

# Pathophysiology II

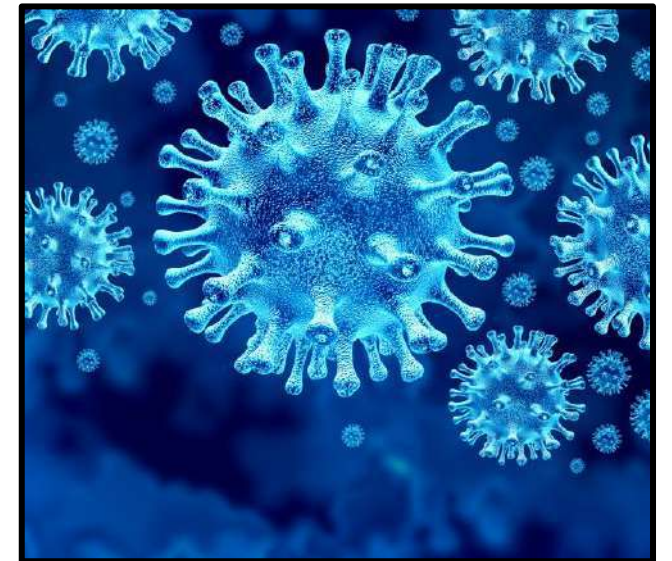
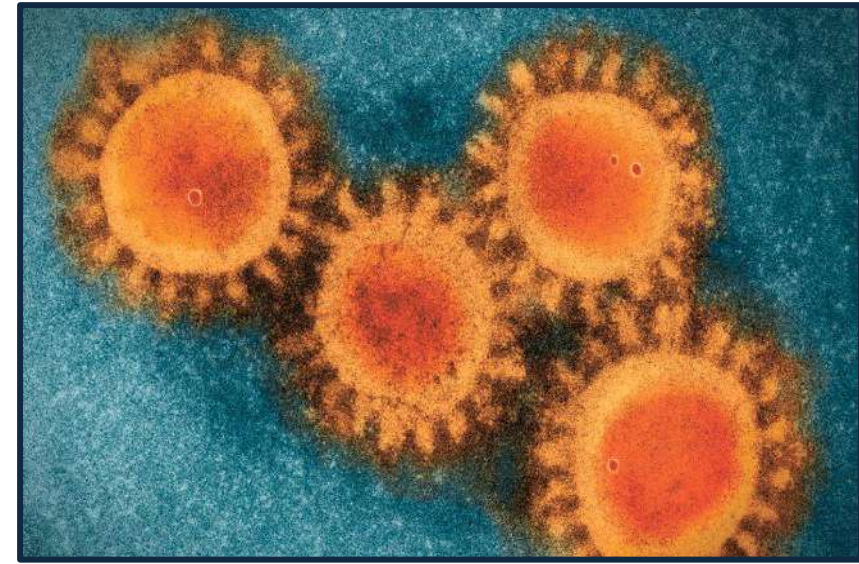
## Chapter (2): Respiratory Diseases

- Infectious Diseases
  - Sinusitis
  - COVID-19
  
- Obstructive Lung Diseases
  - Asthma
  - Chronic Obstructive Pulmonary Disease
  - Cystic Fibrosis

# Infectious diseases

## 2. Coronavirus disease 2019 (COVID-19)

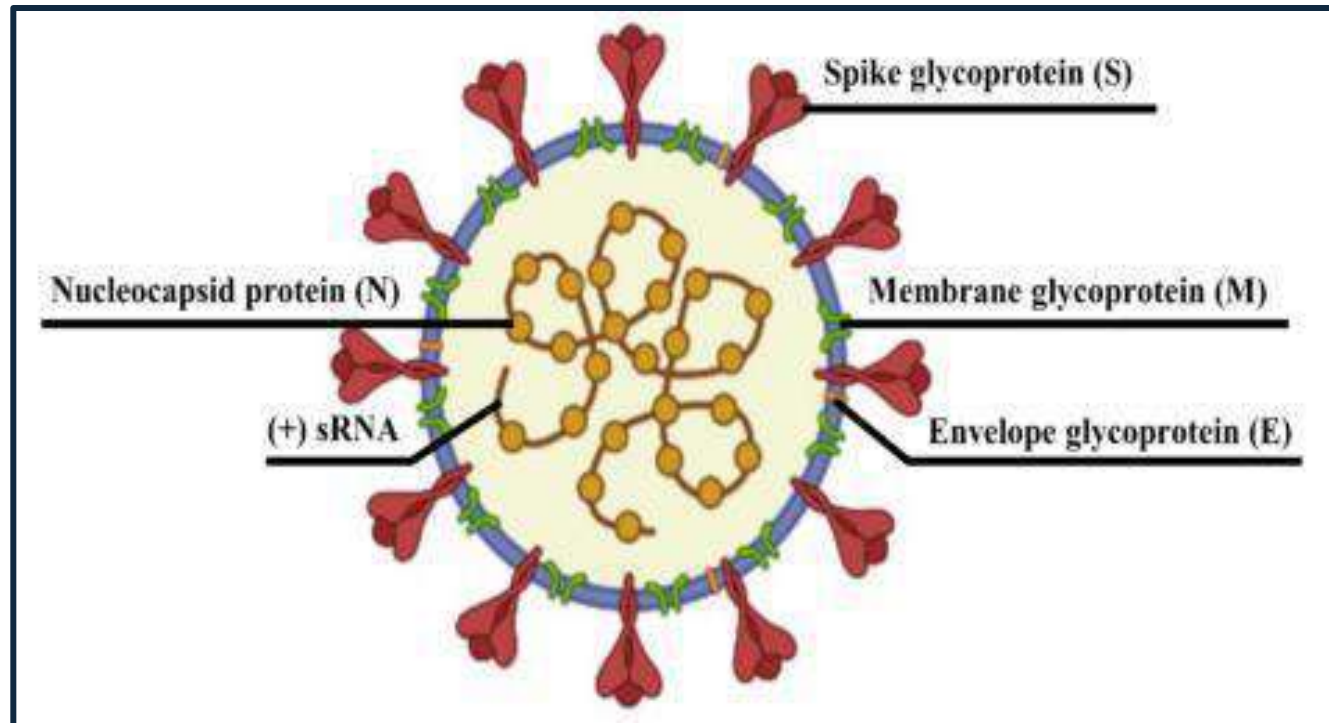
- It is an infectious respiratory disease caused by a newly discovered *coronavirus*.
- Most infected people have mild to moderate respiratory illness and recover without requiring special treatment..
- 2019 novel coronavirus (2019-nCoV)
- Severe Acute Respiratory Syndrome Coronavirus-2 (SARS-CoV-2)



# Infectious diseases

## 2. Coronavirus disease 2019 (COVID-19)

- Severe Acute Respiratory Syndrome Coronavirus-2 (SARS-CoV-2)



