Diseases of Respiratory system

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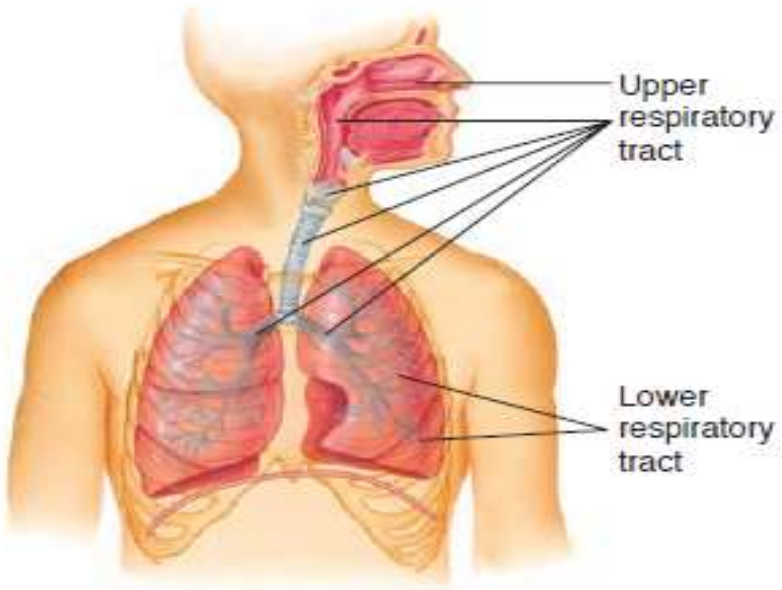
Respiratory system

- The **respiratory system consists of:**

1. **the upper respiratory tract—consisting of the nasal cavity, pharynx,** larynx, trachea, and bronchi
2. **lower respiratory tract—composed** of the lungs

This entire system is lined with moist epithelium. However, in the upper respiratory tract epithelium contains mucus-secreting cells and is covered with cilia.



Respiratory system defence mechanisms

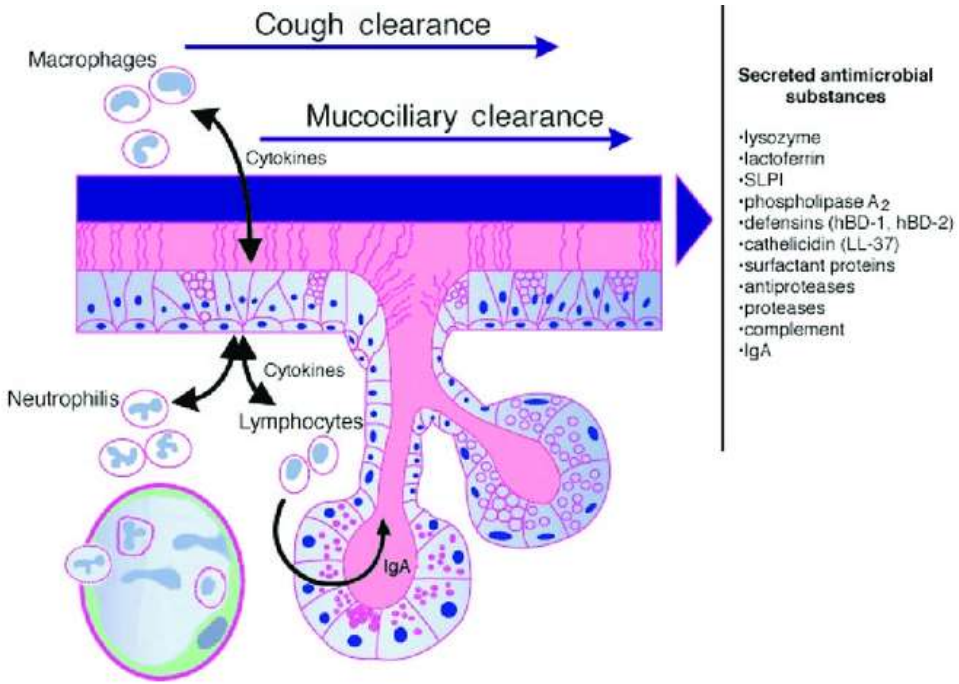
- Some microorganisms and particles breathed in are removed by hairs and mucus as the air passes through the **nasal cavity.**
- The upper respiratory tract contains a variety of normal microflora that help prevent infection by pathogens that may be inhaled.

