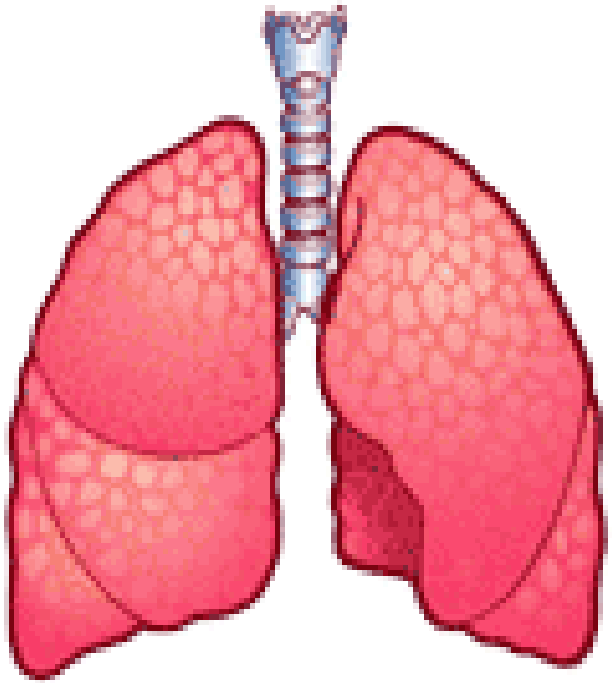
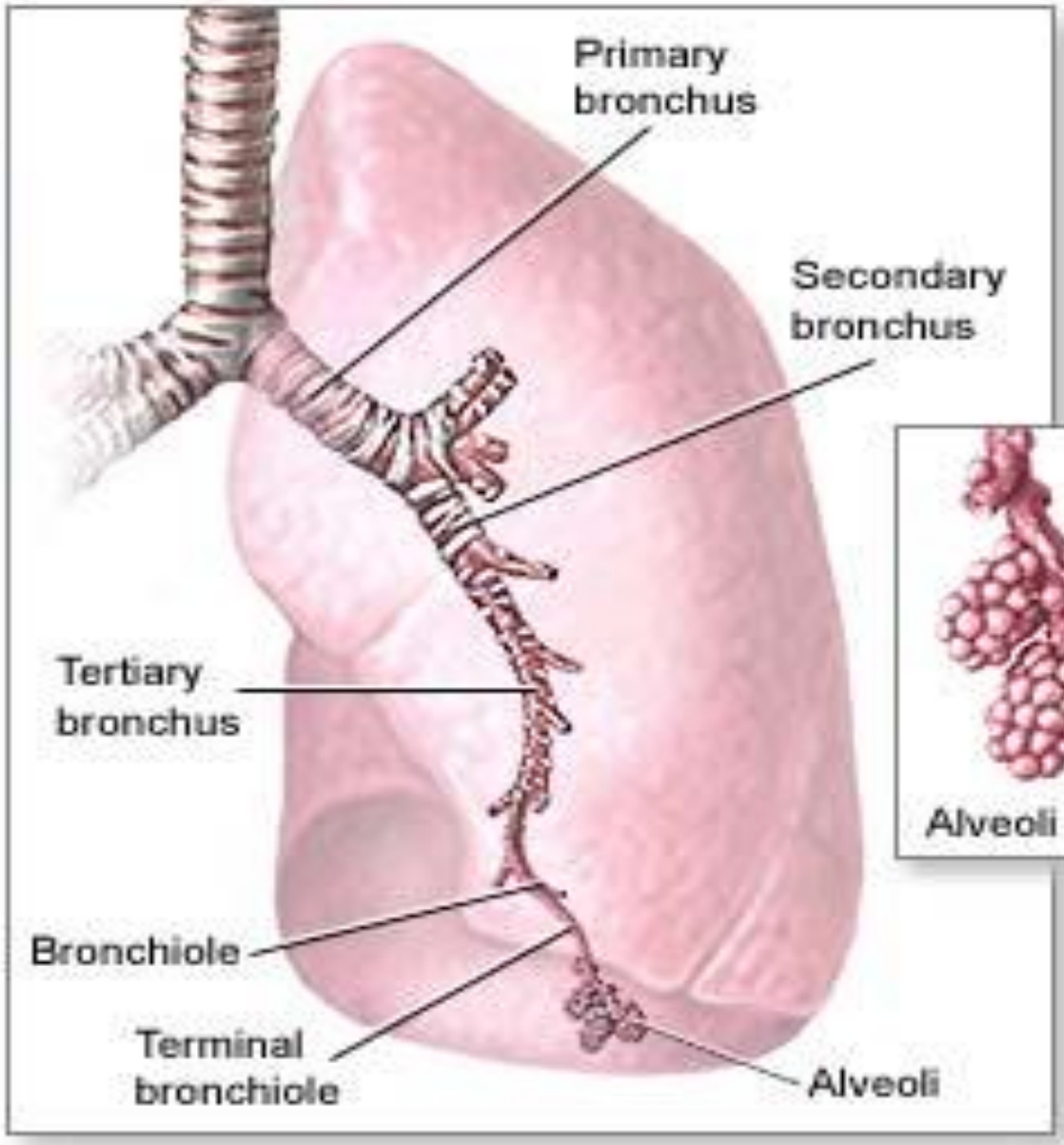
CHRONIC OBSTRUCTIVE PULMONARY DISEASE