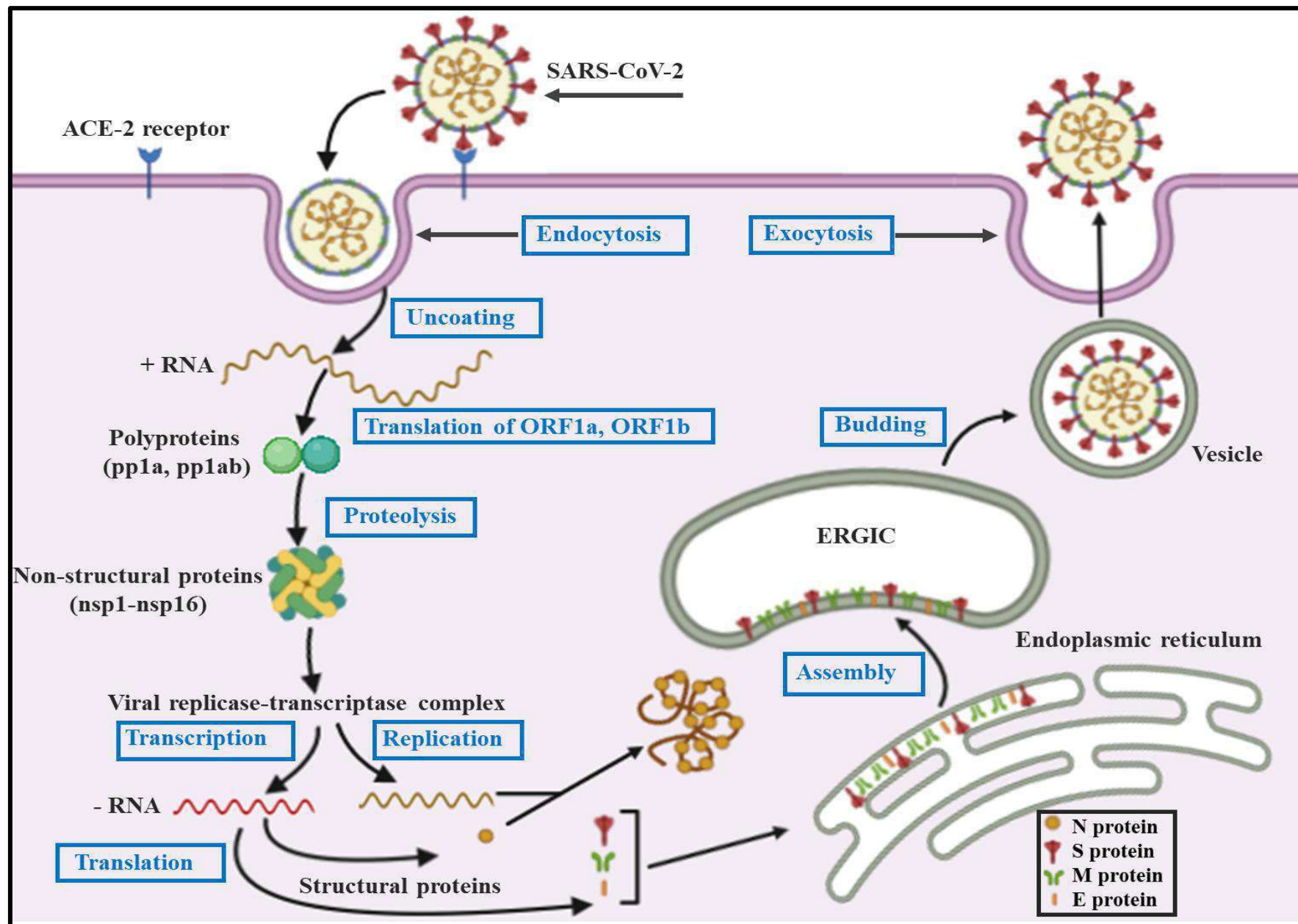
Structure of SARS-CoV-2

# Infectious diseases

## 2. (COVID-19)

### ▪ Pathogenesis

#### A. Virus entry



# Infectious diseases

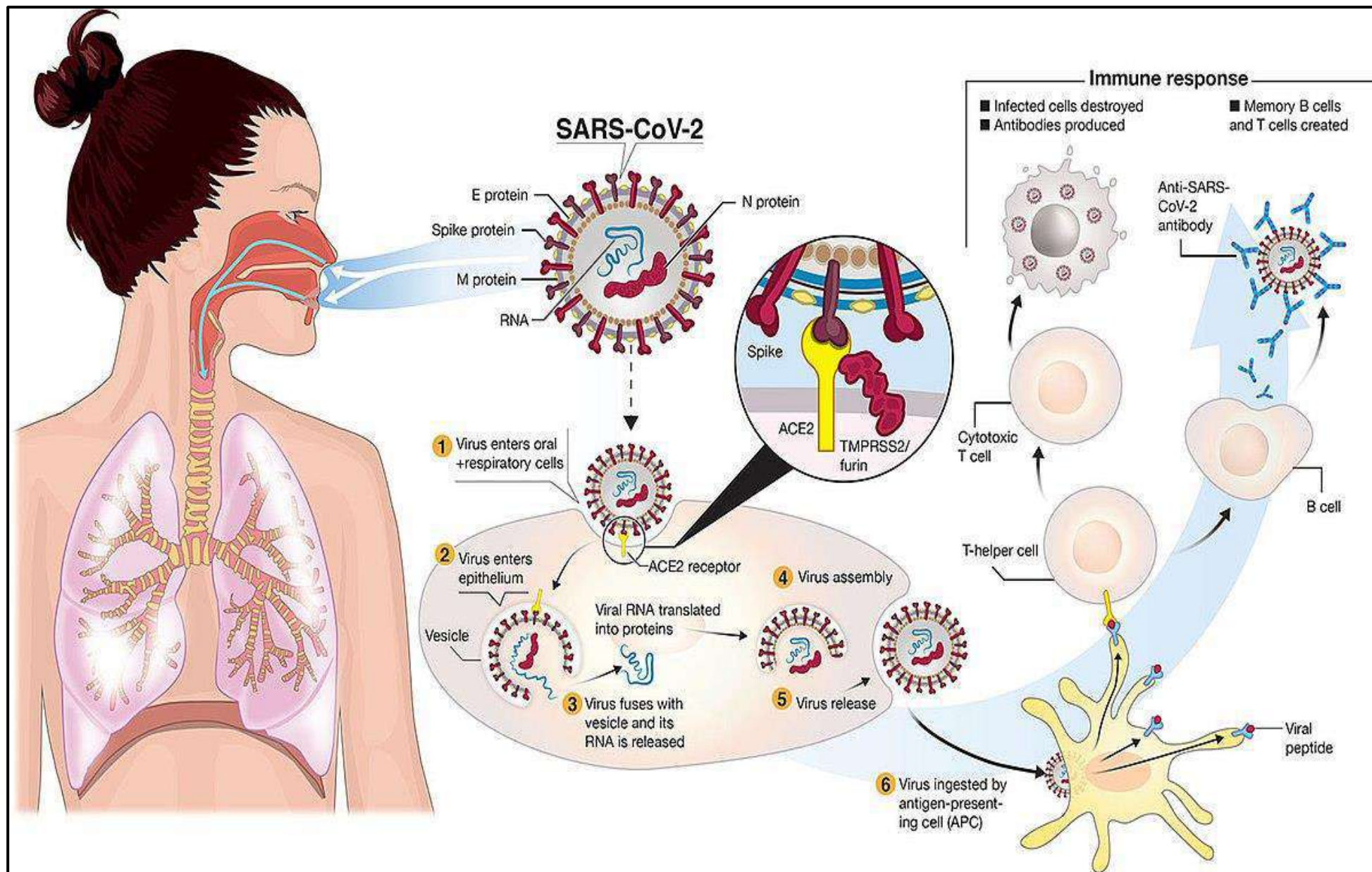
## 2. (COVID-19)

### Pathogenesis

### B. Immune response

Cytokine storm

ARDS

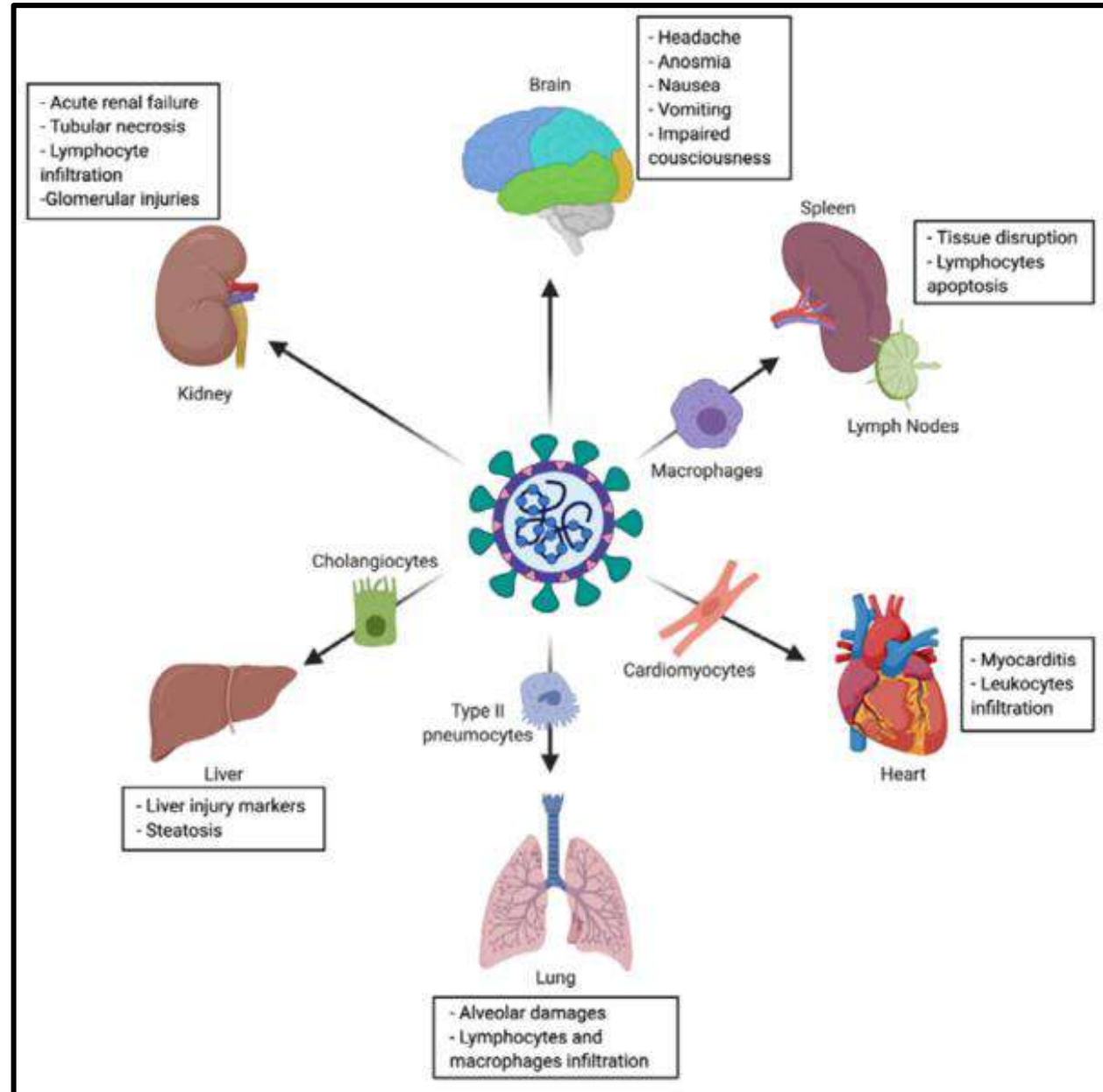


# Infectious diseases

## 2. (COVID-19)

### ■ Symptoms

### ■ Clinical manifestations



# Infectious diseases






















## 2. (COVID-19)

### ■ Diagnosis

- Symptoms
- PCR
- Serological test

### ■ Treatments

- Antiviral agents
- Anti-inflammatory drugs
- Convalescent plasma
- Vaccines

Company	Type	Doses	Storage
 Oxford Uni- AstraZeneca	Viral vector (genetically modified virus)	x2 	 2 to 8°C (6 months)
 Moderna	RNA (part of virus genetic code)	x2 	 -25 to -15°C (7 months)
 Pfizer-BioNTech	RNA	x2 	 -80 to -60°C (6 months)
 Gamaleya (Sputnik V)	Viral vector	x2 	 -18.5°C (liquid form) 2 to 8°C (dry form)
 Sinovac (CoronaVac)	Inactivated virus (weakened virus)	x2 	 2 to 8°C
 Novavax	Protein-based	x2 	 2 to 8°C
 Janssen	Viral vector	x1 	 2 to 8°C (3 months)

# Infectious diseases






















## 2. (COVID-19)

### ■ Diagnosis

- Symptoms
- PCR
- Serological test

### ■ Treatments

- Antiviral agents
- Anti-inflammatory drugs
- Convalescent plasma
- Vaccines

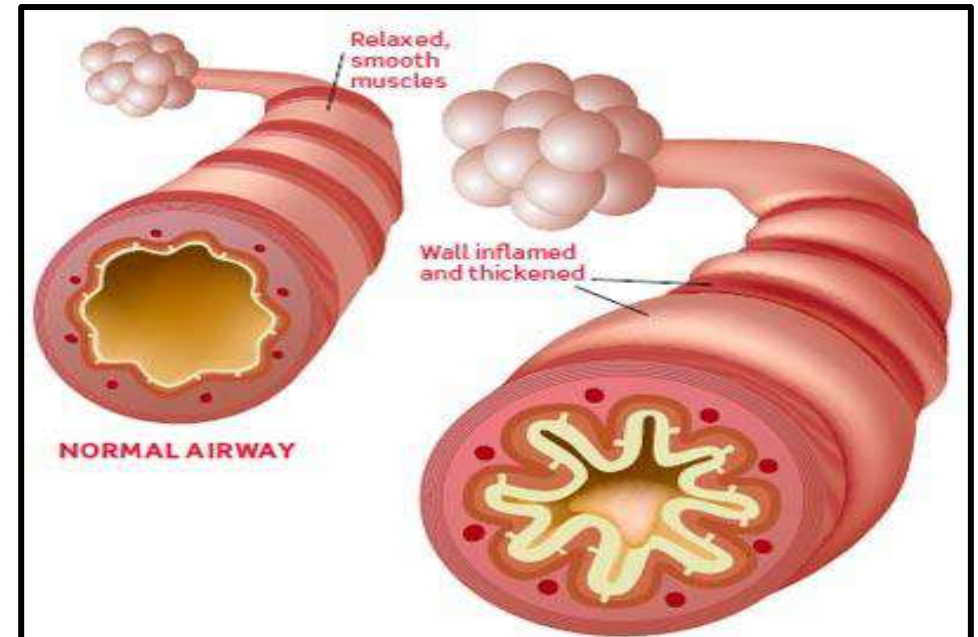
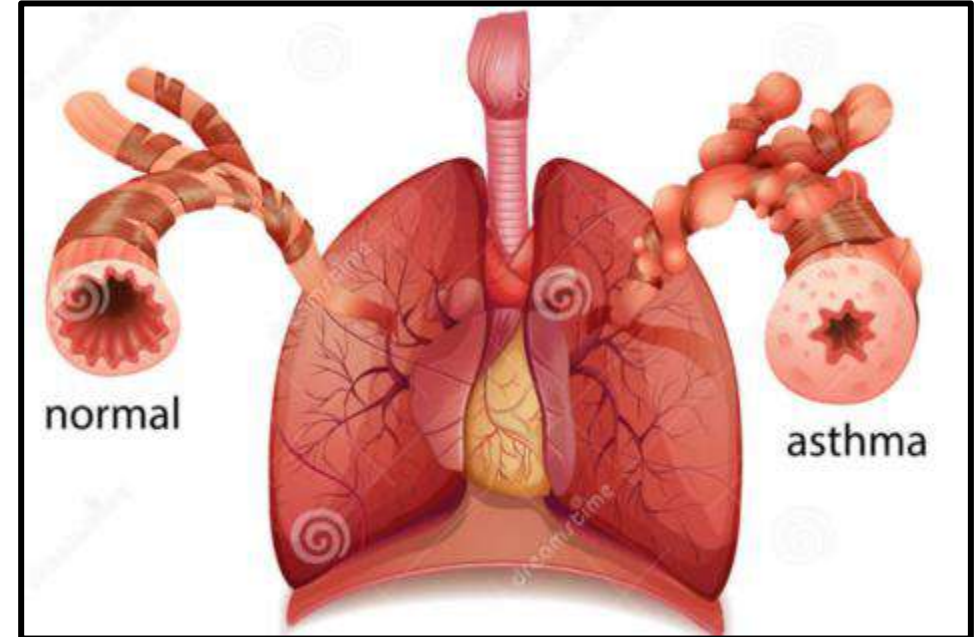
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# Obstructive Lung Diseases

