PNEUMONIA

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PATHOLOGY

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OBJECTIVES

- Definition
- Normal morphology
- Functions
- Causes
- Causative organisms
- Types
- Pathophysiology
- Morphology

PNEUMONIA

DEFINITION

Pneumonia can be broadly defined as any infection in the lung parenchyma.

Normal Lung

- The lungs are constructed to carry out their cardinal function: the exchange of gases between inspired air and blood.

Normal Lung

- The right main stem bronchus is more vertical and more directly in line with the trachea than is the left.
- Consequently, aspirated foreign material, such as vomitus, blood, and foreign bodies, tends to enter the right lung rather than the left.

Normal Lung

- The main right and left bronchi branch give rise to progressively smaller airways.

- Progressive branching of the bronchi forms *bronchioles*, which are distinguished from bronchi by the lack of cartilage and submucosal glands within their walls.

Normal Lung

- Further branching of bronchioles leads to the *terminal bronchioles*, which are less than 2 mm in diameter.

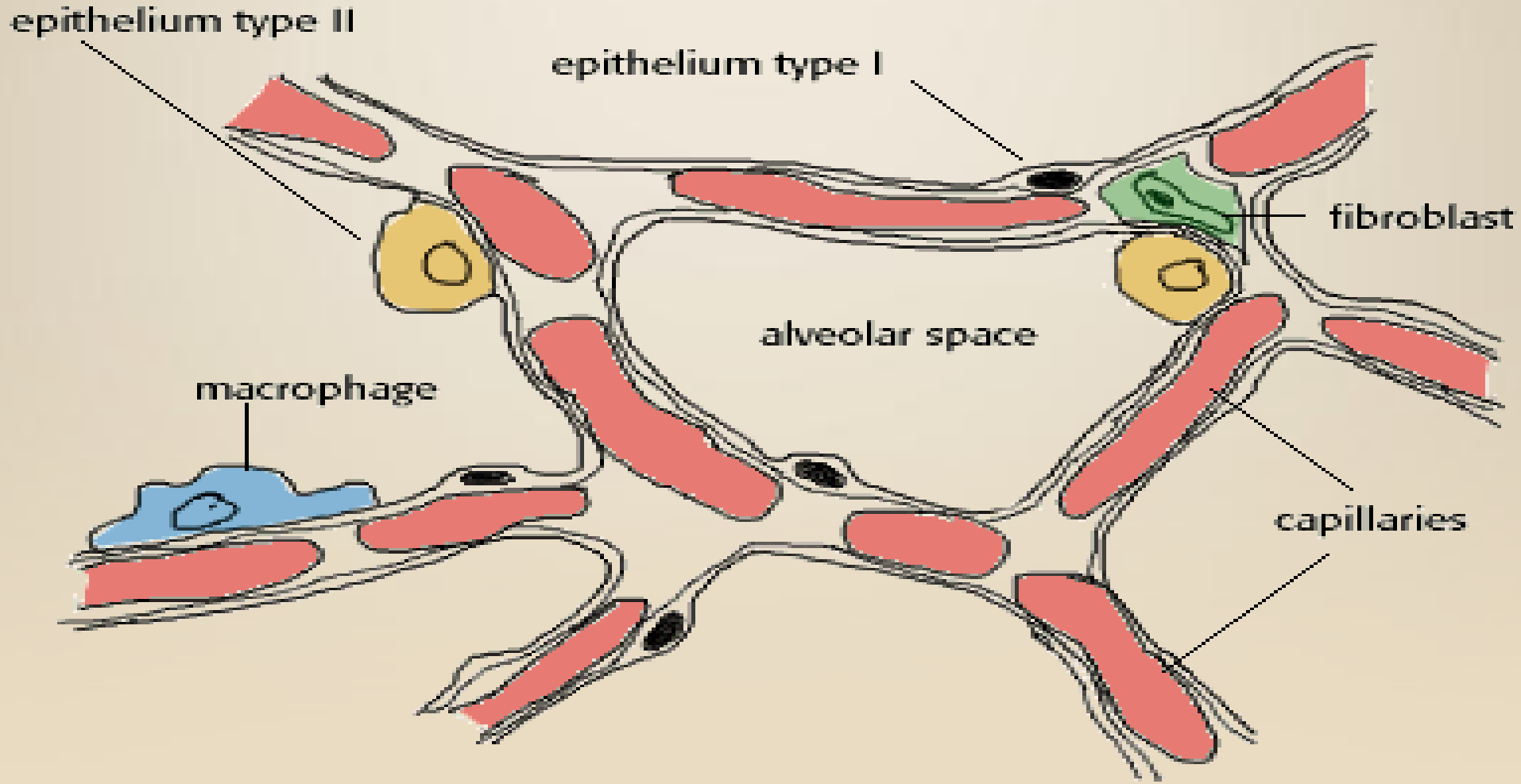
- The part of the lung distal to the terminal bronchiole is called the *acinus*; it is approximately spherical, with a diameter of about 7 mm.

