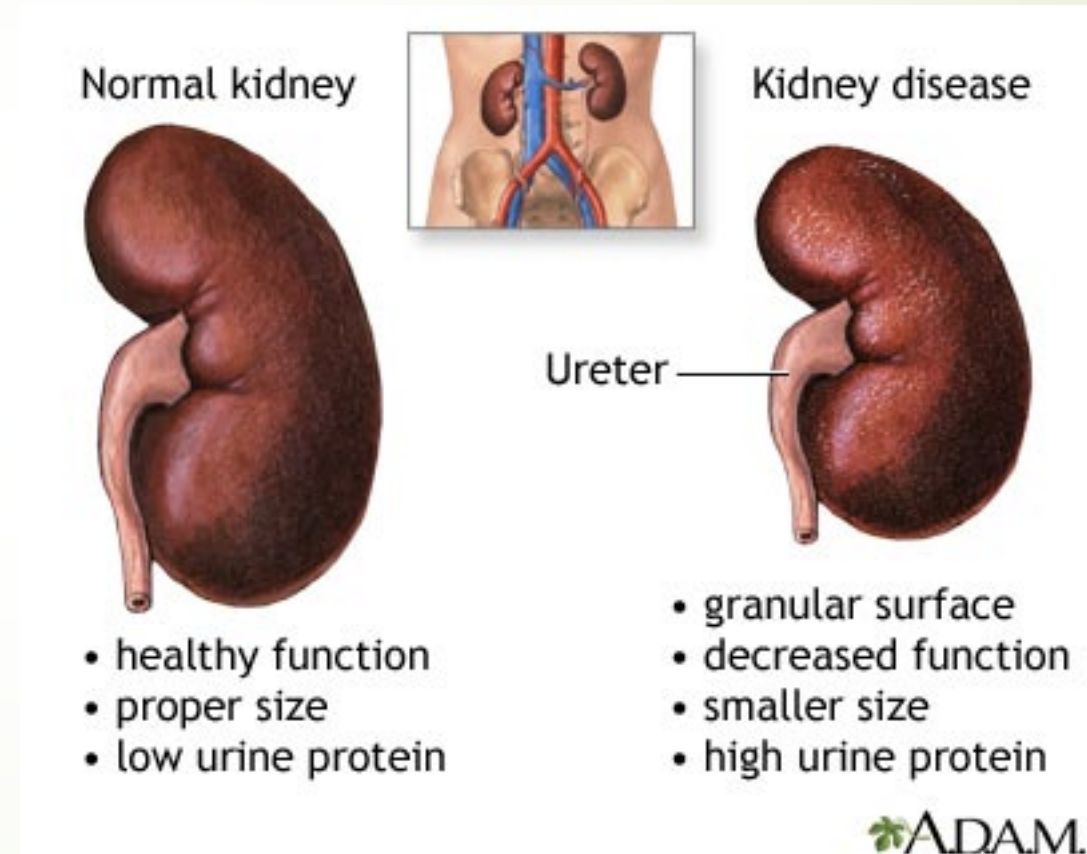


Disease: Disturbance to Alveoli



Disease: Disturbance to Kidneys

- Lack of oxygen flow to kidneys can cause kidney failure
- Results in loss of ability to filter waste out of the blood





Disease: Susceptibility

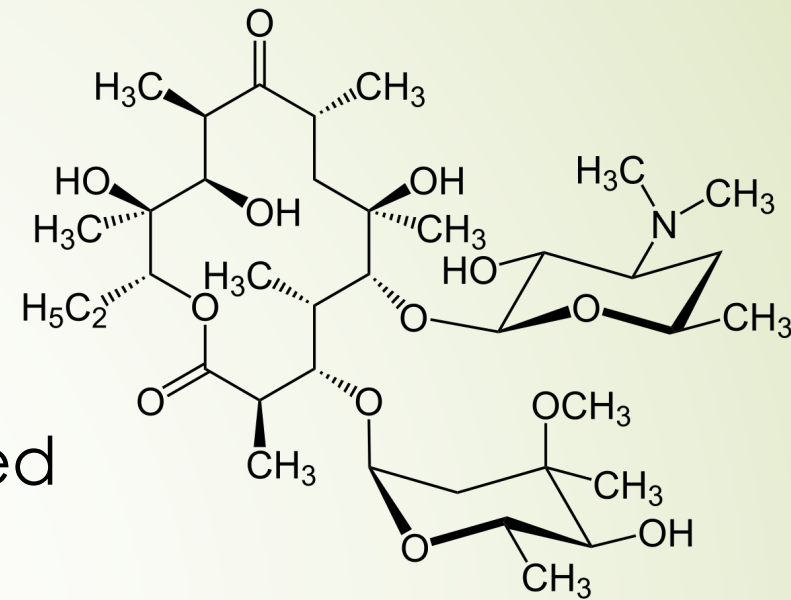
- Use of corticosteroid nebulizer and the occurrence of asthma
- Corticosteroids found to cause a more diffuse pneumonia, persistent neutrophil exudate, and failure to recruit lymphocytes
- Individuals with chronic diseases like lung disease and diabetes
- Individuals with a weakened immune system with compromised mucociliary clearance