## 1. Bronchial asthma

- It is a reversible form of obstructive airway disease caused by narrowing of the airways due to bronchospasm, inflammation, and increased airway secretions.
- Bronchial hyperresponsiveness condition
  - Extrinsic, allergic, atopic asthma
  - Intrinsic, non-atopic asthma



# Obstructive Lung Diseases

## 1. Bronchial asthma

- Causes: **hyperresponsiveness of bronchial smooth muscles**
  - Extrinsic, allergic, atopic asthma
  - Intrinsic, non-atopic asthma

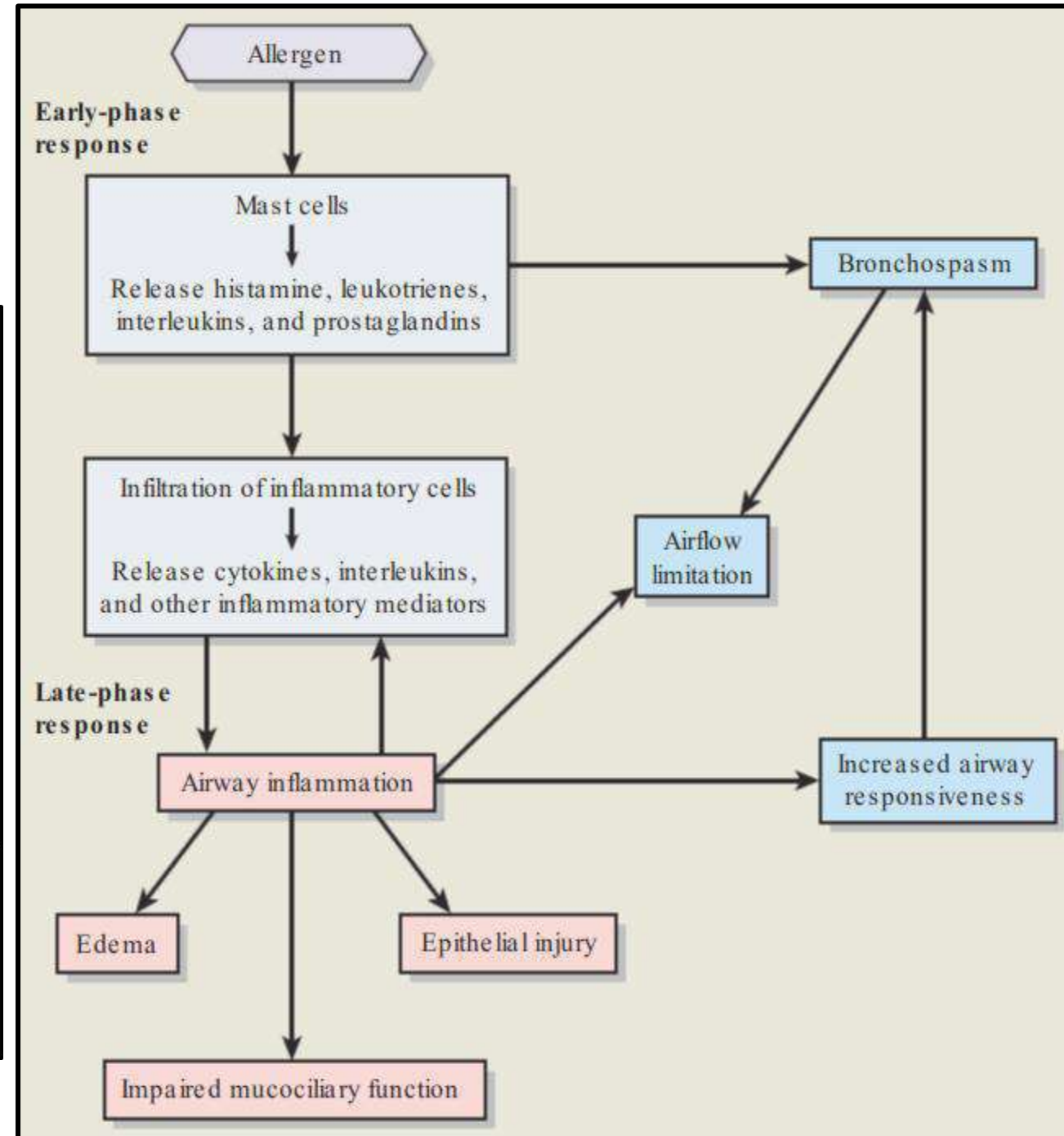
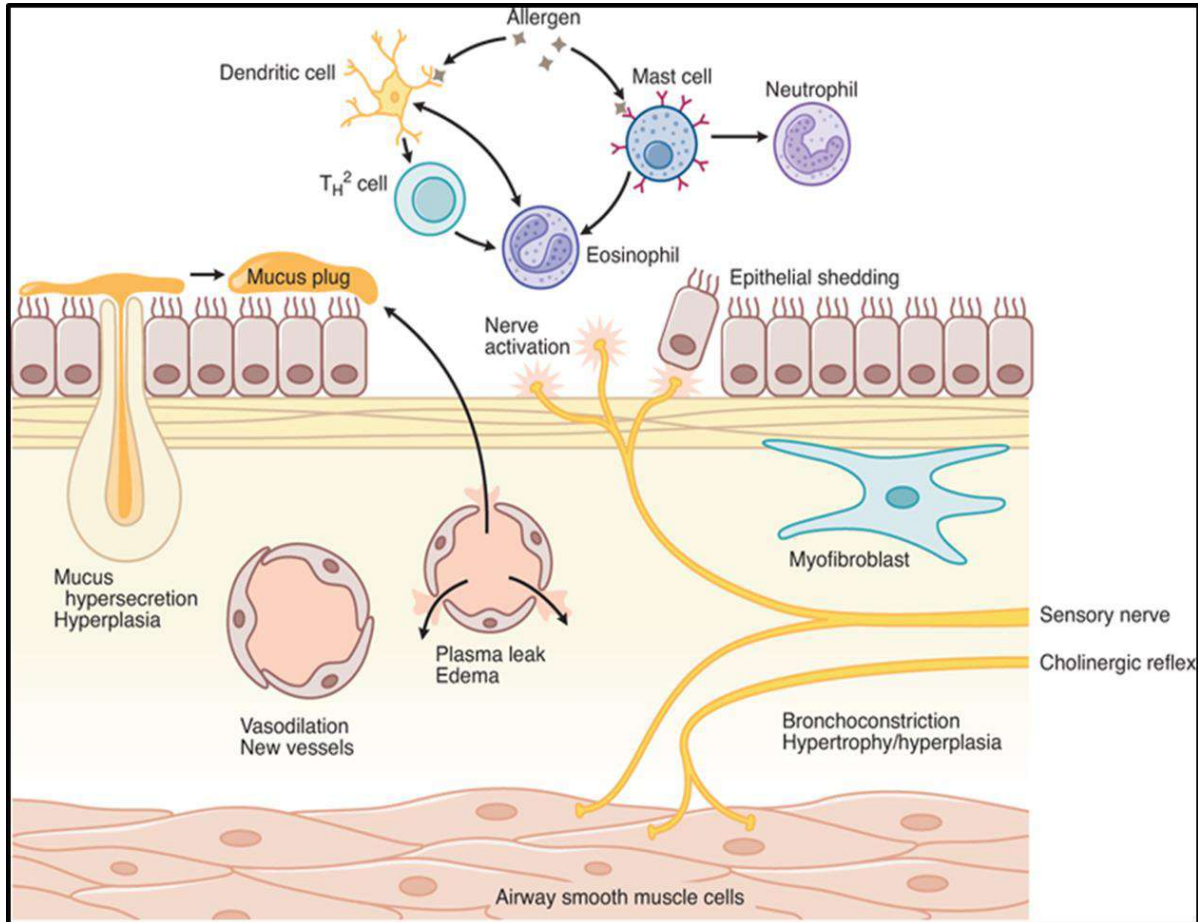
**Asthma triggers** →