by Dr.Swathi Swaroopa. B



MORPHOLOGY OF LUNGS



INTRODUCTION

- Chronic obstructive pulmonary disease (**COPD**) is characterized by airflow limitation that is not fully reversible.
- The airflow limitation is usually both progressive and associated with an abnormal inflammatory response of the lungs.
- Cigarette smoking (> 20 PACK YEAR)is the primary cause of COPD
- Chronic obstructive pulmonary disease generally refers to **Emphysema** or **Chronic bronchitis**.

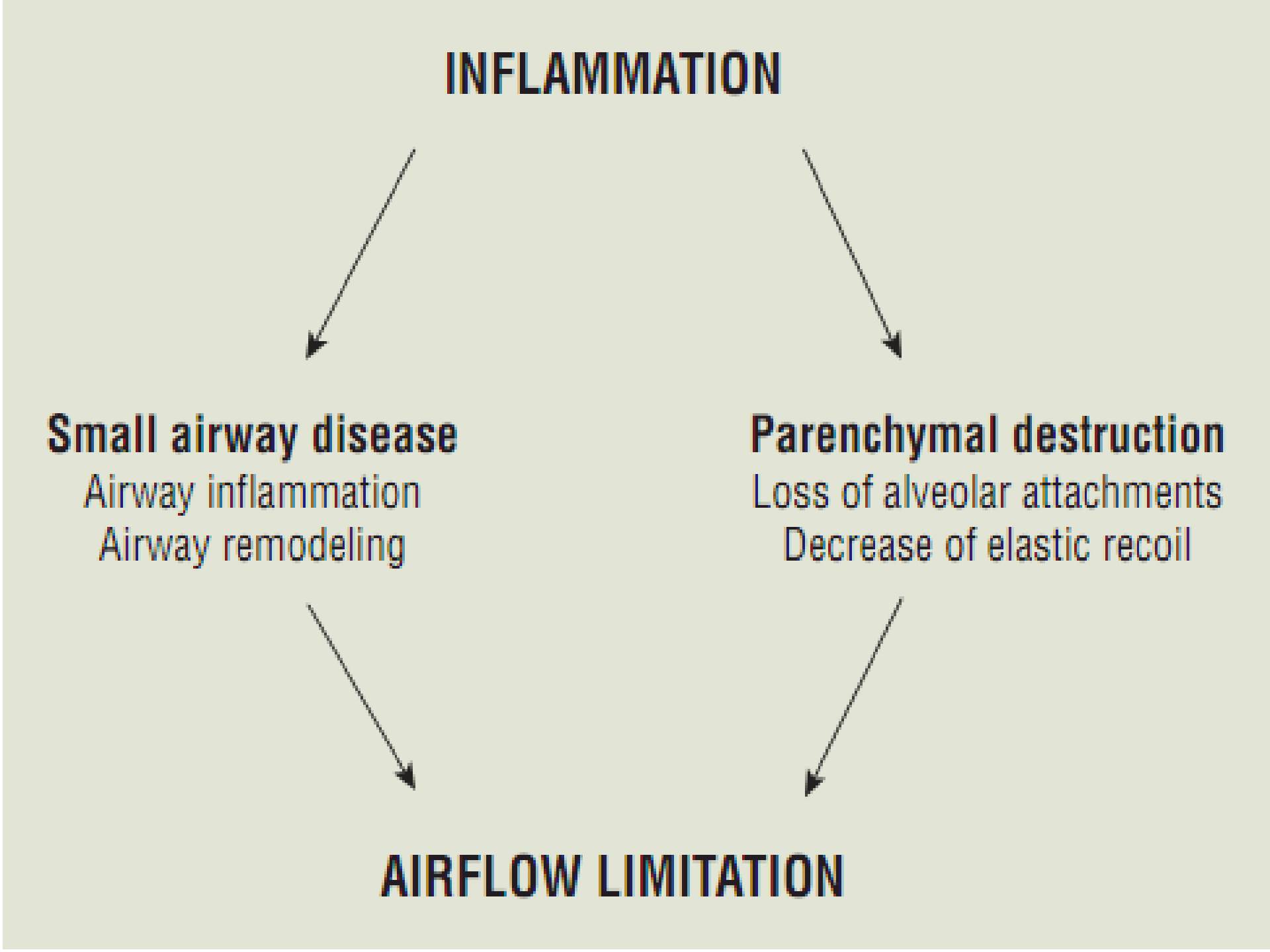
- **Emphysema** is characterized by alveolar wall destruction and abnormal, permanent enlargement of air–space.