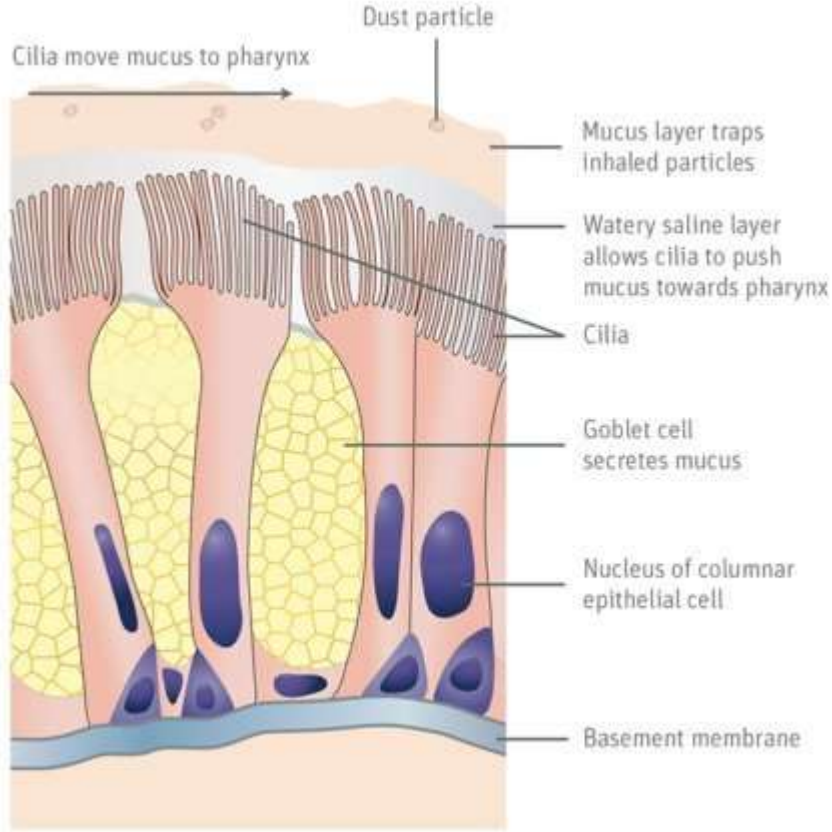
- Upper resp tract normal flora: Staph. epidermidis, corynebacteria & S. aureus
- mucus from the membranes that line the nasal cavity and pharynx traps microorganisms and most particles of debris.
- Coughing and sneezing mechanically agitate mucus, increasing exposure of microorganisms to mucus and helping to expel them.

Respiratory system defence mechanisms

- Mucociliary escalator: allows materials in the bronchi to be lifted to the pharynx and to be spit out or swallowed.
- Macrophages in alveoli engulf particles & microbes.
- Epiglottis closes during swallowing & prevent organisms in secretions to enter the larynx then to lungs

Respiratory system defence mechanisms





DISEASES OF THE UPPER RESPIRATORY TRACT

Pharyngitis and Related Infections

- **Pharyngitis, or sore throat, is an infection of the pharynx.** It is frequently caused by a virus but is sometimes bacterial in origin.
- **Streptococcal Pharyngitis mainly . Less than 10% of cases** of pharyngitis are caused by the group A β-hemolytic *Streptococcus pyogenes* most common in children but seen in adults.
- Transmission: inhaling droplet from active cases or healthy carriers.

Pharyngitis and Related Infections

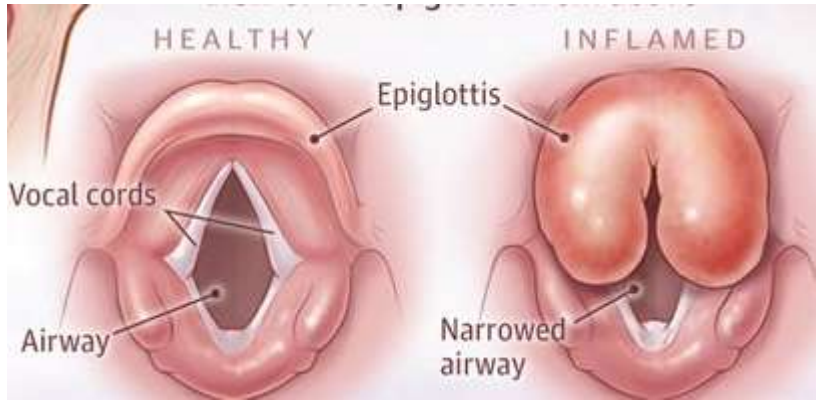
- Symptoms: throat inflamed, lymph nodes in the neck swell, tonsils become tender with white pus filled lesion. Chills, headache, acute throat soreness upon swallowing & often nausea & vomiting, high fever. Absence of cough & nasal discharge distinguish strep throat from common cold.

- Immediate treatment is important. If treatment is delayed, *S. pyogenes can interact with the immune system* and give rise to rheumatic fever or cause kidney damage (glomerulonephritis) occurs in 3% of untreated cases.
- For this reason Treatment with penicillin or one of its derivatives is often begun

DISEASES OF THE UPPER RESPIRATORY TRACT

- **Laryngitis and Epiglottitis.**
- **Laryngitis can be caused** by bacteria such as *Haemophilus influenzae and Streptococcus pneumoniae, by viruses alone, or by a combination.*

- Acute epiglottitis was almost invariably caused by *H. influenzaena.*
- Inflammation of the tissues rapidly closes the airway, causing difficulty in breathing or even death



DISEASES OF THE UPPER RESPIRATORY TRACT

- **Sinusitis**
- There are two main types of sinus infections, chronic (lasting over 3 months) and acute (one month in duration).
- More than half the cases of acute sinusitis are caused by bacteria, such as *Streptococcus pneumoniae or H. influenzae, but some cases are caused by Staphylococcus aureus or Streptococcus pyogenes.*

- Swelling of sinus cavity lining prevents drainage of mucous → causes pressure, severe pain & accumulation of mucus which encourage bacterial growth. Secretions, bacteria &phagocytic cells accumulate in sinuses.

DISEASES OF THE UPPER RESPIRATORY TRACT

Sinusitis

Treatment

- If symptoms are severe, antibiotics are given in concern with intranasal corticosteroids, as well as nasal decongestants.
- Amoxicillin is the drug of choice, but if resistance is a concern, then amoxicillin-clavulanate (Augmentin) is used.

DISEASES OF THE UPPER RESPIRATORY TRACT

- **Common cold** is a **viral infection** of the upper respiratory tract, including some or all of the following structures: the nose, throat, sinuses, eustachian tubes, trachea, and larynx.
- Rhinoviruses (more than 100 serotypes) are the most common aetiology (up to 50%).