# Obstructive Lung Diseases

## 1. Bronchial asthma

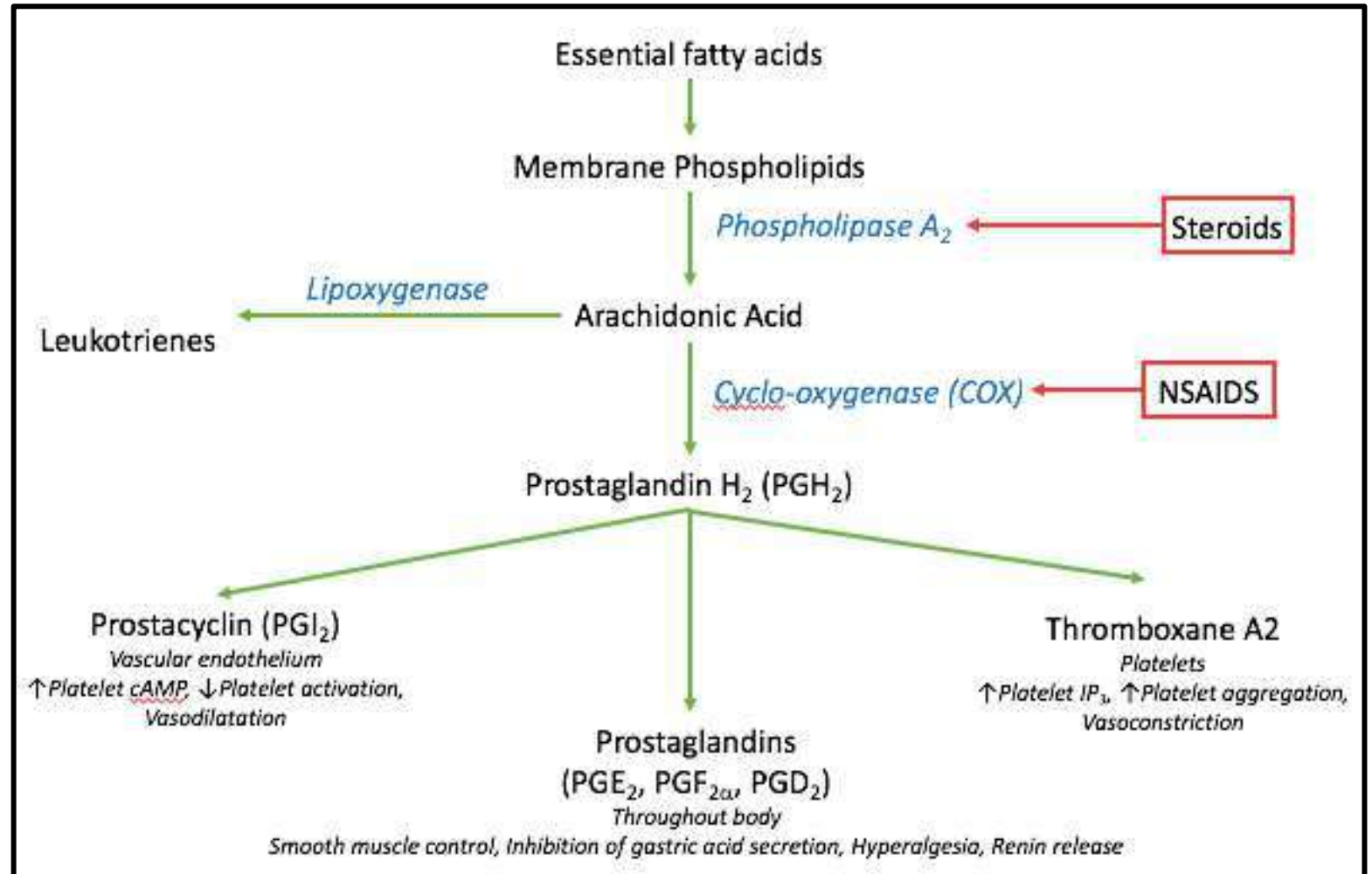
- Pathogenesis
  - Extrinsic, allergic, atopic asthma



# Obstructive Lung Diseases

## 1. Bronchial asthma

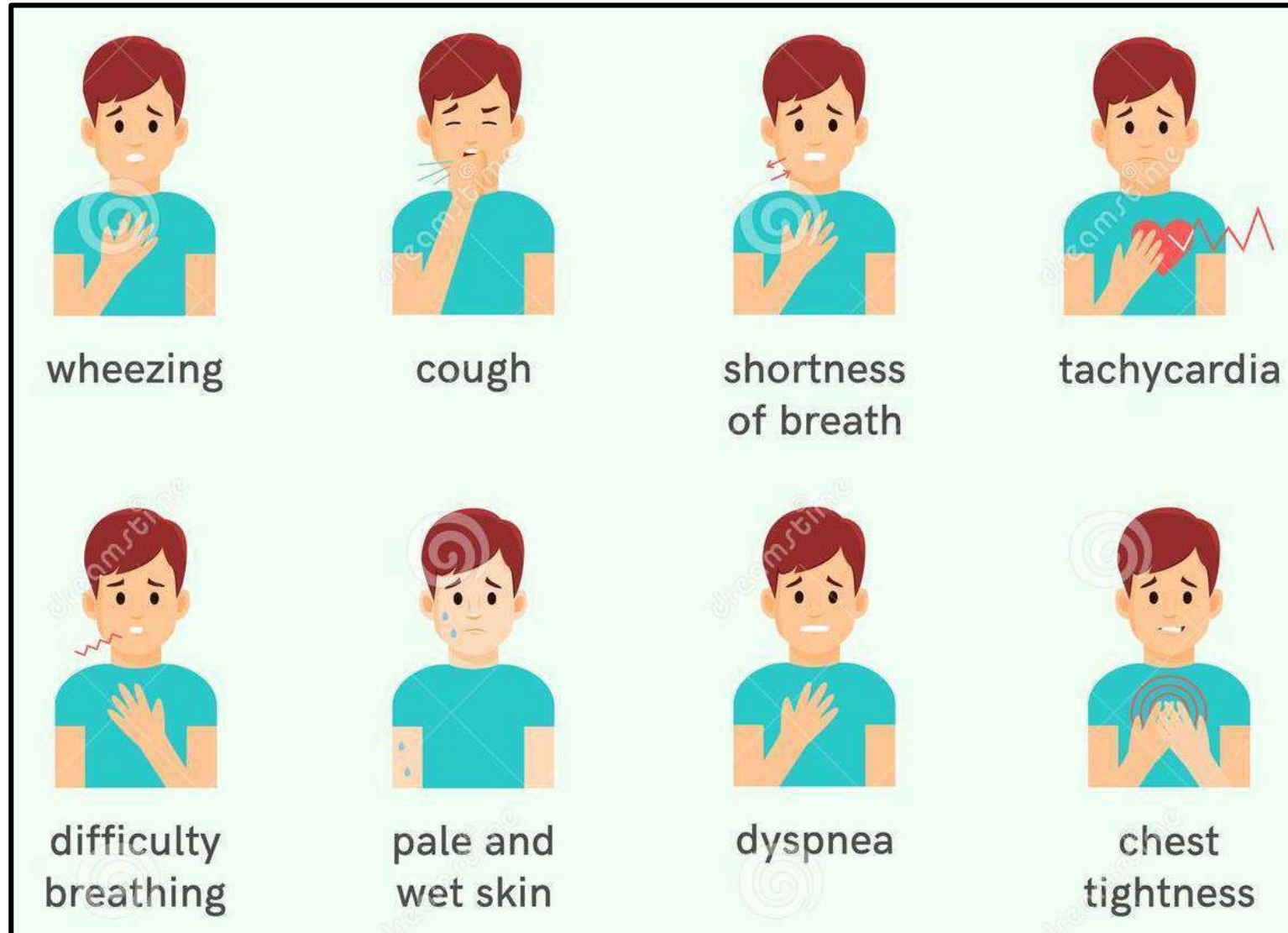
- Pathogenesis
  - Intrinsic, non-atopic asthma



# Obstructive Lung Diseases

## 1. Bronchial asthma

- Symptoms



# Obstructive Lung Diseases

## 1. Bronchial asthma

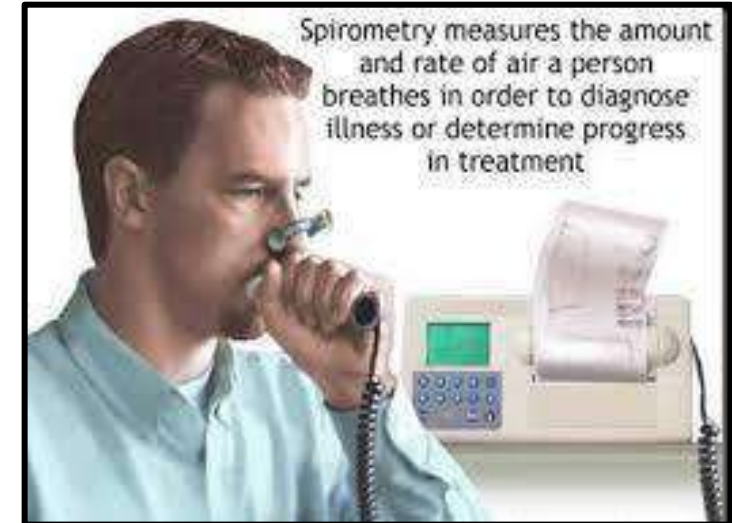
### ■ Diagnosis

- Symptoms: wheezing
- Laboratory findings: for allergic asthma
- Pulmonary functions: spirometer (VC, FVC, FEV1, FEV1/FVC ratio)
- Airway responsiveness: histamine, cholinergic agonists, cold air

**VC: vital capacity**, the maximum amount of air can be expelled from the lungs after a maximum inhalation (4L).

**FVC: forced vital capacity**, the volume of air that can forcibly be blown out after full inspiration (4.5-5L)

**FEV1: forced expiratory volume in 1 second**, the volume of air that can forcibly be blown out in first 1 second after full inspiration (80% of FVC)



# Obstructive Lung Diseases

## 1. Bronchial asthma

### ▪ Treatment

#### 1. Life style management and education

2. **Quick-relief medications:** anticholinergic, adrenergic agonists (adrenaline and short acting B2 agonists)

#### 3. Long term medications

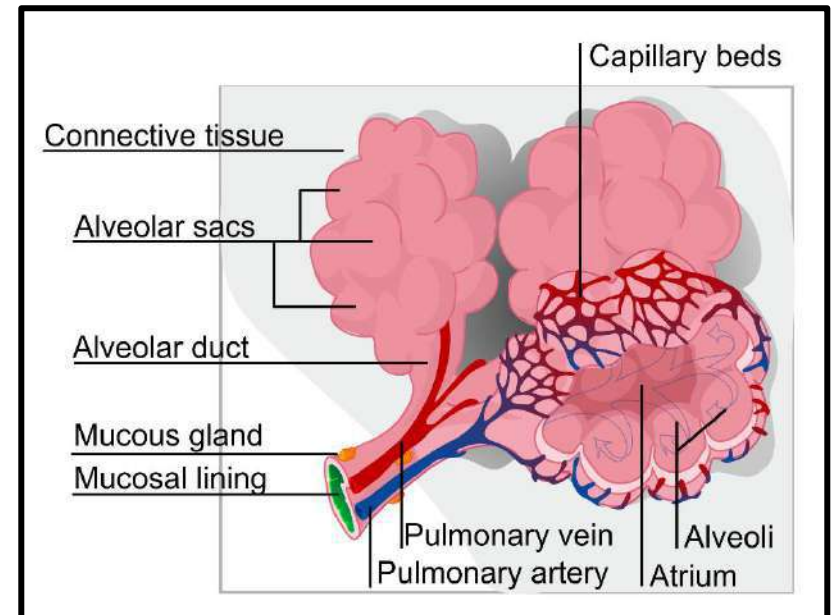
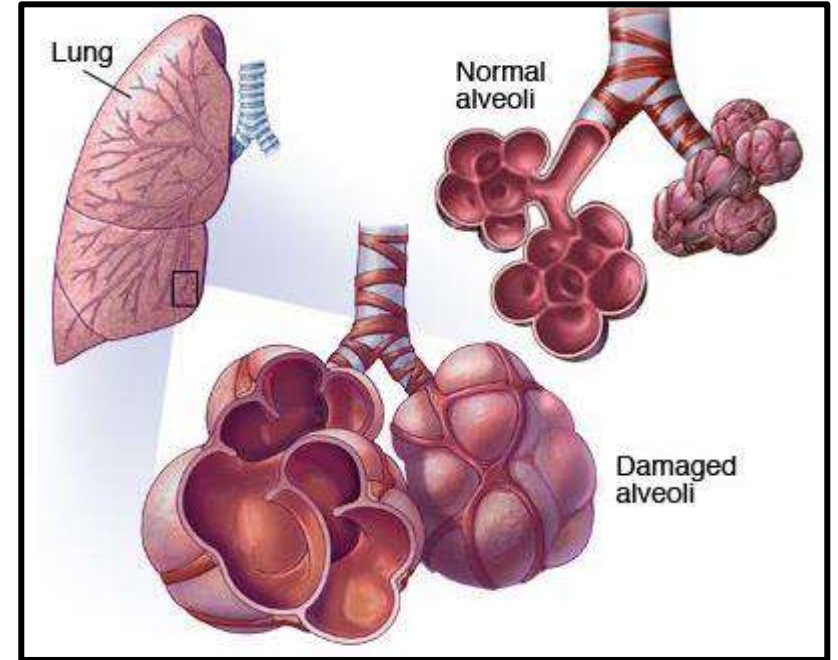
- Inhaled corticosteroids
- Long-acting B2 agonists
- Cromolyn
- Leukotriene receptor antagonists: used to treat acute (monelukast and zafirlukast)
- AntiIgE monoclonal antibody (omalizumab)



