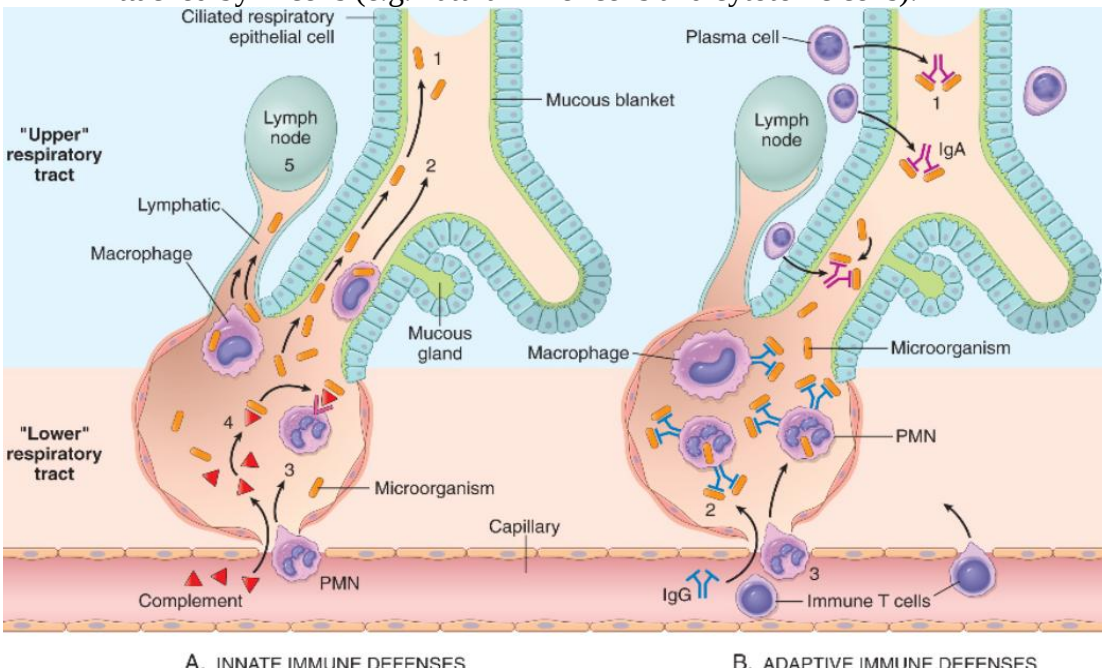
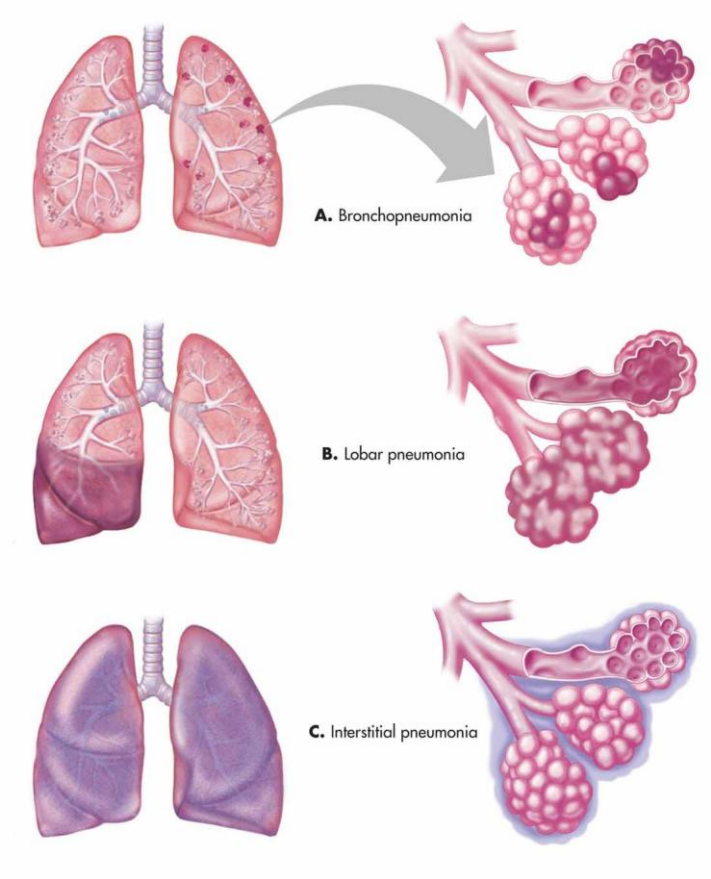
Unit II – Problem 2 – Pathology: Pneumonia