Normal Lung

- The entire respiratory tree, including the larynx, trachea, and bronchioles, is lined by pseudostratified, tall, columnar, ciliated epithelial cells, heavily admixed in the cartilaginous airways with mucus-secreting goblet cells

- The vocal cords are covered by stratified squamous epithelium

Cross Section Through Alveoli



Introduction

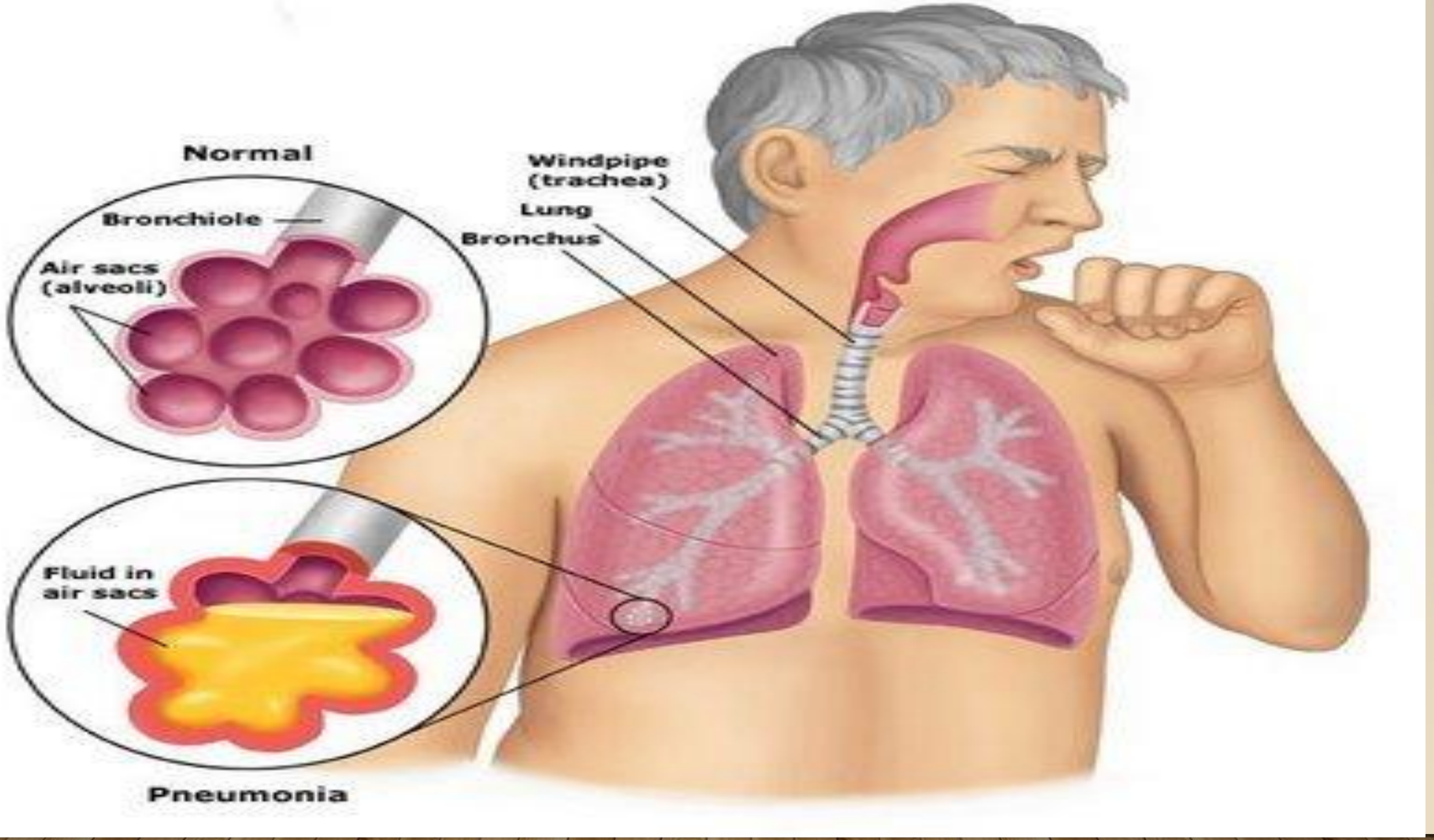
- Daily 10,000 liters of air – filtered
- Nasopharyngeal flora
- Virulent organisms.