# Obstructive Lung Diseases

## Chronic Obstructive Pulmonary Disease (COPD)

- It is a progressive disease characterized by chronic and recurrent obstruction (**may be reversible**) of airflow in the lungs.
- Emphysema
- Chronic obstructive bronchitis





# Obstructive Lung Diseases

## COPD

### 1. Chronic obstructive bronchitis

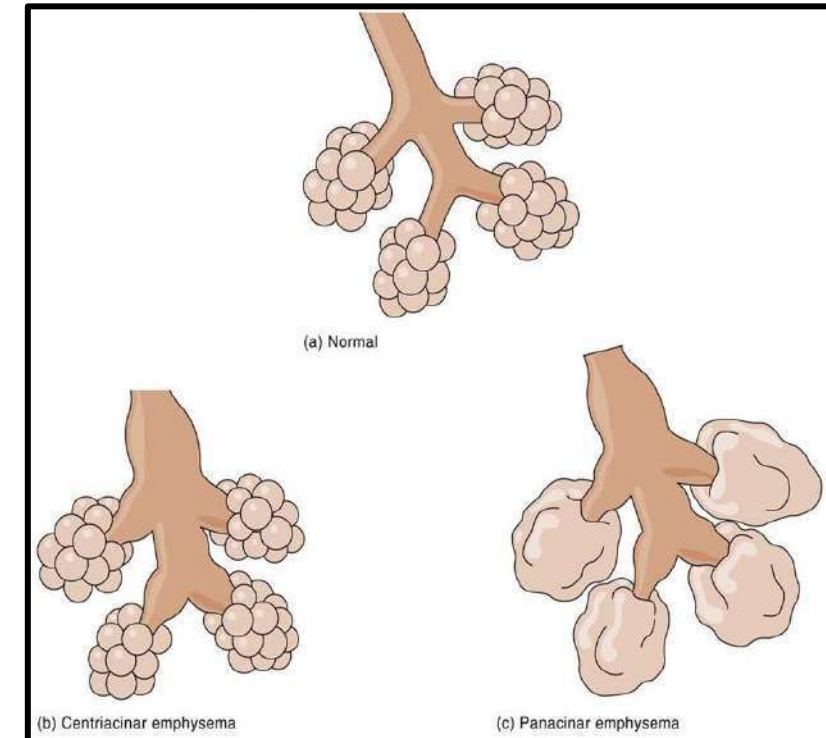
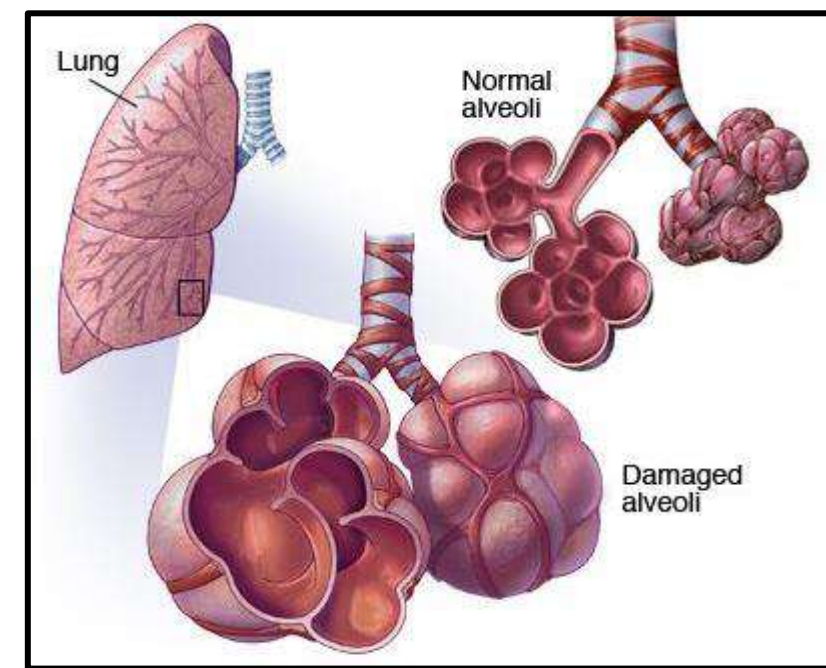
It is an obstruction of the airways due to mucus hypersecretion and fibrosis of the bronchiolar wall which is associated with chronic irritation from smoking and recurrent infections.

### 2. Emphysema

Loss of lung elasticity and abnormal enlargement of the air spaces, with destruction of the alveolar walls and capillary beds.

#### Types

- Centriacinar emphysema
- Panacinar emphysema

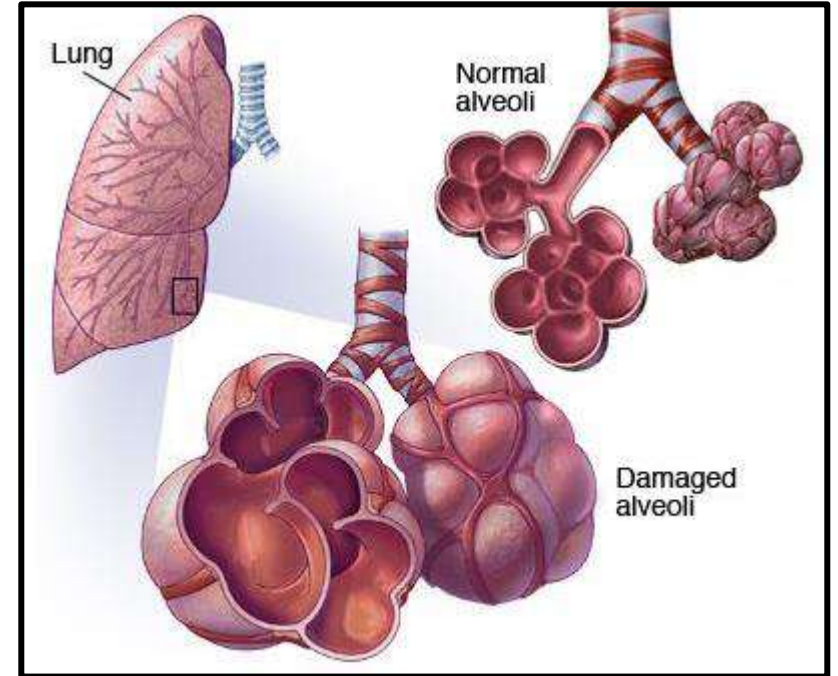


# Obstructive Lung Diseases

## ➤ Emphysema

### Causes

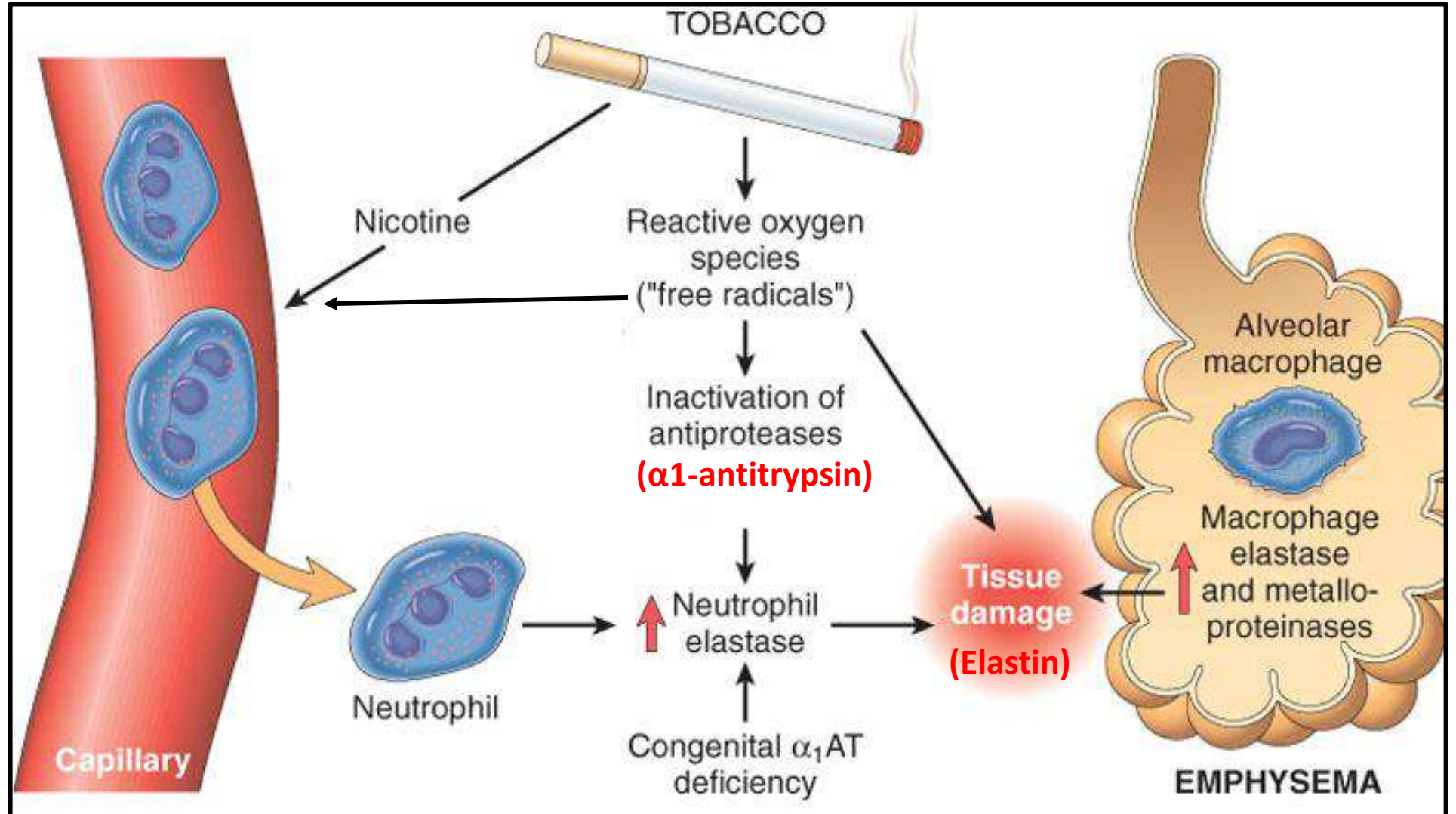
- Smoking, main cause of emphysema
- Deficiency of  $\alpha$ 1-antitrypsin, an antiprotease enzyme



