



Diseases of Respiratory system

Pharmaceutical Microbiology

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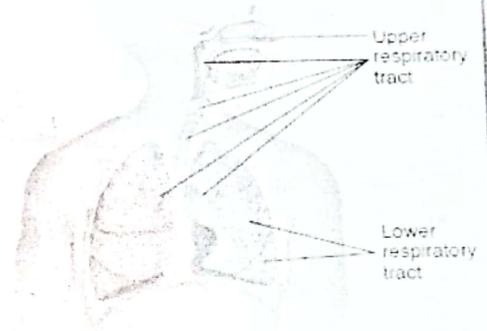
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RS → Respiratory System

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

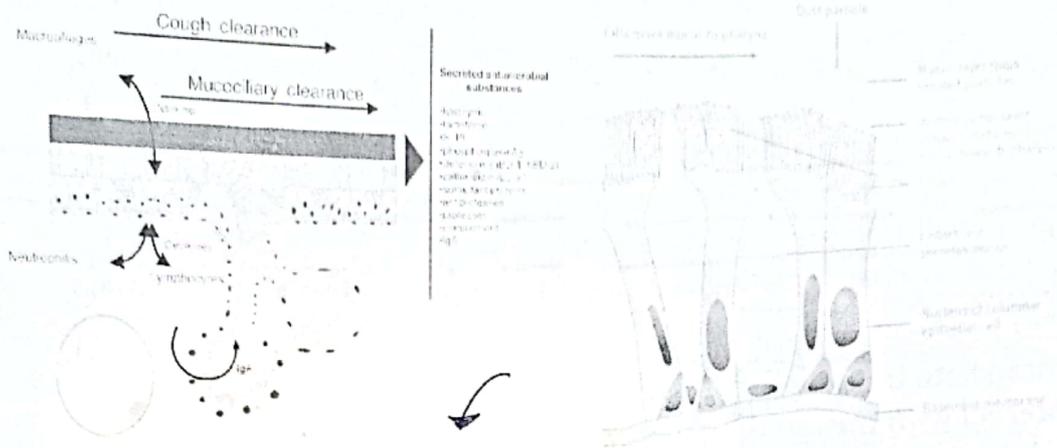
This entire system is lined with moist epithelium. However, in the upper respiratory tract epithelium contains mucus-secreting cells and is covered with cilia.



Note

All upper respiratory tract infections are transmitted through inhalation of respiratory droplets of infection.

Respiratory system defence mechanisms



Epithelial cells ended with cilia → help to push off any microbes & get rid of them to enhance expel it easily from RS by Coughing or sneezing this mechanical process is accompanied with Goblet cell which is capable to secrete mucus

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. (mainly by virus)
- Streptococcal Pharyngitis mainly. Less than 10% of cases of pharyngitis are caused by the most common in children but seen in adults. group A β -hemolytic Streptococcus pyogenes
- Transmission: inhaling droplet from active cases or healthy carriers.



It is important not to left or not untreated any infection if caused by the Pyogen bacteria because this infection if not properly treated will cause or responsible to cause rheumatic fever

Pharyngitis and Related Infections

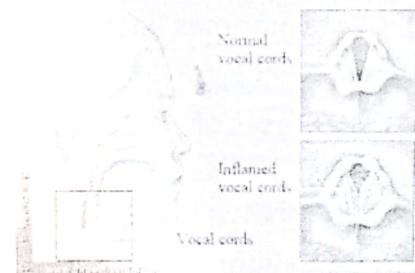
- Symptoms: throat inflamed, lymph nodes in the neck swell, tonsils become tender with white pus filled lesion. Chills, headache, acute throat soreness upon swallowing & often nausea & vomiting, high fever. Absence of cough & nasal discharge distinguish strep throat from common cold.
- Immediate treatment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

A Amoxicillin mostly drug of choice [Extended Spectrum]

- Penicillin with Clavulenic acid

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. influenzae*.
- Inflammation of the tissues rapidly closes the airway, causing difficulty in breathing or even death



DISEASES OF THE UPPER RESPIRATORY TRACT

Sinusitis

Allergy condition ^{هذا الالتهاب يمكن ان يكون سبب}

- 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*.



mucus is secreted, but it is easily drain & removed, but in sinusitis there is mucus secretion but no mucus draining

Symptoms

- 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**. ^{منزل الاحتقان}
- **Amoxicillin** is the drug of choice, but if resistance is a concern, then **amoxicillin-clavulanate** (Augmentin) is used.

↓
تسببه اذا عجزت
البكتريا
resistance

Amoxicillin

↓
الاسم تجاري
Amoxicillin

من الـ antibiotic

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%).

50% of the rhinoviruses have aetiology to cause common cold

- 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.