- Cold viruses present year round, but most infections occur in early fall or early spring. After an incubation period of 2 to 4 days, signs and symptoms such as sneezing, inflammation of mucous membranes, excessive mucus secretion, and airway obstruction appear. Sore throat, malaise, headache, cough, and occasionally tracheobronchitis occur.

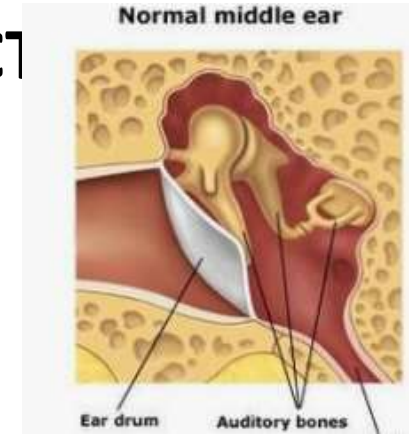
DISEASES OF THE UPPER RESPIRATORY TRACT

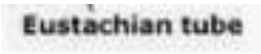
- **Common cold**
- Transmission: rhinovirus is transmitted mainly by handling contaminated objects more than by close contact with diseased person

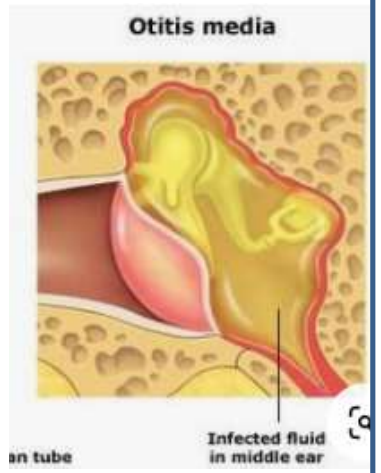
- Treatment: Symptomatic strategies include oral decongestants. If used for more than a few days, nasal sprays may be associated with rebound congestion after stopping

DISEASES OF THE UPPER RESPIRATORY TRACT

- **OTITIS MEDIA:** is an infection of the middle ear caused by either viruses or bacteria.
- Any process that leads to eustachian tube obstruction can result in fluid retention and concomitant infection of the middle ear.
- *Streptococcus pneumoniae, S. pyogenes,* and , *Haemophilus influenzae* account for about half of acute cases.







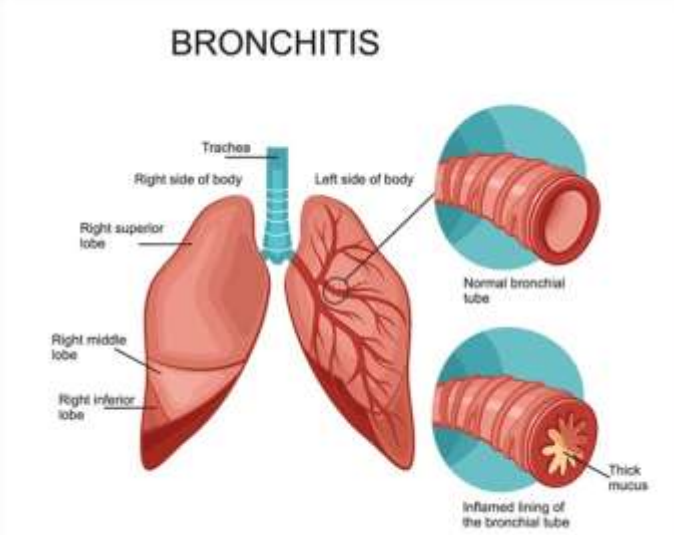
- Patients present with ear pain and pressure, often accompanied by an upper respiratory tract infection.

- **Treatment**

Amoxicillin orally is usually the drug of choice together with nasal decongestants to open the eustachian tube. In cases of bacterial resistance, amoxicillin-clavulanate (Augmentin) may be used.

DISEASES OF THE UPPER RESPIRATORY TRACT

- **Bronchitis** involves the bronchi and bronchioles but does not extend into the alveoli.
- It is most common in older people and is linked to smoking, air pollution.
- **Causative** agents include *Streptococcus pneumoniae, Mycoplasma pneumoniae, and various species of Haemophilus.*
- Infections can spread to the alveoli of the lung and cause pneumonia. By the time respiratory membranes may have been permanently damaged.
- Antibiotics should be used only in those for whom a bacterial etiology has been clearly demonstrated.



DISEASES OF THE LOWER RESPIRATORY

- **Pneumonia,** an inflammation of lung tissue, can be caused by bacteria, viruses, fungi, certain helminths, chemicals, and some allergies.

- Infectious forms of the disease develop when pathogens that are able to evade upper respiratory defenses are inhaled. → They initiate the process by colonizing the upper respiratory tract → entering the lower respiratory tract accidentally during a deep breath or suppressed cough, or by means of a large amount of mucus → infect cells and multiply.

- Mainly caused by Strep. pneumoniae (Pneumococcus), Staph. aureus, Klebsiella pneumoniae, Mycoplasma pneumoniae & pseudomonas aeruginosa .