# Obstructive Lung Diseases

## ➤ Emphysema

### Pathogenesis

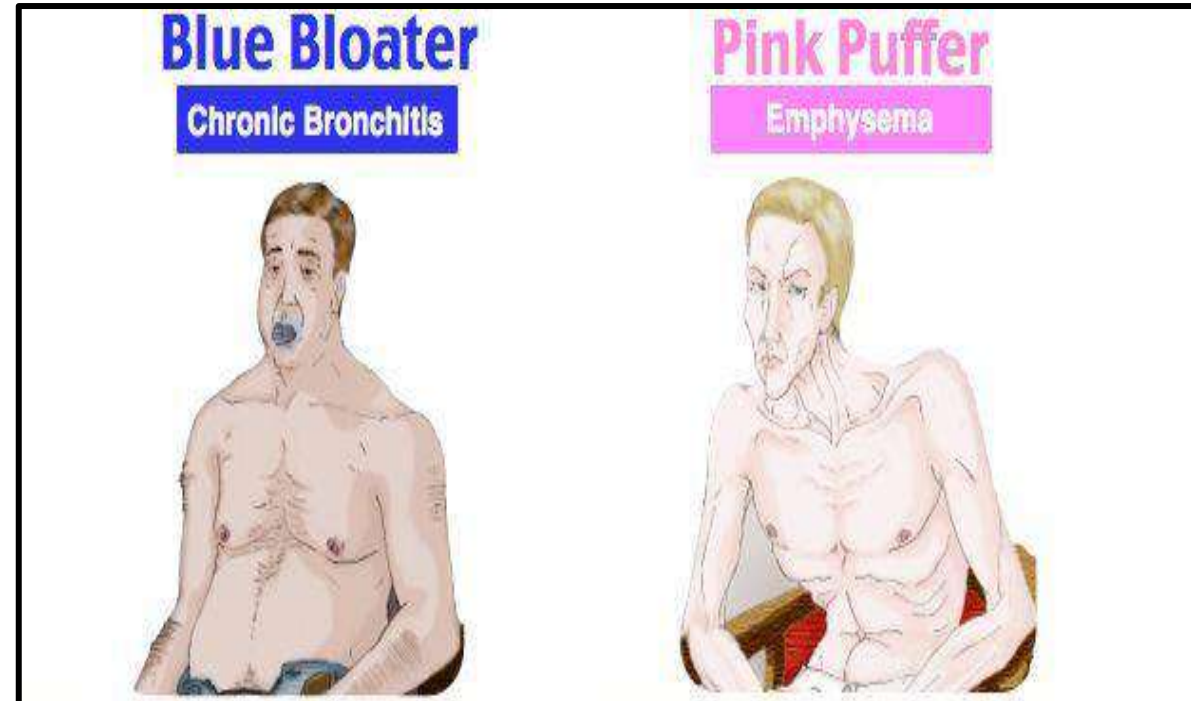
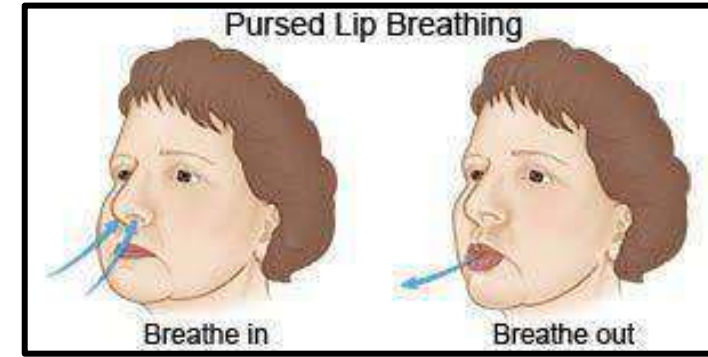
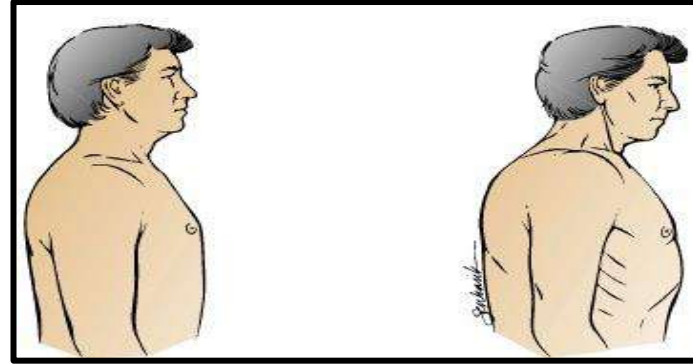


# Obstructive Lung Diseases

## ➤ Emphysema

### Symptoms

- Minimal cough, shortness of breath, dyspnea, recurrent respiratory infections
- Pink puffers: tachypnea
- Pursed-lip breathing
- Wheezing
- Barrel chest
- Respiratory failure: diaphragm fatigue



# Obstructive Lung Diseases

## ➤ Emphysema

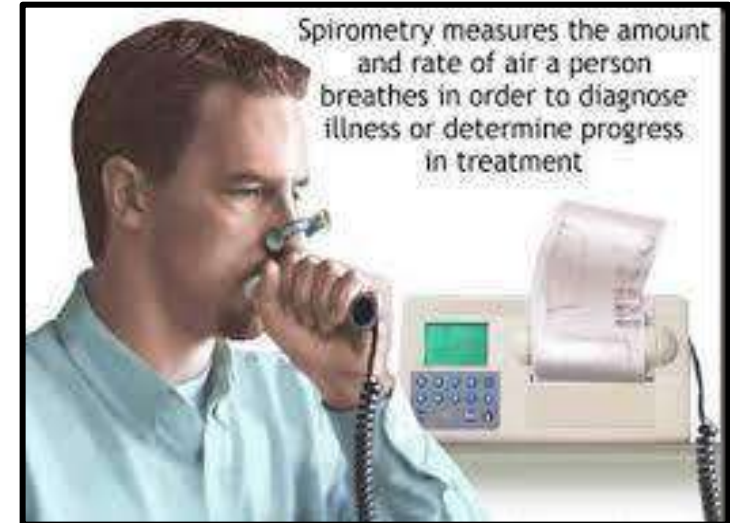
### ▪ Diagnosis

- Pulmonary functions: spirometer (**TLC**, VC, FVC, FEV1, FEV1/FVC ratio)
- Chest radiography
- Hemoglobin saturation, and arterial blood gases

**VC: vital capacity**, the maximum amount of air can be expelled from the lungs after a maximum inhalation (4L).

**FVC: forced vital capacity**, the volume of air that can forcibly be blown out after full inspiration (4.5-5L)

**FEV1: forced expiratory volume in 1 second**, the volume of air that can forcibly be blown out in first 1 second after full inspiration (80% of FVC)



# Obstructive Lung Diseases

## ➤ Emphysema

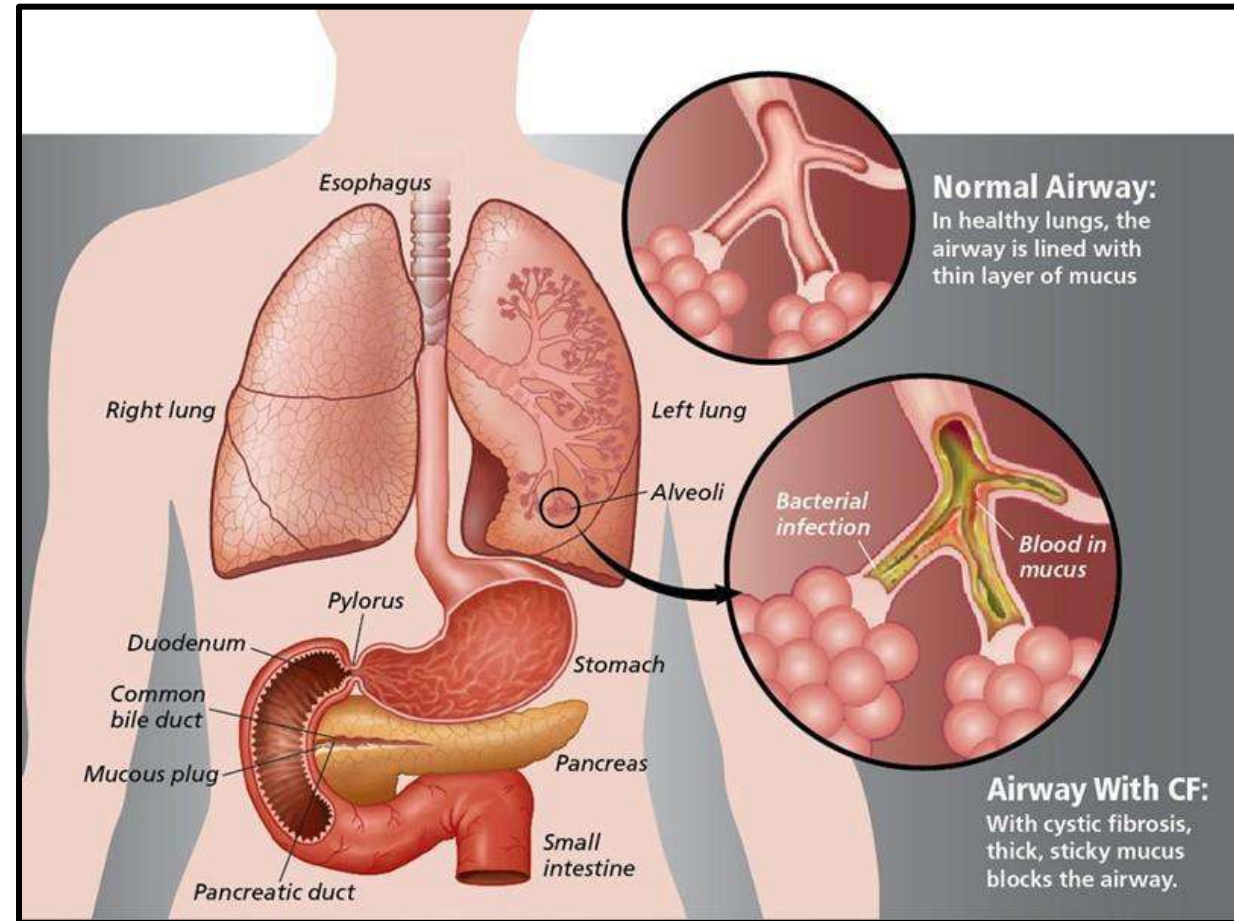
### ▪ Treatment

1. **Life style management: Stop Smoking**
2. **Pulmonary rehabilitation program**
3. **Oxygen therapy**
4. **Pharmacological medications**
  - Bronchodilators: B2-agonists, anticholinergics

# Obstructive Lung Diseases

## 3. Cystic Fibrosis (CF)

- It is a genetic disorder that affects mostly the lungs, but also the pancreas, liver, and GIT.
- Secretions become sticky and thick instead of acting as a lubricant.