- Respiratory tract infections – commonest in medical practice.
- Enormous morbidity & mortality.

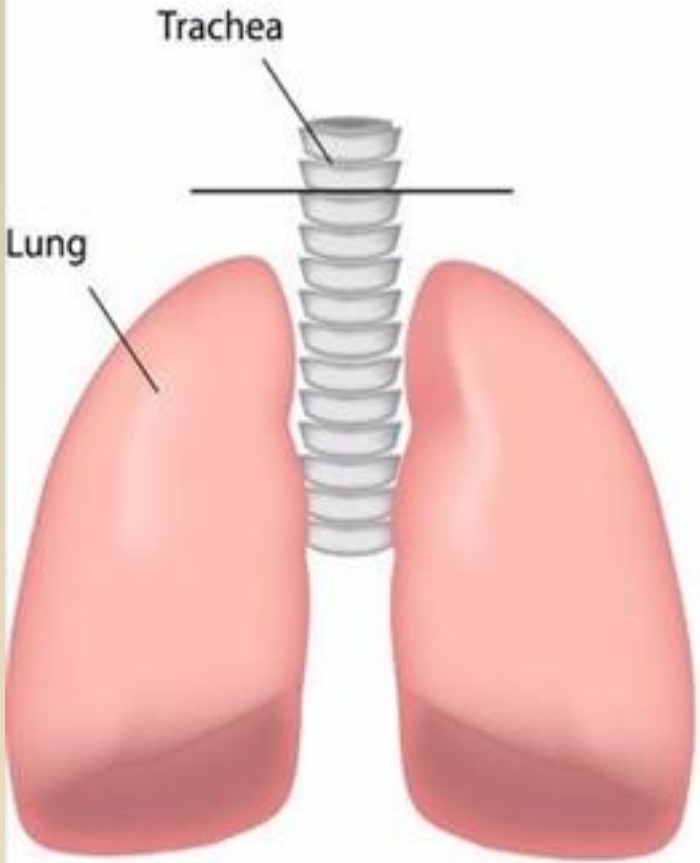
Routes of Infection

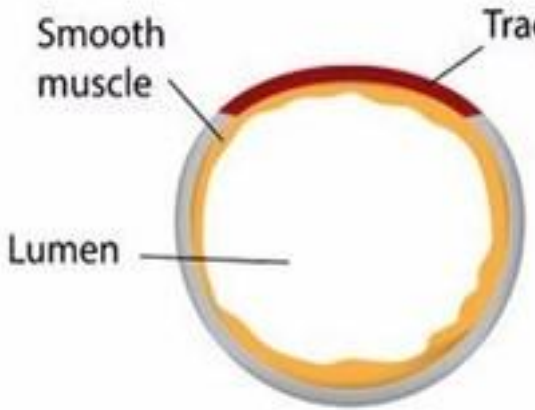
Several possible routes of infection of the lung exist:

- **Aspiration** of contaminated secretions-most common
- **Inhalation** of infected airborne droplets
- **Bacteremia**
- **Direct extension** of an acute inflammatory process from an adjacent organ or structure.