DISEASES OF THE LOWER RESPIRATORY

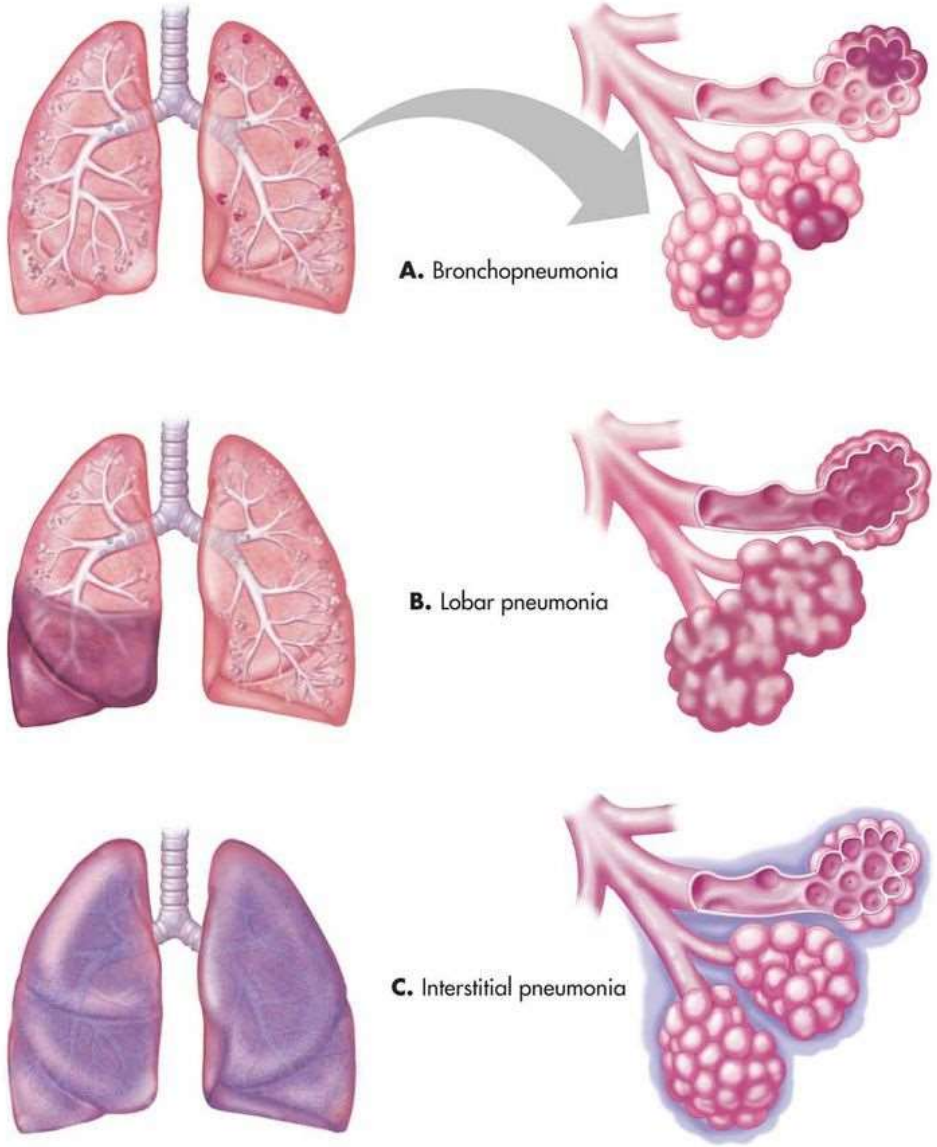
- **Classification of Pneumonias. Pneumonias are classified** by site of infection as lobar or bronchial.

- **Transmission. Both lobar and bronchial pneumonia** are transmitted by respiratory droplets and, in the winter, by carries who have contact with infected people (healthcare workers).

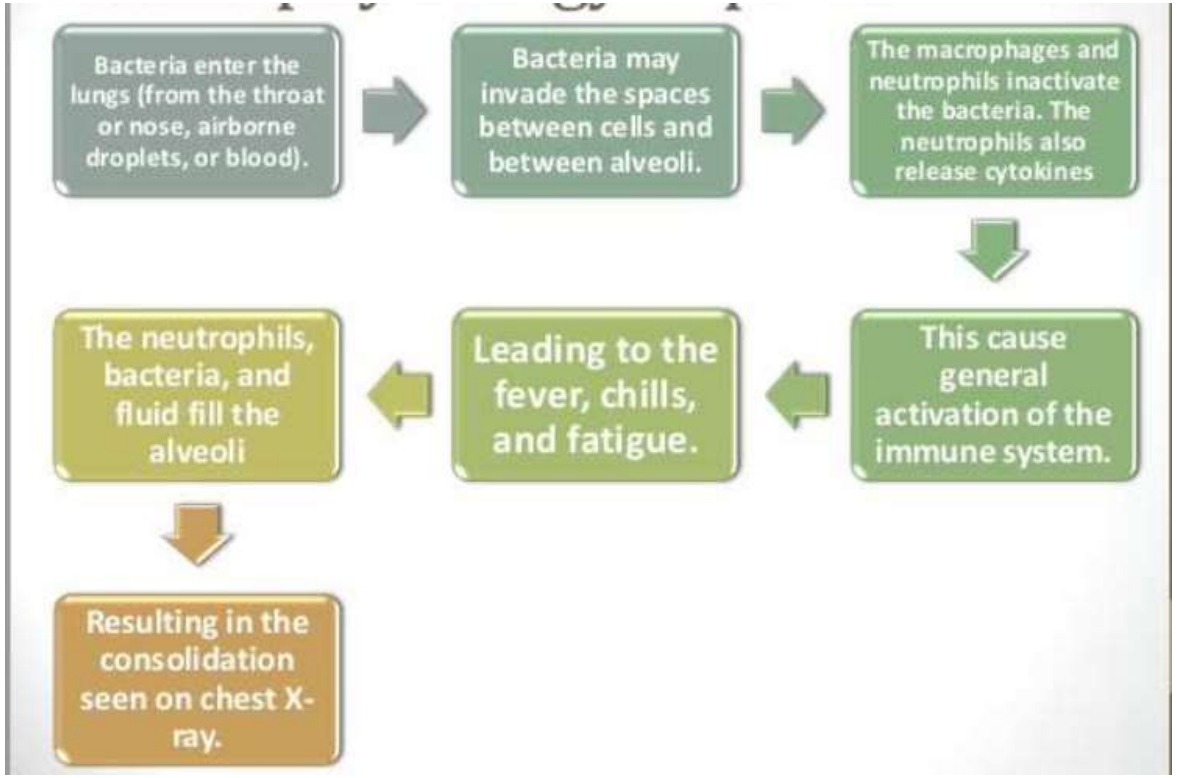
- Symptoms include cough that may be productive of sputum, fever, chills, and shortness of breath.