- **Definition**: pneumonia is the infection of lung parenchyma which occurs especially when normal defenses are impaired such as:
  - Cough reflex.
  - Damage of cilia in respiratory epithelium.
  - Excessive mucus blocking the airway will increase the risk of infection distal to the site of the block.
- **There are two types of pulmonary defenses:**
  - **Innate defense**: when an organism enters the airway it will be:
    - ✓ Trapped in mucus and then expelled by the cilia.
    - ✓ Phagocytosed by alveolar macrophages.
    - ✓ Attacked by neutrophils (PMNs) and complements.
    - ✓ Drained by lymphatic system.
  - **Adaptive defense**: when an organism enters the airway:
    - ✓ Immunoglobulins (especially secretory IgA which is present in respiratory tract) will attack it.
    - ✓ Attacked by T-cells (e.g. natural killer cells and cytotoxic cells).

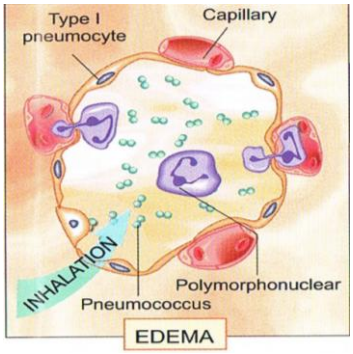


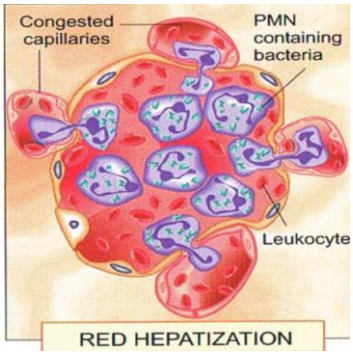
- **What is the clinical presentation of pneumonia (in general):**
  - Fever and chills.
  - Cough with sputum which can be:
    - ✓ Yellow-green.
    - ✓ Rusty (containing blood).
  - Pleuritic chest pain (produced when you breath in and stretch the pleura).
  - Decreased breath sounds with dullness to percussion (because air is replaced with consolidation due to production of exudates from the inflammatory process).
  - Increased WBCs count (because patient is infected).
- **How would you diagnose a patient presenting with clinical features suggesting pneumonia?**
  - Chest x-ray.
  - Sputum Gram-stain and culture.
  - Blood culture (because organisms will enter the blood hence causing fever and chills).

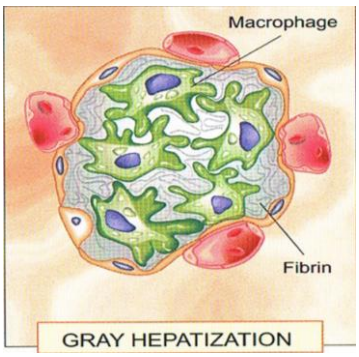
- **There are three patterns of pneumonia which are seen on chest x-ray:**
  - **Lobar pneumonia**: caused by bacteria; affecting a whole lobe of the lung.
  - **Bronchopneumonia**: it is multifocal and bilateral; consolidation running along small airway in a patchy manner.
  - **Interstitial pneumonia**: caused by viral infection; inflammation within interstitium of the lung.



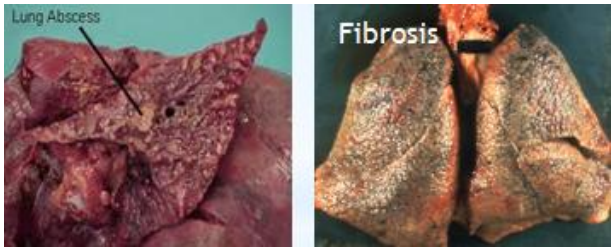
- **Lobar pneumonia:**
  - **Causes:**
    - ✓ S.pneumoniae (95% of cases). Notice that S.pneumoniae is the most common cause of community-acquired pneumonia.
    - ✓ Klebsiella pneumonia (5% of cases). Klebsiella is an enteric flora which is aspirated in elderly or alcoholics. It is often complicated into abscess.
  - **Histology**: air sacs are filled with neutophils and exudates (pink frothy material).
  - **There are four classic phases of lobar pneumonia:**
    - ✓ Congestion (1-2 days): of vessels with edema.
    - ✓ Red hepatization (2-4 days): development of exudates with RBCs.
    - ✓ Grey hepatization (4-8 days): when RBCs break down.
    - ✓ Resolution (8-9 days): achieved by type-II pneumocytes.