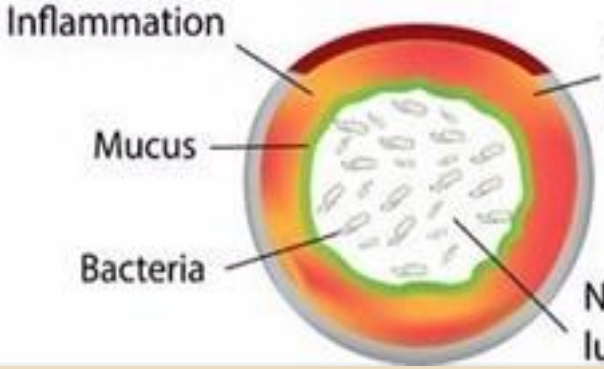

Normal
Bronchiole
Air sacs
(alveoli)
Fluid in
air sacs
Pneumonia
Windpipe
(trachea)
Lung
Bronchus

Pneumonia

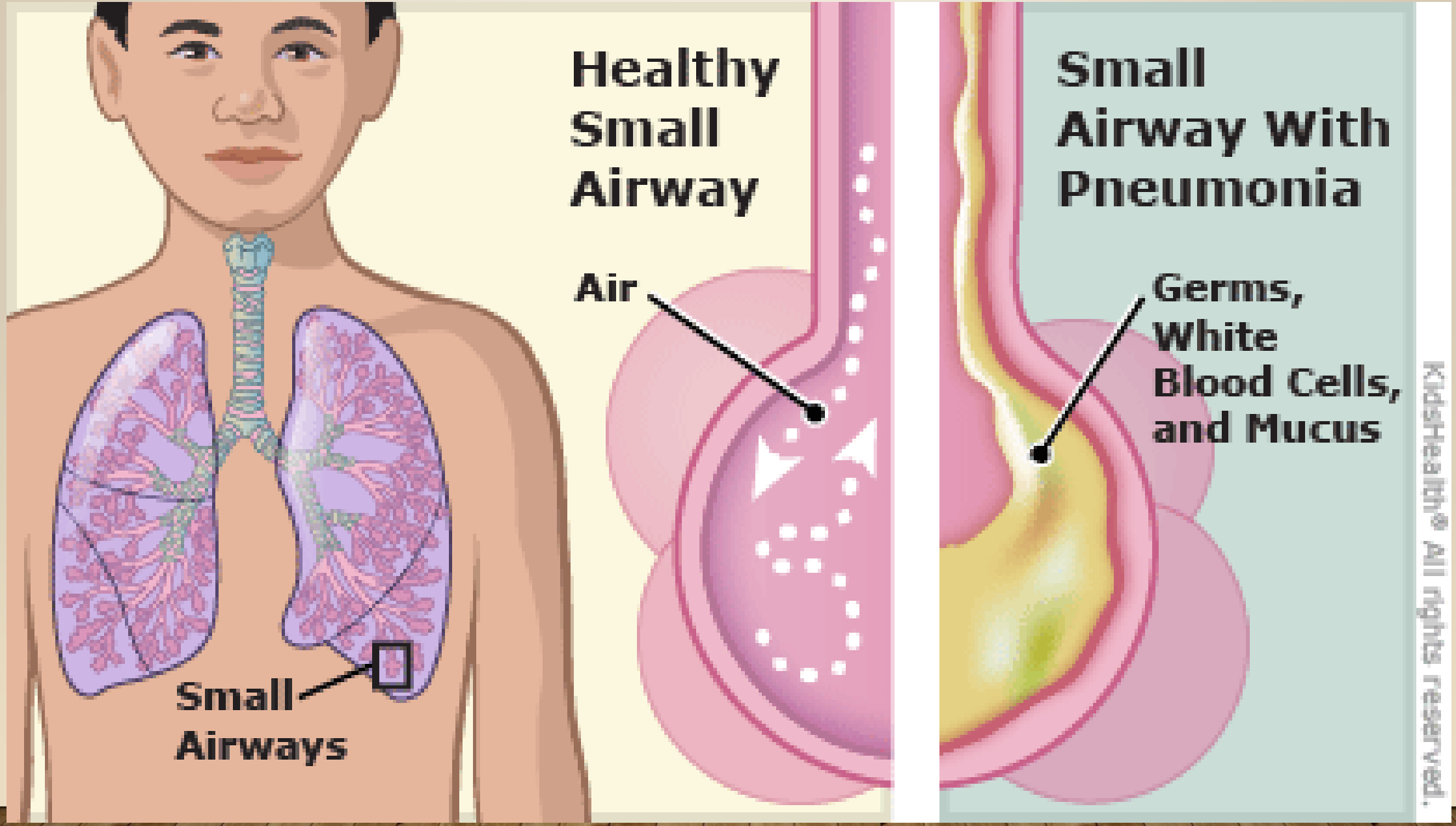




Healthy



Pneumonia


Small
Airways
Healthy
Small
Airway
Air
Small
Airway With