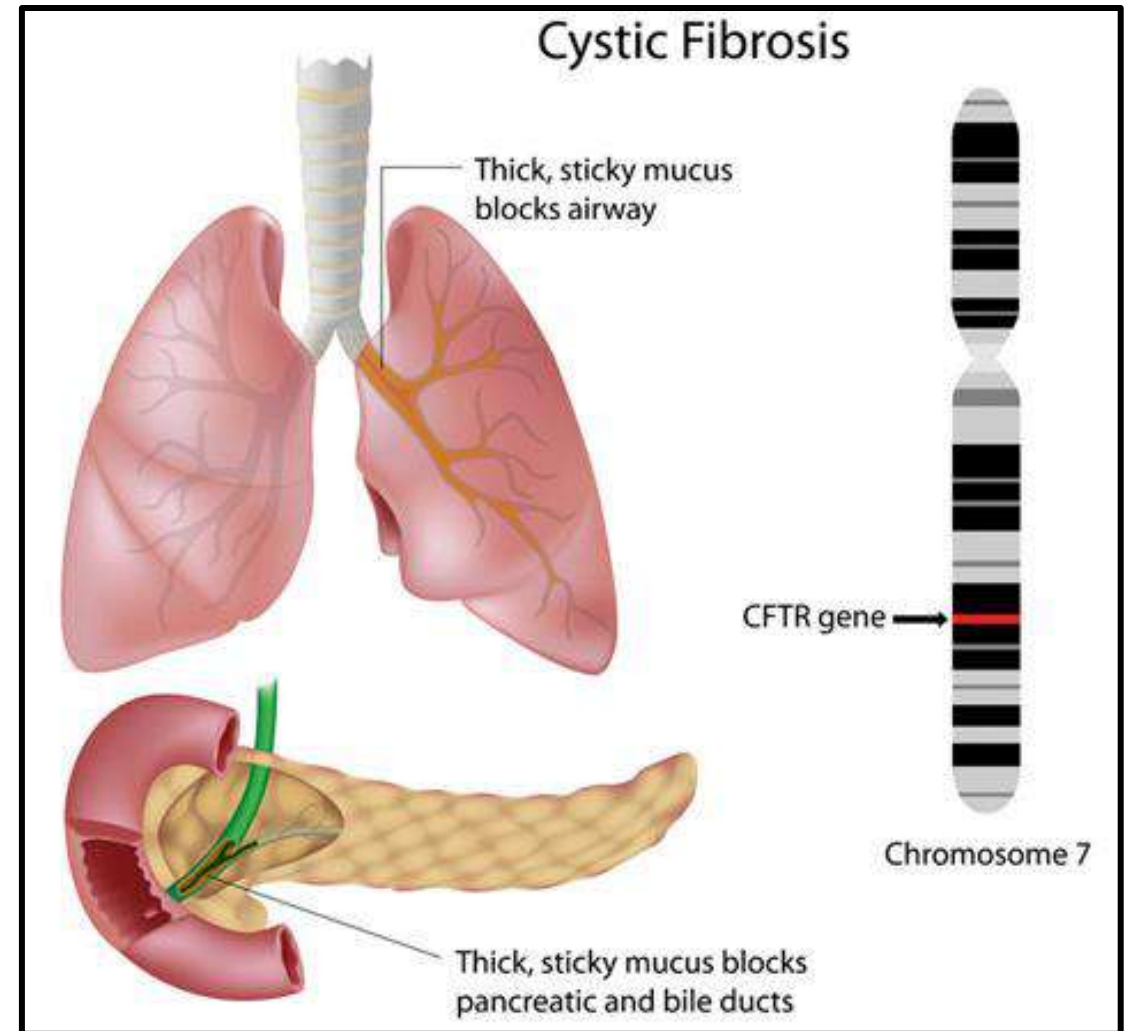


# Obstructive Lung Diseases

## 3. Cystic Fibrosis (CF)

### Causes

- a mutation in the gene cystic fibrosis transmembrane regulator (CFTR).

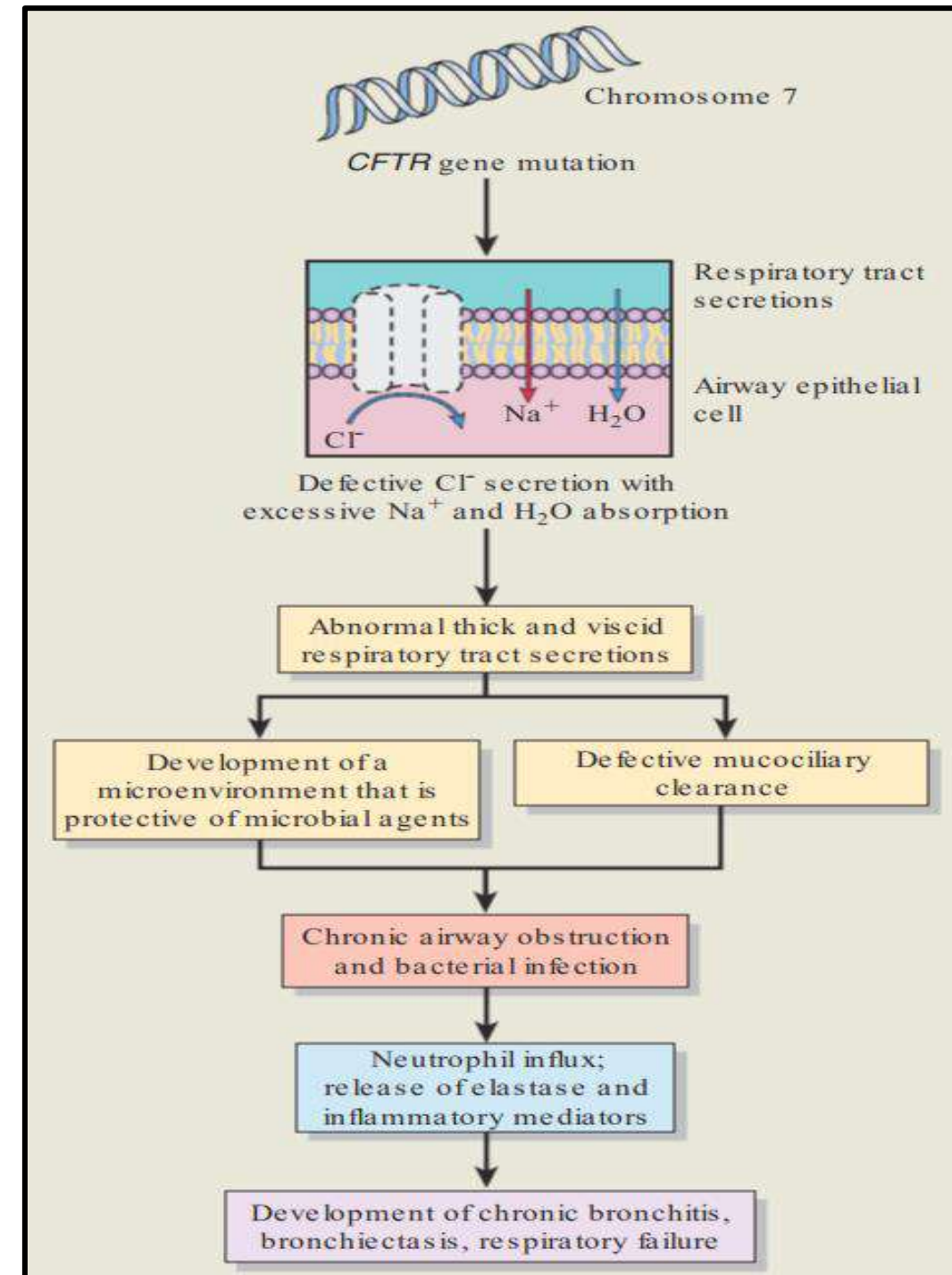
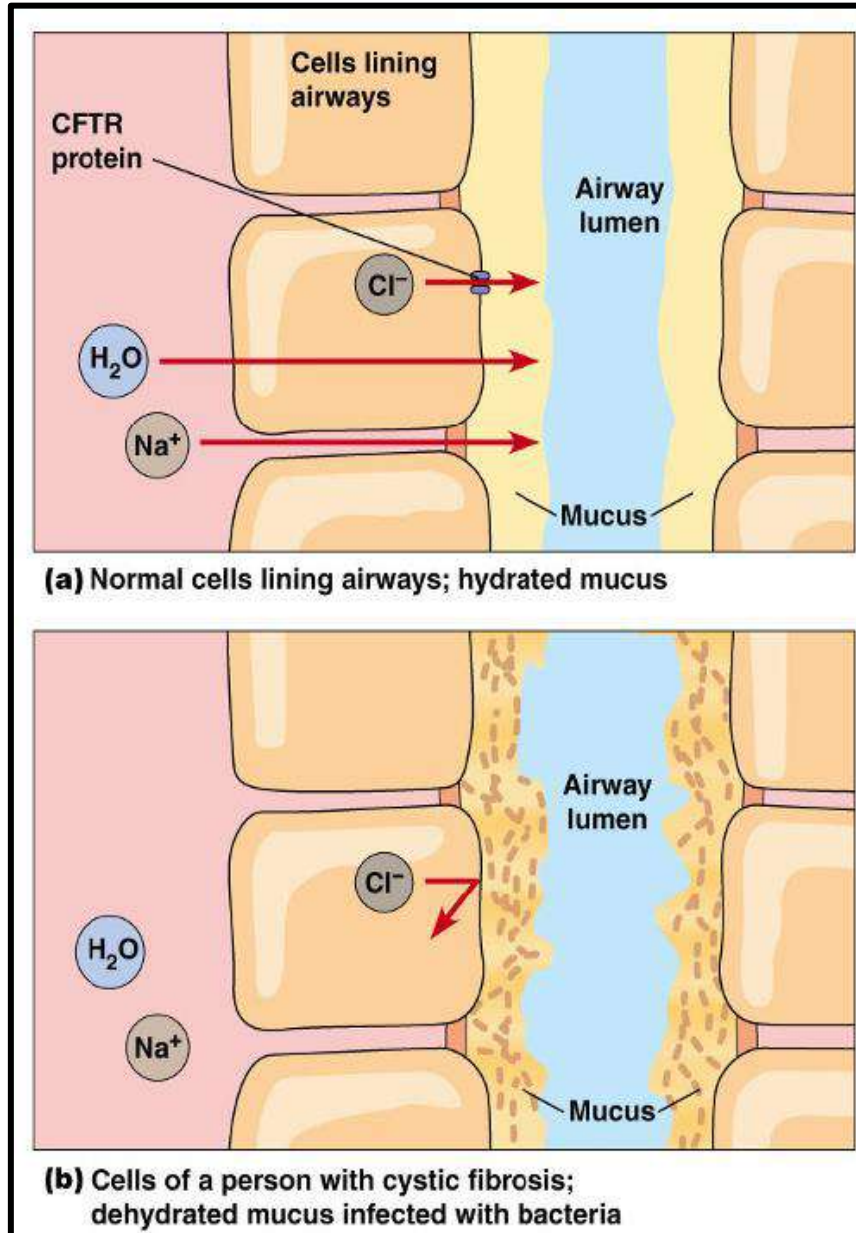