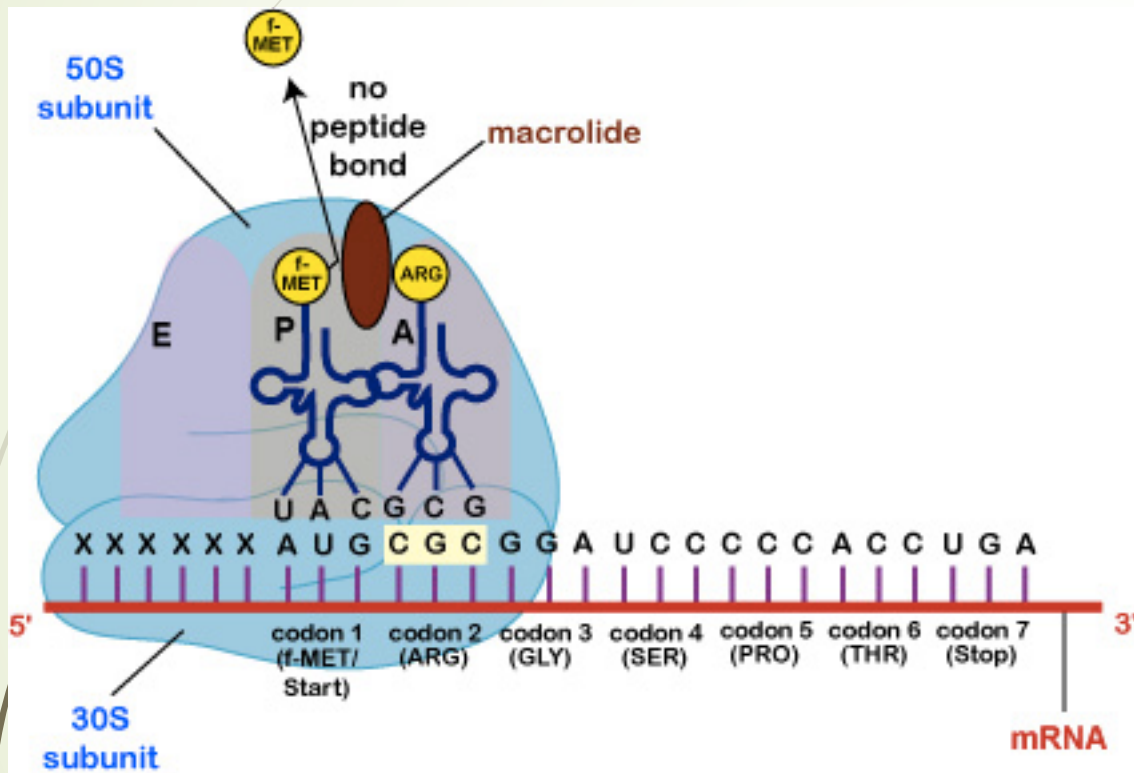
TREATMENT

Treatment: Erythromycin

- Semisynthetic macrolide antibiotic used to treat a wide variety of bacterial infections
- Bacteriostatic against many gram-positive bacteria
- Broad-spectrum antibiotic
- Works by inhibiting the growth of bacteria