Pneumonia
Germs,
White
Blood Cells,
and Mucus
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PNEUMONIA

Pneumonia can result whenever:

- **local defense mechanisms are impaired.**

or

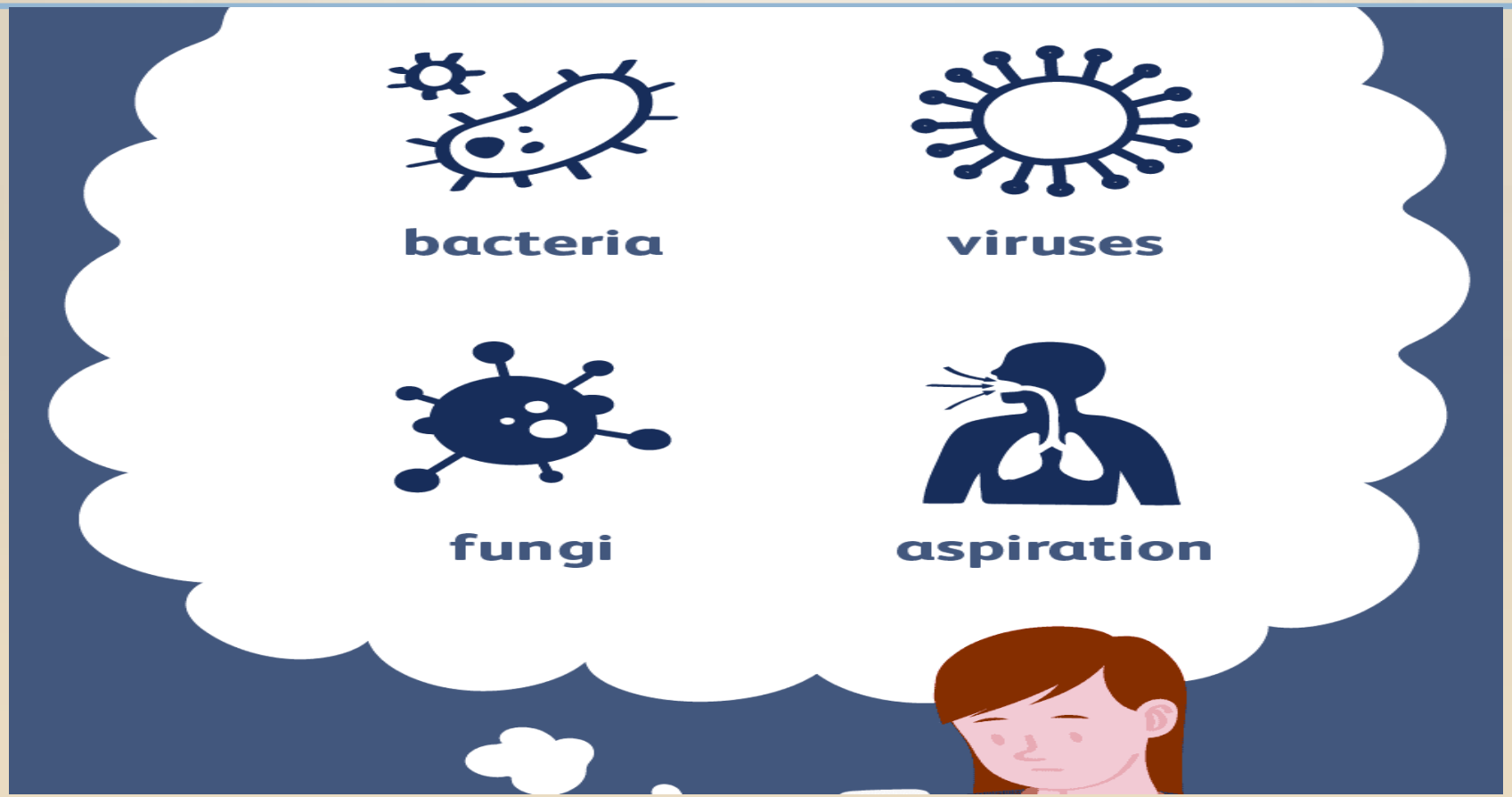
- **systemic resistance of the host is lowered.**