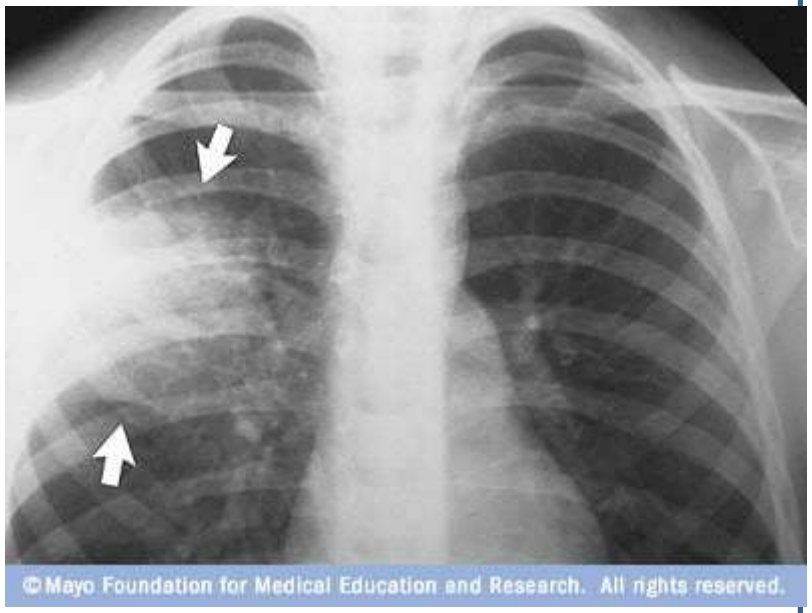
- Klebsiella pneumoniae causes more severe pneumonia with high mortality rate. It can lead to chronic ulcerative lesions in the lungs and extensive destruction of lung tissue

Pneumonia


A. Bronchopneumonia
B. Lobar pneumonia
C. Interstitial pneumonia

Patho-physiology of pneumonia





DISEASES OF THE LOWER RESPIRATORY

- **Diagnosis:** of pneumonia is based on clinical observations, X-rays, or sputum culture.

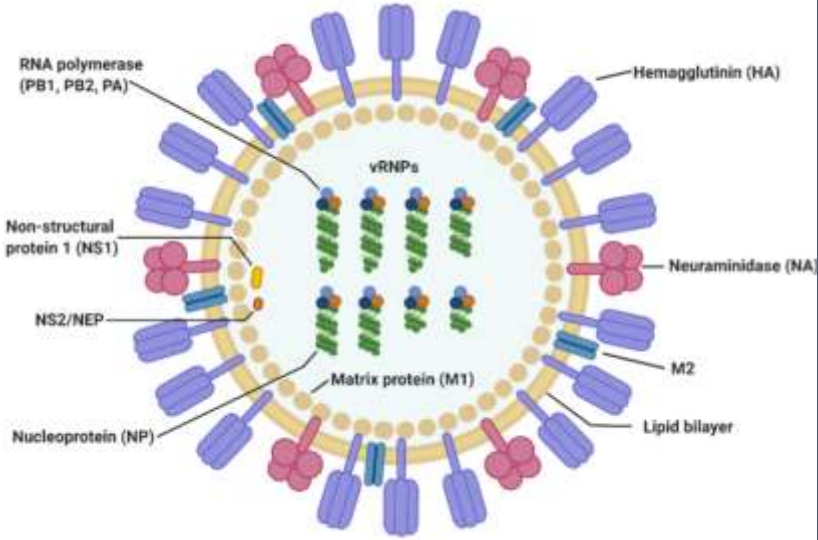
- **Treatment** *:* Klebsiella pneumonia is usually treated with cephalosporins. Penicillin is the drug of choice for treatment of pneumococcal pneumonia; but due to resistance, third-generation cephalosporin, or a fluoroquinolone such as levofloxacin.
- **Prevention**: Immunity is short. However, The pneumococcal polysaccharide (nonconjugate) vaccine available for older adults is important

DISEASES OF THE LOWER RESPIRATORY

- **Mycoplasma Pneumonia** One of the tiniest bacterial pathogens known, Mycoplasma pneumoniae ordinarily causes mild, and sometimes inapparent, upper respiratory tract infections.
- it causes **primary atypical pneumonia as** atypical because the symptoms are different from those of classic pneumonia.
- Some patients have no signs or symptoms related to their respiratory tract—only fever and malaise**.**
- The mortality rate is less than 0.1%.
- Treatment: Azithromycin (Macrolides) or a fluoroquinolones are the drugs of choice. Penicillins have no effect.

DISEASES OF THE LOWER RESPIRATORY

- **Influenza** is caused by **orthomyxoviruses.** These RNA viruses have an envelope surface hemagglutinin (H) that is responsible for their infectivity → attachment to host receptors
- Some viruses have enzyme neuraminidase (N) →helps in penetrating the mucus layer that protecting respiratory epithelium.