Systems

يعني رشح الأنف و رشح (سبح بجز رشح) في فوق 100 serotype

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

هذه الانتقال عن طريق لمس الأشياء الملوثة

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

تستخدم لو التوقف nasal decongestant (5-7) أيام

Antibiotic is not effective to control Viral infection

✗ Using of topical or nasal decongestant they should not be more than (5-7) days

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.

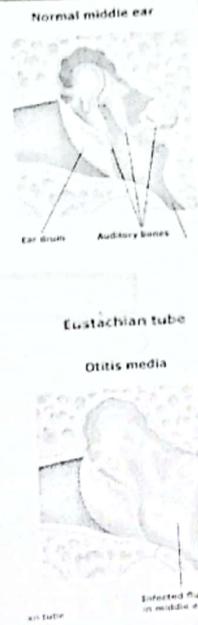
- Patients present with ear pain and pressure, often accompanied by an upper respiratory tract infection.

يعتبر سبب التهاب الأذن الوسطى

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.

مثل ما حكمنا لو صار Amoxicillin resistance



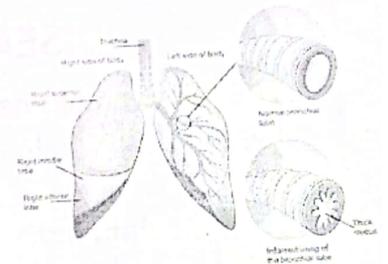
التهاب المجاري التنفسية

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.

BRONCHITIS



لما اتأكد ان السبب هو بكتريا يعني Antibiotic عن طريق أخذ عينه وعمل Subculture لها

DISEASES OF THE LOWER RESPIRATORY

- **Diagnosis:** of pneumonia is based on clinical observations, X-rays, or sputum culture. → To identify the microorganism
- **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

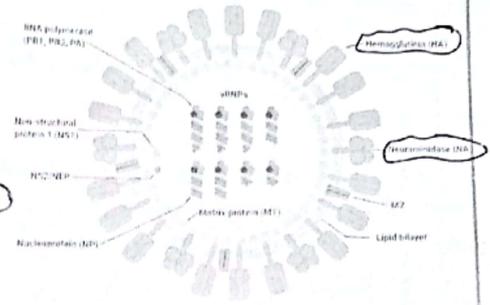
Asthma ~~is~~ up → Vaccines less important
COPD →

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 fluoroquinolone 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**.

severe infection ← A, B, and C → moderate infection → very mild infection

DISEASES OF THE LOWER RESPIRATORY

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

انتقوئرا الخنازير

→ mutation and virus change

- 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

Defence mechanism *مقاومة الفيروس*

• 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.

حسب
المرض
الذي
يحدث

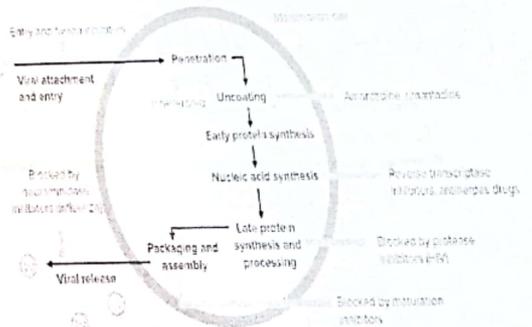
حسب
نوع

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.

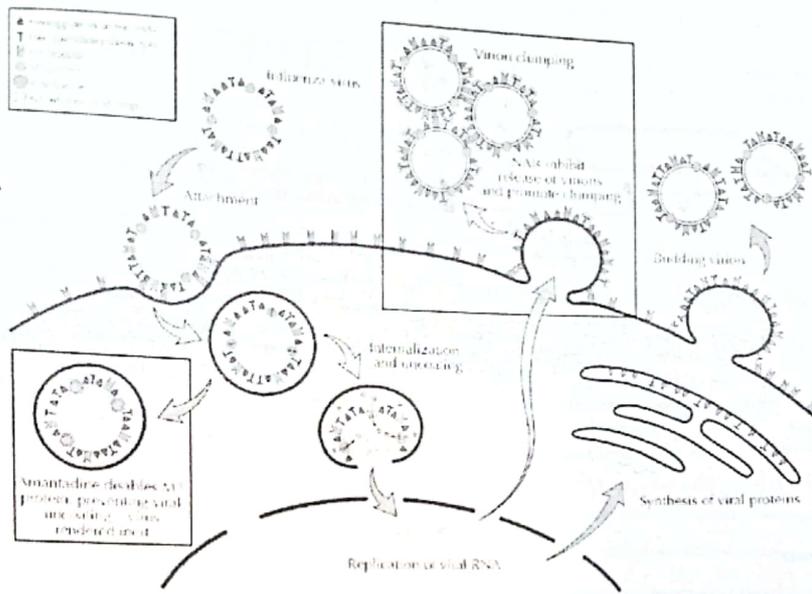
• Immunity and Prevention. Because of influenza viruses' ability to mutate, annual immunization is recommended, especially for high-risk persons, such as those with chronic conditions.