# Obstructive Lung Diseases

## 3. Cystic Fibrosis

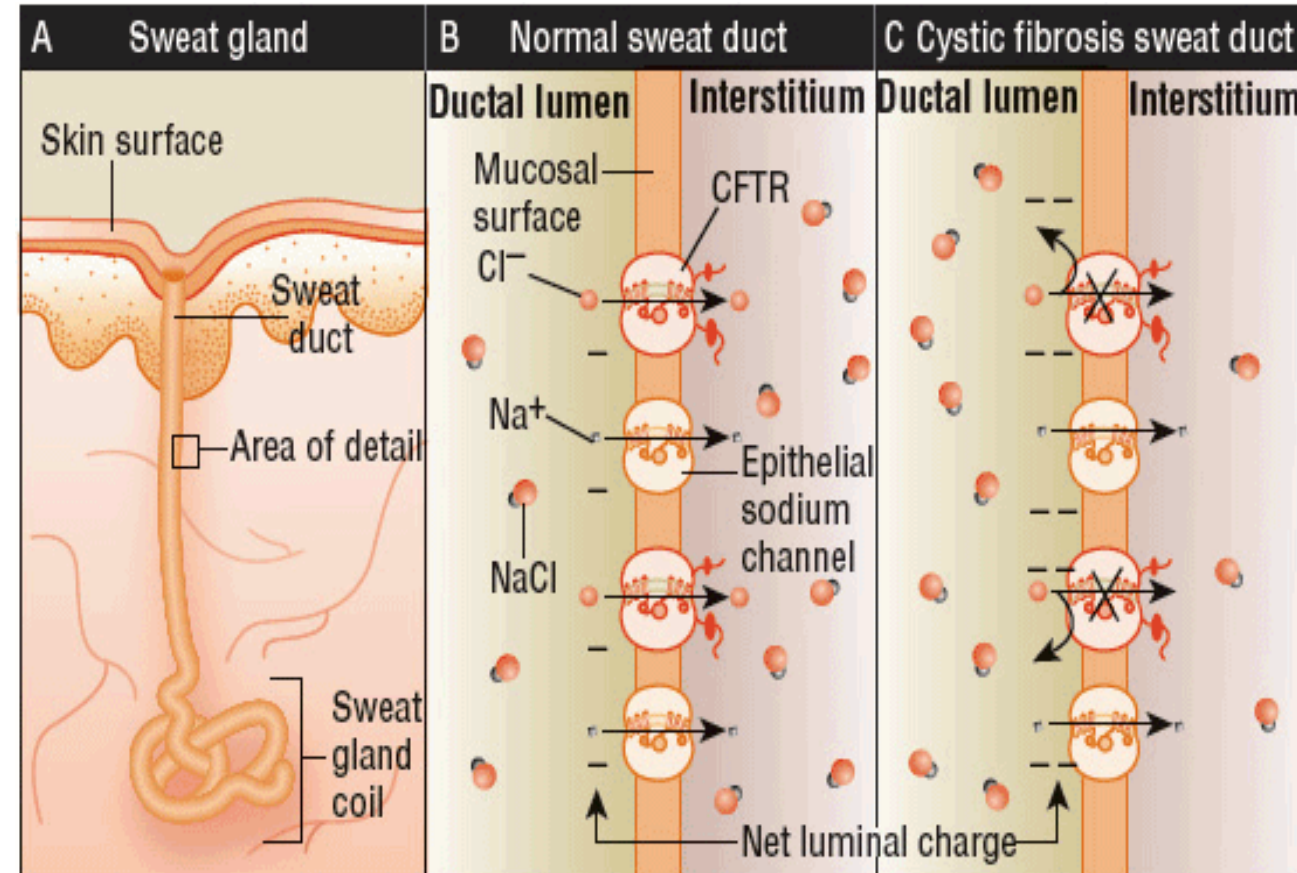
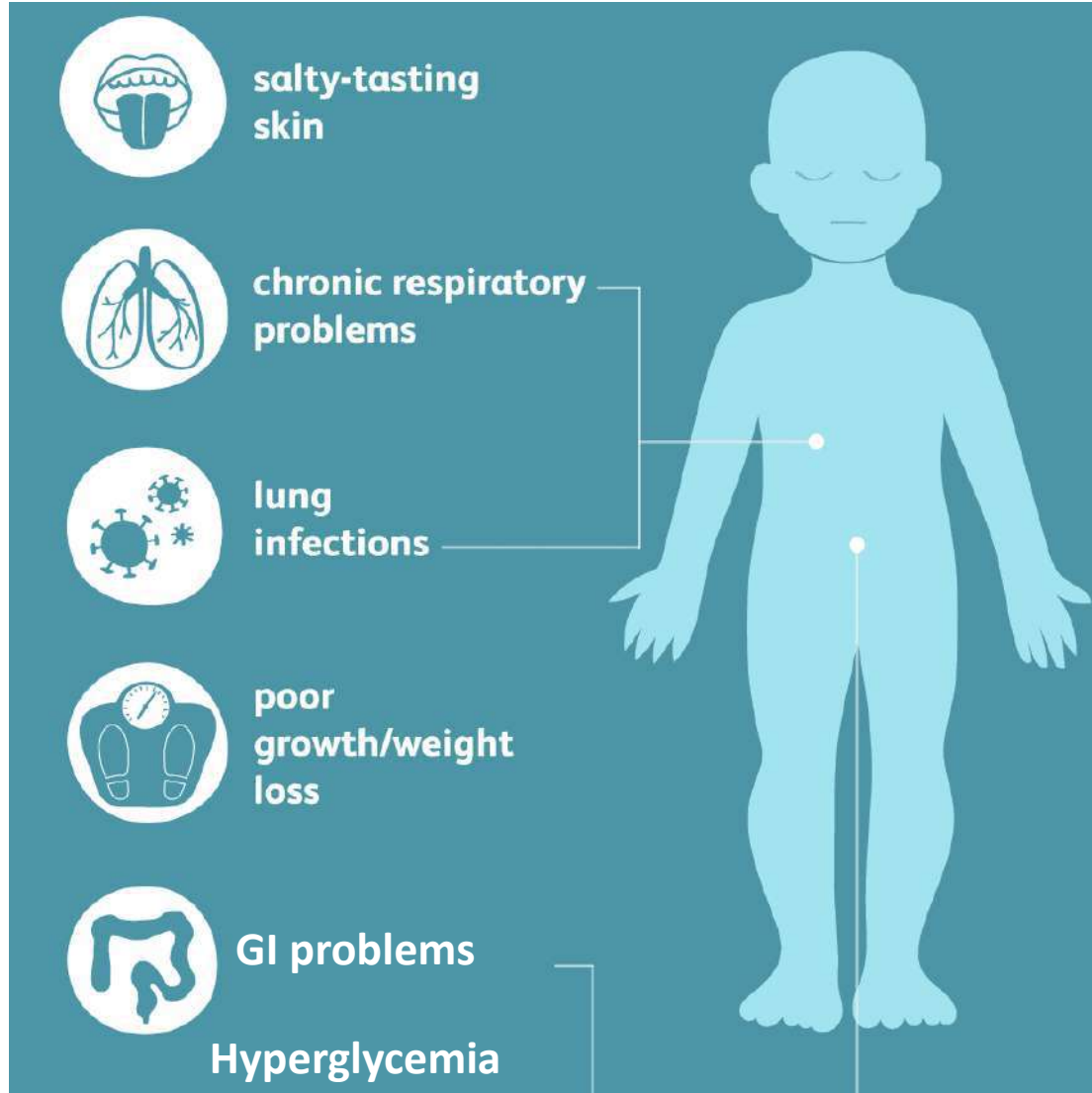
### Pathogenesis



# 3. Cystic Fibrosis

## Obstructive Lung Diseases

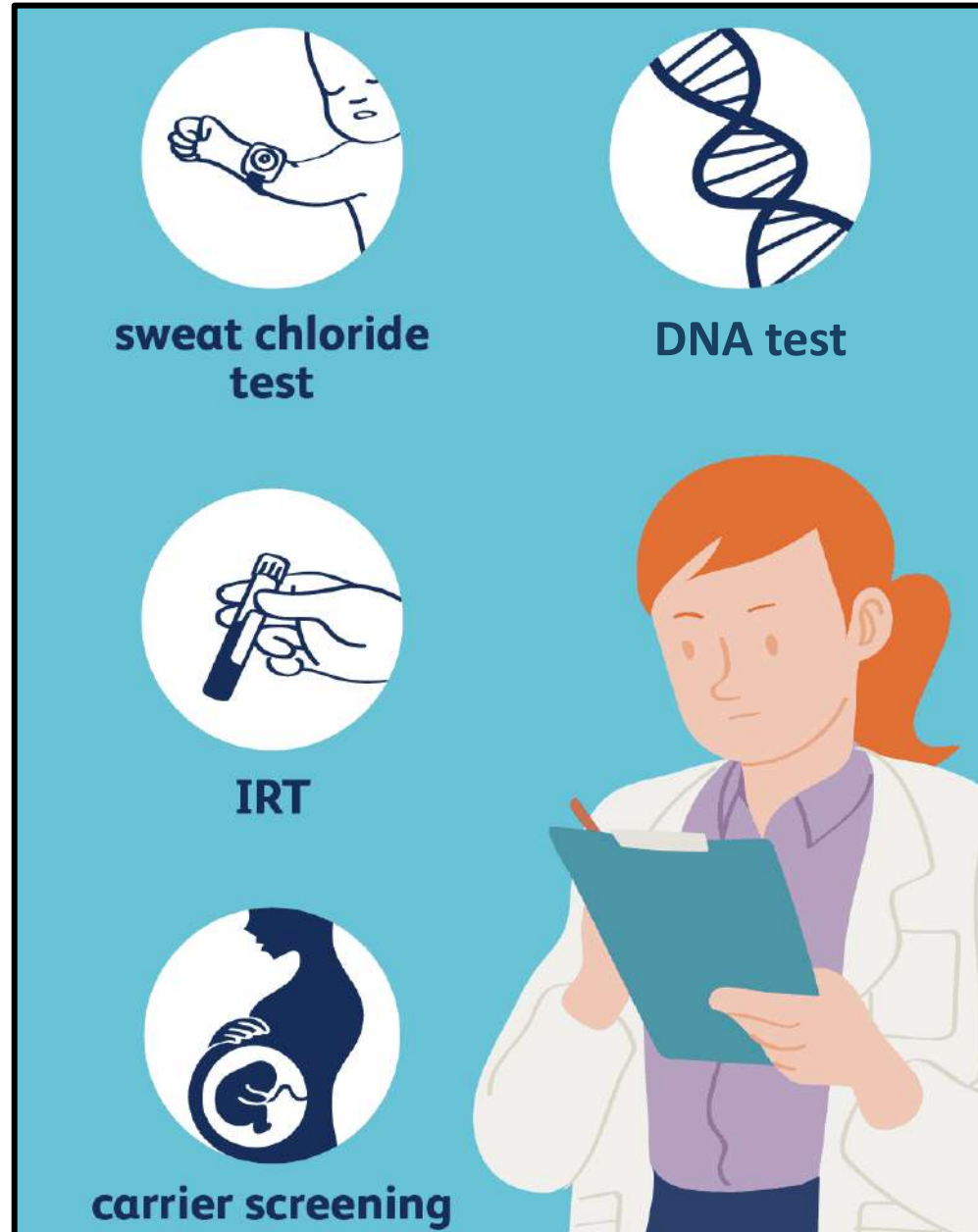
### Symptoms



# Obstructive Lung Diseases

## 3. Cystic Fibrosis

### Diagnosis



# Obstructive Lung Diseases

## 3. Cystic Fibrosis

### Treatment

- Antibiotics
- Chest physical therapy (chest percussion and postural drainage)
- Mucolytic agents
- Nutritional therapy including pancreatic enzyme replacement