PNEUMONIA

- **Defense Mechanisms**
  In the normal respiratory system there are a number of important defense mechanisms that protect the lung from infection. These include:

1. **Reflex closure of the vocal cords**
2. **Cough reflex**
3. **Mucociliary clearance**
4. **Macrophage activity and immune competence.**

CAUSES OF PNEUMONIA



CAUSATIVE PATHOGENS OF PNEUMONIA

- Community-acquired acute pneumonia
  - *Streptococcus pneumonia*
  - *Haemophilus influenza*
  - *Moraxella catarrhalis*
  - *Staphylococcus aureus*
  - *Legionella pneumophilia*
  - Klebsiella
  - Pseudomonas
- Community-acquired atypical pneumonia
  - *Mycoplasma*
  - *Chlamydia*
  - *Legionella*
  - Viruses (RSV, parainfluenza & influenza, adenovirus)

- Nosocomial pneumonia
  - Gram negative rods
  - *Staphlyococcus aureus*
- Aspiration pneumonia
  - Anaerobic oral flora
  - Amniotic fluid
  - Gastric content
  - Chemicals
- Chronic pneumonia
  - Nocardia
  - Actinomyces
  - Granulomatous
- Necrotizing pneumonia
  - Anaerobic
  - *Staphlyococcus aureus*
  - Klebsiella
  - *Streptococcus pyogens*

PNEUMONIA IN IMMUNOCOMPRIMISED PATIENTS

- **CYTOMEGALOVIRUS**
- **PNEUMOCYSTIS JIROVECI**
- **MYCOBACTERIUM AVIUM**
- **INVASIVE ASPERGILLOSIS**
- **INVASIVE CANDIDIASIS**
- **USUAL bacterial, viral, and fungal organisms.**

MORPHOLOGY

Bacterial pneumonia has two patterns of anatomic distribution:

- **Lobular bronchopneumonia**

- **Lobar pneumonia**

MORPHOLOGY

- **Patchy consolidation of the lung is the dominant characteristic of bronchopneumonia**

- **Consolidation of a large portion of a lobe or of an entire lobe defines lobar pneumonia**

MORPHOLOGY

In lobar pneumonia, four stages of the inflammatory response have classically been described

- **Congestion,**
- **Red hepatization**
- **Gray hepatization**
- **Resolution.**

MORPHOLOGY

- **Foci of bronchopneumonia are consolidated areas of acute suppurative inflammation.**
- **Well-developed lesions are slightly elevated, dry, granular, gray-red to yellow, and poorly delimited at their margins.**
- **Histologically, the reaction usually elicits a neutrophil-rich exudate that fills the bronchi, bronchioles, and adjacent alveolar spaces.**

COMPLICATIONS

- **Complications** of pneumonia include
- Tissue destruction
- Necrosis, causing **abscess formation** (pneumococci or *Klebsiella* infections)
- Spread of infection to the pleural cavity, causing the intrapleural fibrinosuppurative reaction known as **empyema**
- **Bacteremic dissemination** to the heart valves, pericardium, brain, kidneys, spleen, or joints, causing metastatic abscesses, endocarditis, meningitis, or suppurative arthritis.


Thank
You