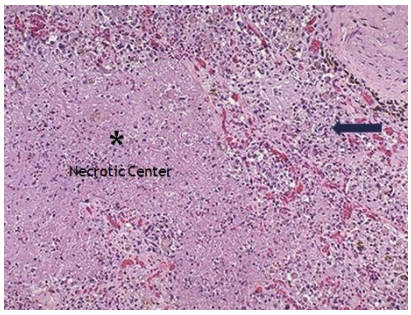


- **Bronchopneumonia:**
  - **Causes:**
    - ✓ S.aureus: it is a common cause of secondary pneumonia after a viral infection → complicated by abscess or empyema (presence of pus in pleural cavity).
    - ✓ H.influenzae: it is a common cause of secondary pneumonia and pneumonia superimposed on COPD. It was one of the most common organisms causing meningitis and epiglottitis in children (but not anymore due to vaccination).
    - ✓ Pseudomonas aeruginosa: causing pneumonia in patients with cystic fibrosis.
    - ✓ Moraxella catarrhalis: causes community-acquired pneumonia and pneumonia superimposed on COPD.
    - ✓ Legionella pneumophila: it is similar to Moraxella catarrhalis. It is transmitted from water and it is an inta-cellular organism that is best seen with silver stain. Commonly affecting organ transplant recipients
- **Notice that lobar pneumonia and bronchopneumonia are described above according to anatomical classification of pneumonia. Organisms which are causing both types are all known as community-acquired acute pneumonia (clinical classification).**
- **What are the complications of community-acquired acute pneumonia:**
  - **Abscess**: multiple, basal and diffusely scattered.
  - **Empyema**: presence of pus in pleural cavity.
  - **Fibrosis.**
  - **Hematogenous bacterimic dissemination** (causing meningitis, arthritis or infective endocarditis).