مقاومة الفيروس

مطلوبة كإبتدائي
دقيق وحيد الدم
يؤكد على المرض

The cycle of influenza virus



الرسوة من مصلحة
سوفنة بسجل
اللي ايسر بالرسوة
اللي قبل

Table 27-2 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	<u>Prominent</u>	Occasional
General aches and pains	Slight	<u>Usual; often quite severe</u>	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	<u>Common</u>	Sometimes	Not characteristic
Sneezing	<u>Usual</u>	Sometimes	Not characteristic
Sore throat	<u>Common</u>	Sometimes	Not characteristic
Chest discomfort, cough	Mild to moderate, hacking cough	Can become severe	<u>Frequent and may be severe</u>
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

الخطة الامراض الى ايه وين اكر بي هذا الخارطة موجود
اكر بي

Helpful to prevent as much as they can getting any infection through inhalation (respiration)

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 ^{in upper respiratory 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.

To get rid of (expel out) any foreign organism

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

Defense mechanism

- Normal flora in upper respiratory tract
- mucus in nasal cavity membrane
- Coughing & sneezing
- Mucociliary escalator
- Macrophages in alveoli
- Epiglottis **it closes during swallowing & prevent organism to enter larynx**

• Mucus → **Trap microorganism and most particle of debris**

DISEASES OF THE LOWER RESPIRATORY

- **Pneumonia** is 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**.

* How it happen?

- ① Pathogen try to skip RS
- ② will go down to lower part, because of deep breath or suppressed cough or patient weak immune system
- ③ infect cell & start to multiply

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).
Health care Providers آسز ناس عرضة لهم

- 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.

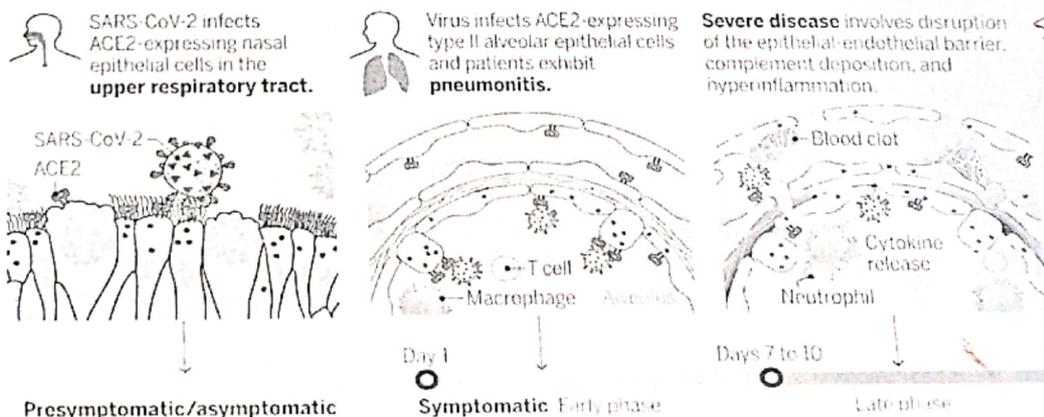
DISEASES OF THE LOWER RESPIRATORY

- **Coronavirus disease 2019** is contagious disease caused by severe 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

Key phases of disease progression

Severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) binds to angiotensin-converting enzyme 2 (ACE2). Initial infection of cells in the upper respiratory tract may be asymptomatic, but these patients can still transmit the virus. For those who develop symptoms, up to 90% will have pneumonitis, caused by infection of cells in the lower respiratory tract. Some of these patients will progress to severe disease, with disruption of the epithelial-endothelial barrier, and multi-organ involvement.



Cytokine → attract other inflammatory cells
So cause inflammatory cascade

epithelial cell للوجود SARS-CoV-2 → الفيروس كان يرتبط
cytokine و T cells activation receptor و Penetration of virus
macrophages و T cells

صحي مطلوب هذا الـ لاير هكت الـ الكورة بالـ ريكورد

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

Common Cold	Flu	COVID-19	Symptoms	Prevalence / Frequency	Vaccine Available
 Common Cold Less contagious Symptomatic individuals shed the virus during the first 2 to 3 days of infection	 Flu More contagious Viral shedding occurs 24 hours before symptoms appear, peaking around day 3 of illness	 COVID-19 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	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
			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
			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 that 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**
- aerobic bacteria ←

DISEASES OF THE LOWER RESPIRATORY

- Respiratory secretion *نفسه من جوف*
- Tuberculosis *توبكولوسيس*
 - 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

infection



DISEASES OF THE LOWER RESPIRATORY

- Tuberculosis *Combination P, S*
- Treatments 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.

Diagnosed from *Patient clinical observation*
Patient signs & symptoms
Specific skin test
by blood detection of microorganism