- On the basis of their nucleoprotein antigens, three major influenza virus serotypes are recognized: types A, B, and C.

DISEASES OF THE LOWER RESPIRATORY

- H & N determine the Subtypes & are strain specific (e.g **H1N1** - sometimes called “swine flu”)

- Influenza viruses have a tendency to undergo **antigenic variations (*changeability), or mutations that*** affect viral antigens. Thus, immunity developed through infection with one influenza virus is often insufficient to prevent infection by a variant.

DISEASES OF THE LOWER RESPIRATORY

- Disease: The invading viruses multiply and spread quickly to other portions of the respiratory tract, including mucus-secreting and ciliated epithelial cells. → The cilia are destroyed → the cells are damaged. Severely damaged cells die and are sloughed.

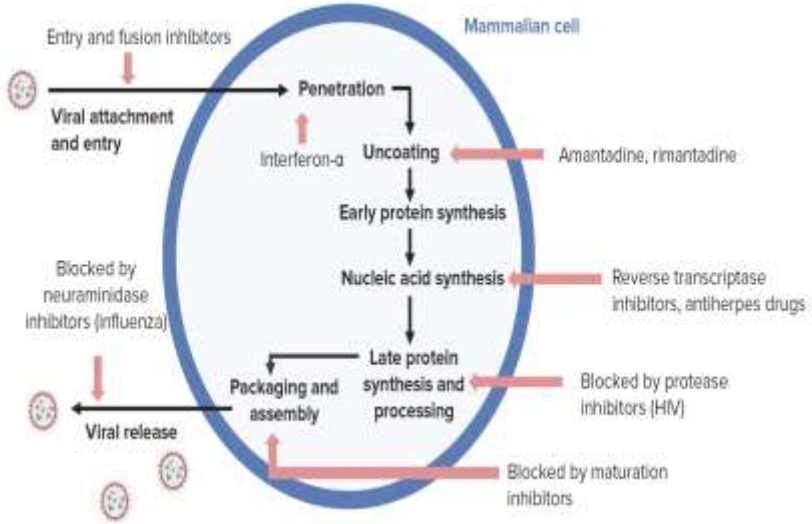
- Loss of the mucociliary action , the major host defense, allows bacterial invasion and enhanced adherence of bacteria to virus-infected cells.

- Impaired phagocytosis and accumulation of fluid in the lungs add to the risk of secondary bacterial infections, especially pneumonia. Death can result from influenza alone, secondary bacterial infection alone, or a combination.

DISEASES OF THE LOWER RESPIRATORY

- **Diagnosis and Treatment. The best specimens for** isolation of viruses are throat swabs taken as early in the illness as possible.
- The drug amantadine blocks influenza A virus replication, probably by interfering with uncoating.

- **Immunity and Prevention.** Because of influenza viruses' ability to mutate, annual immunization is recommended, especially for high-risk persons, such as those with chronic conditions.