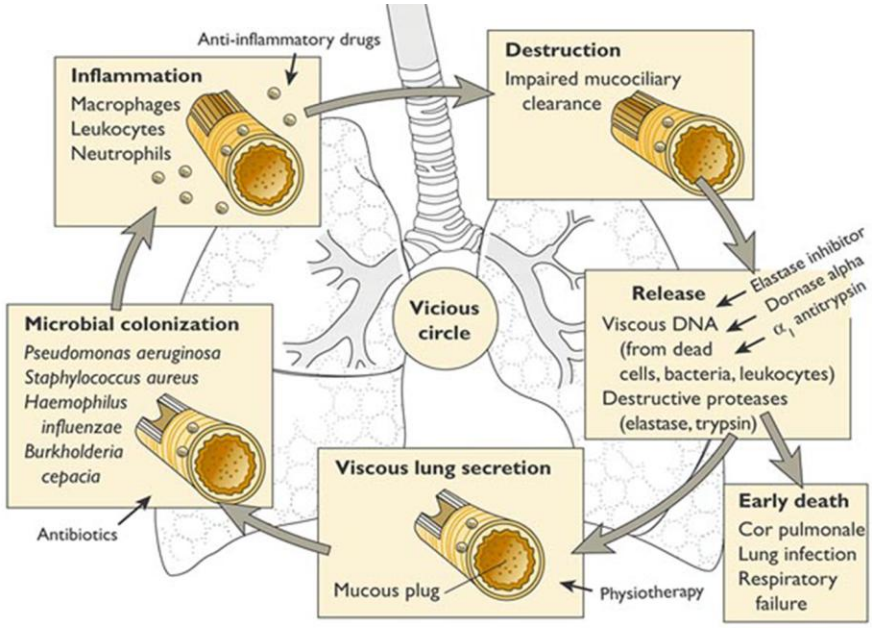


- **Interstitial pneumonia:**
  - **It is also known as atypical pneumonia (why?)** → because symptoms are (moderate) resembling symptoms of upper respiratory tract infection:
    - ✓ Minimal sputum.
    - ✓ Cough.
    - ✓ Low-grade fever.
  - **Histology**: air sacs are empty (in contrast to lobar pneumonia in which air sacs are filled with exudates).
  - **Causes**:
    - ✓ Mycoplasma pneumoniae: affecting young adults, military recruits and college students. It can produce autoimmune hemolytic anemia (IgM).
    - ✓ Chlamydia pneumonia.
    - ✓ Respiratory Syncytial Virus (RSV): causing atypical pneumonia in infants.
    - ✓ Cytomegalovirus (CMV): causing atypical pneumonia in patients with post-transplant immunosuppressive therapy.
    - ✓ Influenza virus: common among elderly. There is increased risk of secondary bacterial pneumonia.
    - ✓ Coxiella burnetti: in farmers.
- **Nosocomial pneumonia:**
  - **Definition**: pulmonary infection which is acquired during hospital stay.
  - **Risk factors**: patient has severe illness (in Intensive Care Unit), immunosuppression or on mechanical ventilation.
  - **This type of pneumonia is often life-threatening and caused mostly by Gram (-) bacilli and S.aureus.**

- **Aspiration pneumonia:**
  - **Seen in**: alcoholics and comatose patients.
  - **Causes**: anaerobic bacteria from oropharynx:
    - ✓ Bacteriodes.
    - ✓ Fusobacterium.
    - ✓ Peptococcus.
  - **Results in**: right lower lobe lung abscess.
- **Lung abscess:**
  - **Definition**: it is a collection of infected material within lung parenchyma.
  - **Etiology:**
    - ✓ 45% ONLY anaerobes, 45% anaerobes MIXED WITH aerobes and 10% ONLY aerobes.
    - ✓ Anaerobes: Peptostreptococcus, Prevotella and Fusobacterium species.
    - ✓ Aerobes: E.coli, Klebsiella, S.aureus and Pseudomonas.
    - ✓ Notice that 90% of patients have a clear association with gingival disease or some predisposition to aspiration.
  - **Clinical manifestations:**
    - ✓ Fever.
    - ✓ Productive cough with foul-smelling sputum.
  - **Diagnosis:**
    - ✓ Chest x-ray shows: thick-walled cavitary lesions.
    - ✓ CT-scan of the chest: to know the extent of the cavity.
    - ✓ To determine specific bacteria involved: aspiration of abscess fluid.
  - **Histopathology:**
    - ✓ Lung abscess due to aspiration is usually on the right and single.
    - ✓ Lung abscess which develops due to pneumonia or bronchiectasis is usually multiple, basal and diffusely scattered.



  - **Treatment**: clindamycin or penicillin (as empiric therapy).
  - **Complications:**
    - ✓ Empyema.
    - ✓ Rupture into bronchus → bronchopneumonia.
    - ✓ Formation of bronchopleural fistula → pneumonthorax.
    - ✓ Septic emboli.
    - ✓ Lung hemorrhage.
- **Bronchiectasis:**
  - **Definition**: permanent dilation of bronchioles and bronchi.
  - **Loss of airway tone results in air trapping (air will be accumulated, rolling around in large airways without being expired).**
  - **Cause**: necrotizing inflammation with damage to airway walls which occur in:
    - ✓ Cystic fibrosis.
    - ✓ Kartagener syndrome.
    - ✓ Tumors or foreign bodies.
    - ✓ Necrotizing infection.
    - ✓ Allergic bronchopulmonary aspergillosis: occurring more in patients with asthma and those with cystic fibrosis.



- **Morphology**:
  - ✓ Usually affects lower lobes bilaterally (except cases caused by tumors or aspiration of foreign bodies).
  - ✓ Airways are dilated appearing as cysts filled with mucopurulent secretions.

- **Clinical features:**
  - ✓ Cough.
  - ✓ Dyspnea.
  - ✓ Foul-smelling sputum.
- **Complications:**
  - ✓ Hypoxemia.
  - ✓ Cor pulmonale.
  - ✓ Secondary amyloidosis.