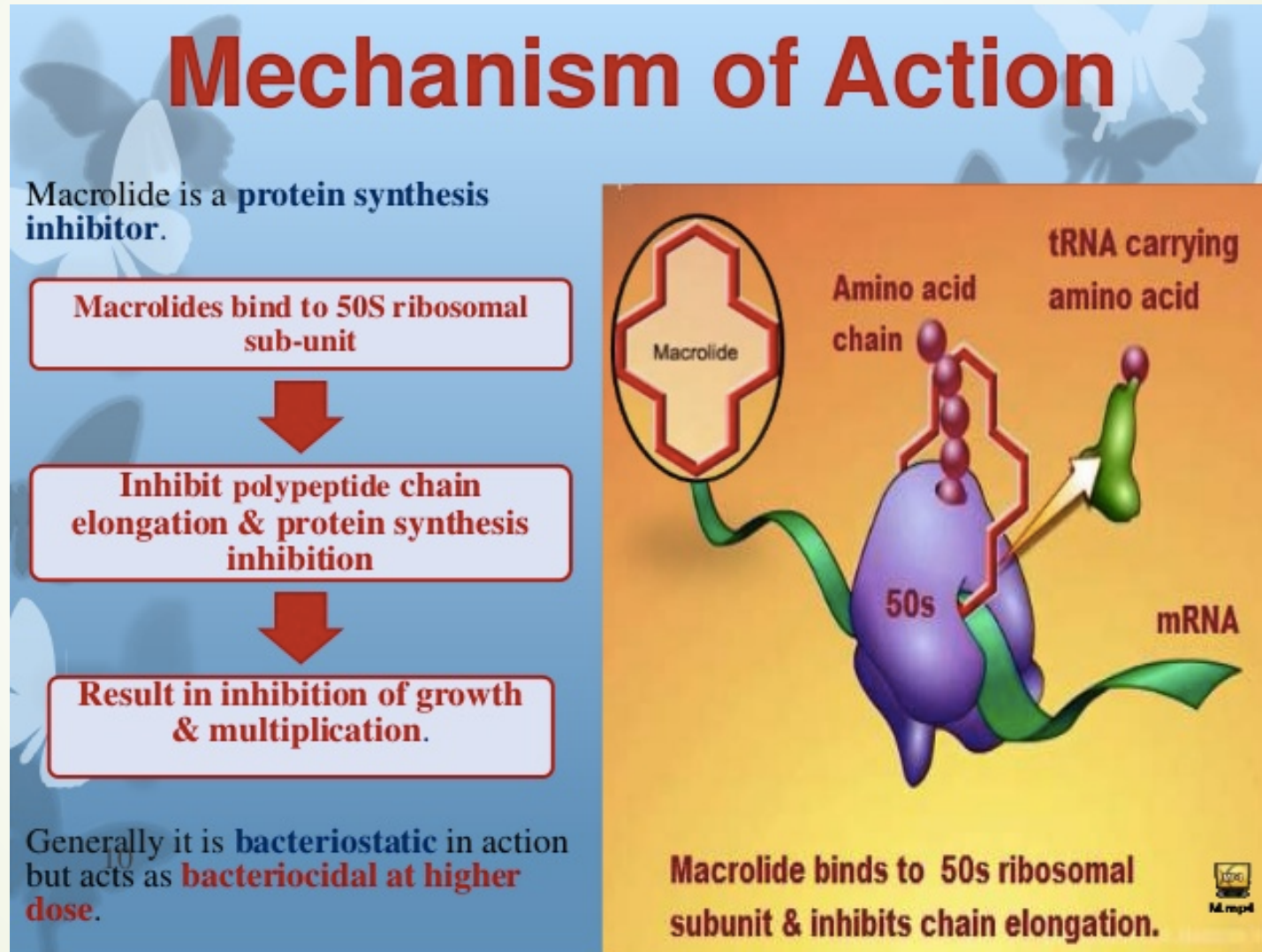


Erythromycin: Mechanism of Action



1. Bind to peptidyl transferase center of bacterial 50S ribosomal subunit
2. Blocks the exit of the growing peptide chain
3. Leads to production of incomplete peptide chains
4. Cell death

Erythromycin: Mechanism of Action



Erythromycin: Dosage

250 mg every 6 hours,

333 mg every 8 hours **OR**

500 mg every 12 hours

*Doses may increase up to 4 g/day,
depending on the severity of the infection





Erythromycin: Side Effects

- Mild: Nausea, vomiting, diarrhea, abdominal pain, and loss of appetite
- Severe: signs of liver disease, muscle weakness, slurred speech, blurred vision, and hearing loss



Treatment: Other Antibiotics

- Other macrolides
 - Azithromycin, clarithromycin
 - MOA: similar to Erythromycin
- Fluoroquinolones
 - Levofloxacin, moxifloxacin
 - MOA: Inhibition of DNA gyrase and topoisomerase IV enzymes
- Tetracyclines
 - Doxycycline
 - MOA: Inhibit bacterial protein synthesis by binding irreversibly to 30S ribosomal subunit



OUTBREAK



Outbreak



What is an outbreak?

The occurrence of more disease cases than would be expected in a given area considering a specific group of people over a particular period of time.

Legionnaire's disease can be labeled as an outbreak once there has been at least two people that have been exposed to Legionella.

In the case study, Tom can be considered a localized outbreak

Outbreak: Reporting

- Refer to state and local health departments to investigate outbreak and implement control measures
- Inform Public Health Agency of Canada
- Public Health Agency of Canada
 - Act on health public matters
 - Health promotion
 - Prevention of chronic disease and injuries
 - Respond to public health emergencies



Public Health
Agency of Canada

Agence de la santé
publique du Canada

Outbreak: Where?

- Legionella bacteria are associated with bodies of water
- Outbreaks can occur in hot springs, lakes, spas, and on cruises
- Potential areas on the cruises: showers, bathtubs, or recreational water systems



Role of hot tub in Case Study

- Hot tub acted as a water reservoir for *L. pneumophila*
- Bacteria resided in hot tub environment
- Contaminated users of the hot tub





END