The cycle of influenzas virus

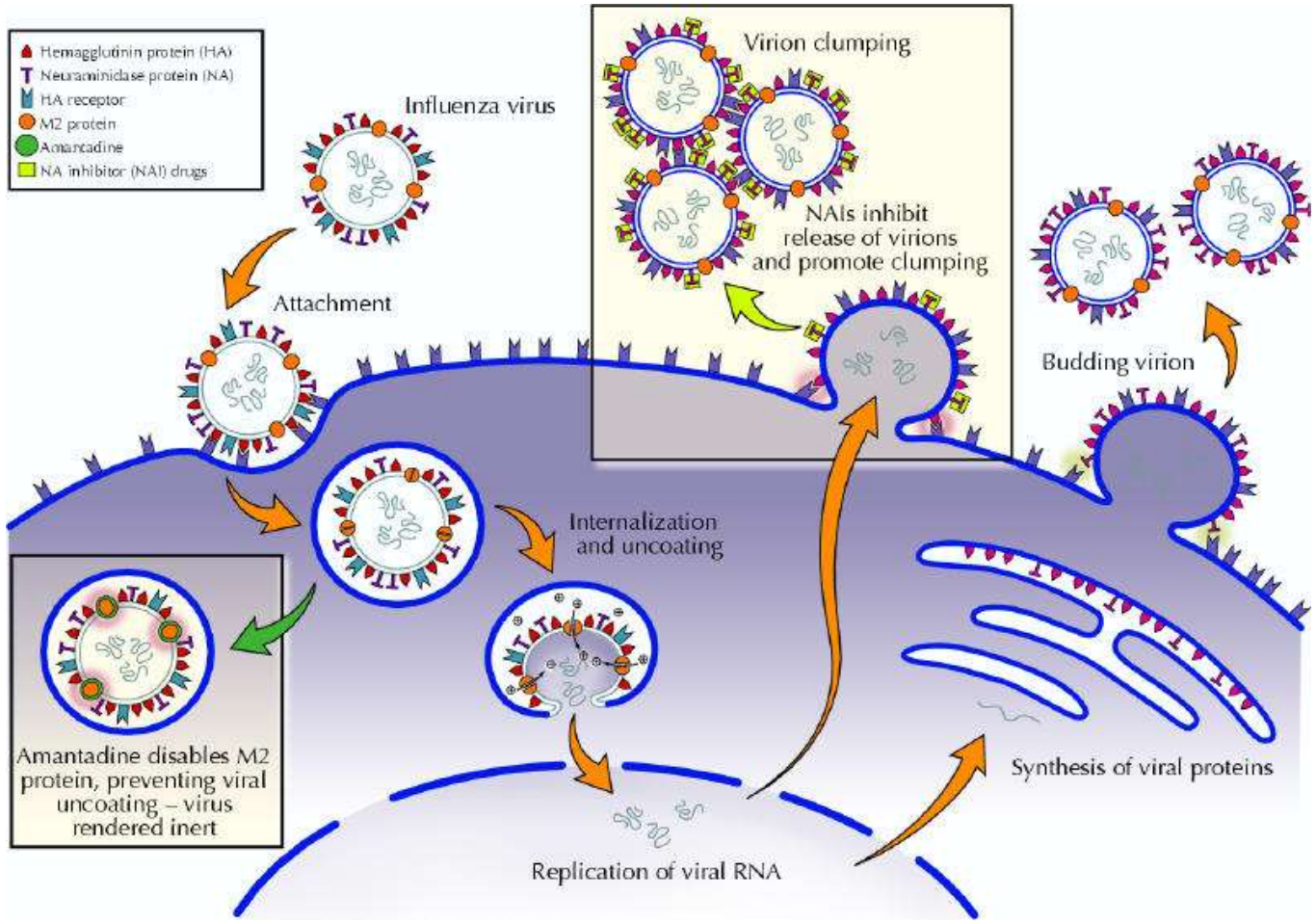


Table 21.3 Differences Among a Common Cold, Influenza, and Pneumonia

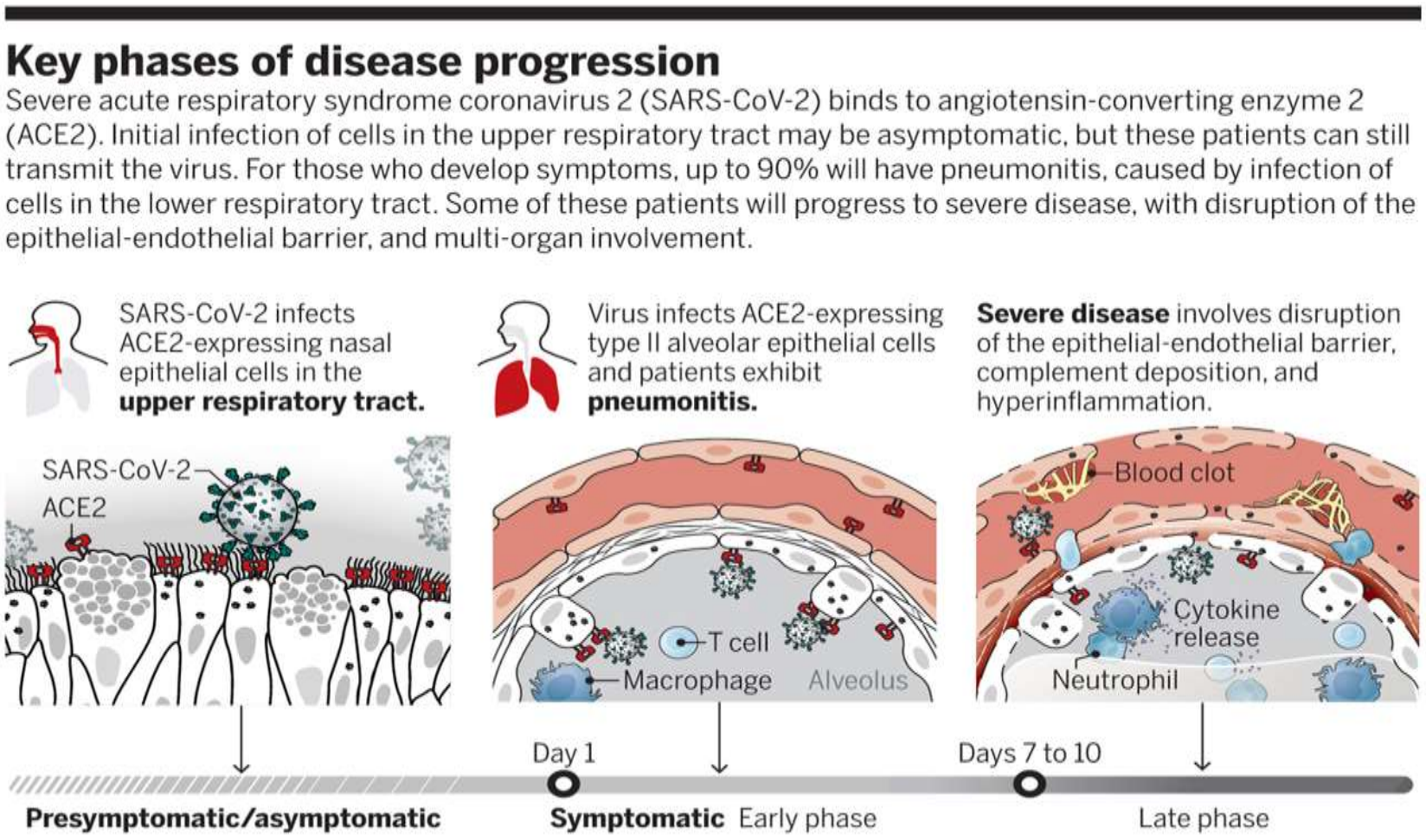
Symptoms	Cold	Influenza	Pneumonia
Fever	Rare	Characteristic high (100.4°–104°F) sudden onset, lasts 3 to 4 days	May or may not be high
Headache	Occasional	Prominent	Occasional
General aches and pains	Slight	Usual; often quite severe	Occasionally quite severe
Fatigue and weakness	Quite mild	Extreme; can last up to a month	May occur, depending on type
Exhaustion	Never	May occur early and prominent	May occur, depending on type
Runny, stuffy nose	Common	Sometimes	Not characteristic
Sneezing	Usual	Sometimes	Not characteristic
Sore throat	Common	Sometimes	Not characteristic
Chest discomfort, cough	Mild to moderate; hacking cough	Can become severe	Frequent and may be severe
Complications	Sinus and ear infections	Bronchitis, pneumonia; can be life-threatening	Widespread infections of other organs; can be life-threatening, especially in elderly and debilitated persons

DISEASES OF THE LOWER RESPIRATORY

- **Coronavirus disease 2019** is contagious disease caused by sever acute respiratory syndrome coronavirus 2 (SARS-CoV-2).
- On average it takes 5–6 days from when someone is infected with the virus for symptoms to show, however it can take up to 14 days. While most people have mild symptoms, some people develop acute respiratory distress syndrome (ARDS). ARDS can be precipitated by cytokine storms, multi-organ failure, septic shock, and blood clots.

- The virus is spread by close contact with an infected. person, usually by exhaled or coughed aerosol droplets. People touching contaminated objects or surfaces, who then touched their nose, mouth, or eyes, became infected

How does SARS-CoV-2 cause COVID-19



COVID vs. Flu vs. Common Cold: **What You Need to Know**

VIRUS	LEVEL OF INFECTIVITY	TIME FROM EXPOSURE TO INFECTION	SYMPTOMS	PREVALENCE IN CHILDREN	VACCINE AVAILABILITY
 **COMMON COLD** *Rhinovirus*	Less contagious Symptomatic individuals shed the virus during the first 2 to 3 days of infection.	2 to 3 days	Cough Low-grade fever Sneezing Sore throat Stuffy nose	Common Most children experience 2 to 4 colds per year; frequently associated with asthma exacerbations.	None
 **SEASONAL INFLUENZA** *Influenza virus (A and B)*	Contagious Viral shedding occurs 24 hours before symptoms appear, peaking around day 3 of illness.	1 to 4 days	Body aches Chills Cough Fatigue Fever Headache Sore throat Stuffy nose	Common Children younger than 2 are at highest risk for more severe disease.	Multiple approved
 **COVID-19** *Severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2)*	More contagious Viral shedding occurs 2 to 3 days before symptoms appear, peaking around day 3 of illness. However, there can be viral shedding without ever developing symptoms.	2 to 14 days	Body aches Chills Cough Diarrhea Fatigue Fever Headache Loss of smell/taste Nausea/vomiting Shortness of breath Stuffy/runny nose	Becoming more common, and asymptomatic children are possible Typically children have mild symptoms, and rarely they develop multisystem inflammatory syndrome in children (MIS-C) weeks after a SARS-CoV-2 infection.	Two-dose shot approved for children 5 and older. Multiple approved for adults.

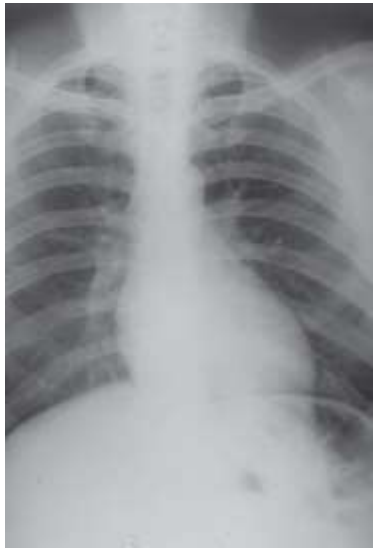
DISEASES OF THE LOWER RESPIRATORY

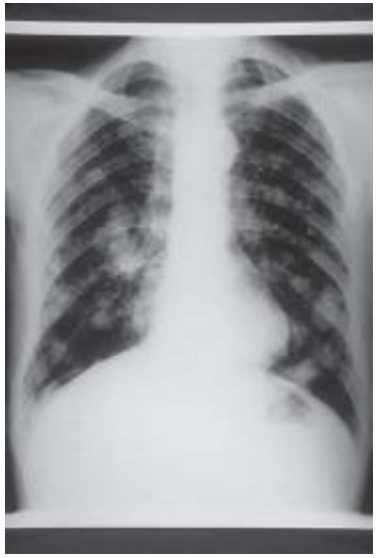
- **Tuberculosis**
- The causative agents of tuberculosis are members of the genus *Mycobacterium.*
- *Mycobacterium tuberculosis* was discovered by Robert Koch in 1882, when the disease was called the “White Plague” of Europe.

- Being obligate aerobes sensitive to slight decreases in oxygen concentration, mycobacteria grow best in the apical, or upper portions of the lungs, which are the most highly oxygenated.
- **Tuberculosis is acquired by the inhalation** of droplet nuclei of respiratory secretions or particles

DISEASES OF THE LOWER RESPIRATORY

- **Tuberculosis**
- phagocytized by WBC →m.o multiply inside WBC& WBC rupture →more infection to other cells → fluid accumulation within the alveoli of the lungs → massive tissue necrosis or solidify to become chronic granulomas, or **tubercles**
- Tubercles consist of central accumulations of enlarged macrophages, tubercle bacilli, peripheral lymphocytes, macrophages, and newly formed connective tissue





DISEASES OF THE LOWER RESPIRATORY

- **Tuberculosis**
- Treatment is with isoniazid and rifampin for at least 1 year. Many strains of *Mycobacterium, however* some strains as in AIDS patients are now resistant to isoniazid.

- Such strains must be treated with a “second-line” or sometimes even a “third-line” drug.

- Tuberculosis can be prevented by vaccination with attenuated organisms in the vaccine BCG.