- **Chronic bronchitis** associated with chronic or recurrent excess mucus secretion into the bronchial tree with chronic cough for at least 3 months for 2 consecutive years.

PATHOLOGICAL CHANGES

Effect 4 different compartments of lungs:

- Central airways
- Peripheral airways
- Lung parenchyma (Bronchioles, alveoli, capillaries)
- Pulmonary vasculature


INFLAMMATION
Small airway disease
Airway inflammation
Airway remodeling
Parenchymal destruction
Loss of alveolar attachments
Decrease of elastic recoil
AIRFLOW LIMITATION

PATHOPHYSIOLOGY

- Noxious Agent
- Inflammation
- Hyperinflation and Hypersecretion
- Airflow Obstruction
- Gas exchange abnormalities

1. Noxious particles and gas inhalation

Activation of neutrophils, macrophages, and CD8 + lymphocytes,

Release tumor necrosis factor-α , interleukin-8, and leukotriene B

Inflammation

Increased number and size of goblet cells and mucus glands

Smooth muscle& connective tissue thickening in airways

Scarring and fibrosis.

2.Oxidative stress

Increased oxidants

Damage various proteins and lipids

Cell and tissue damage.

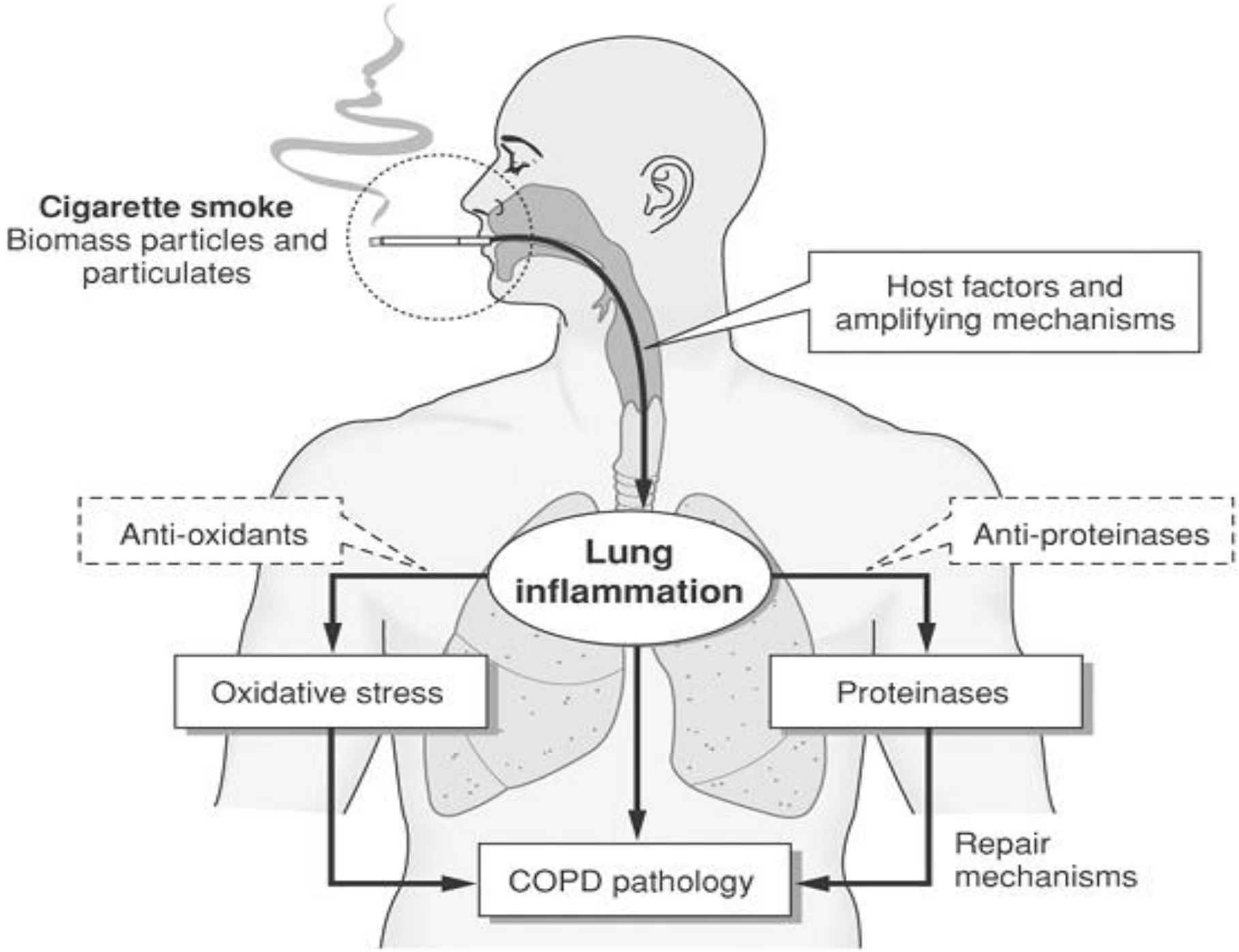
OXIDANTS → Promote inflammation

Inhibit antiprotease activity.

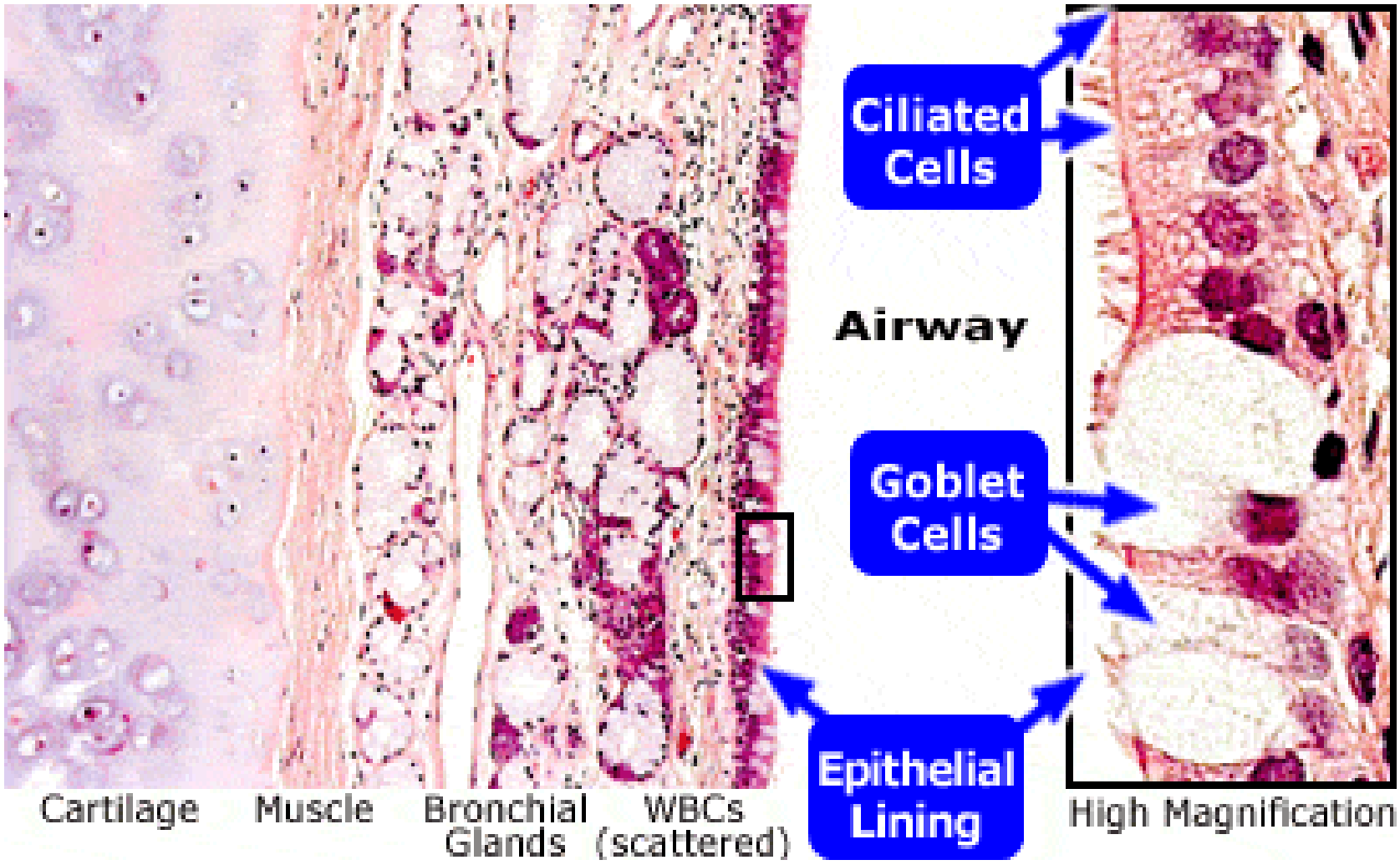
Increase protease-antiprotease imbalance

Proteases and antiproteases imbalance

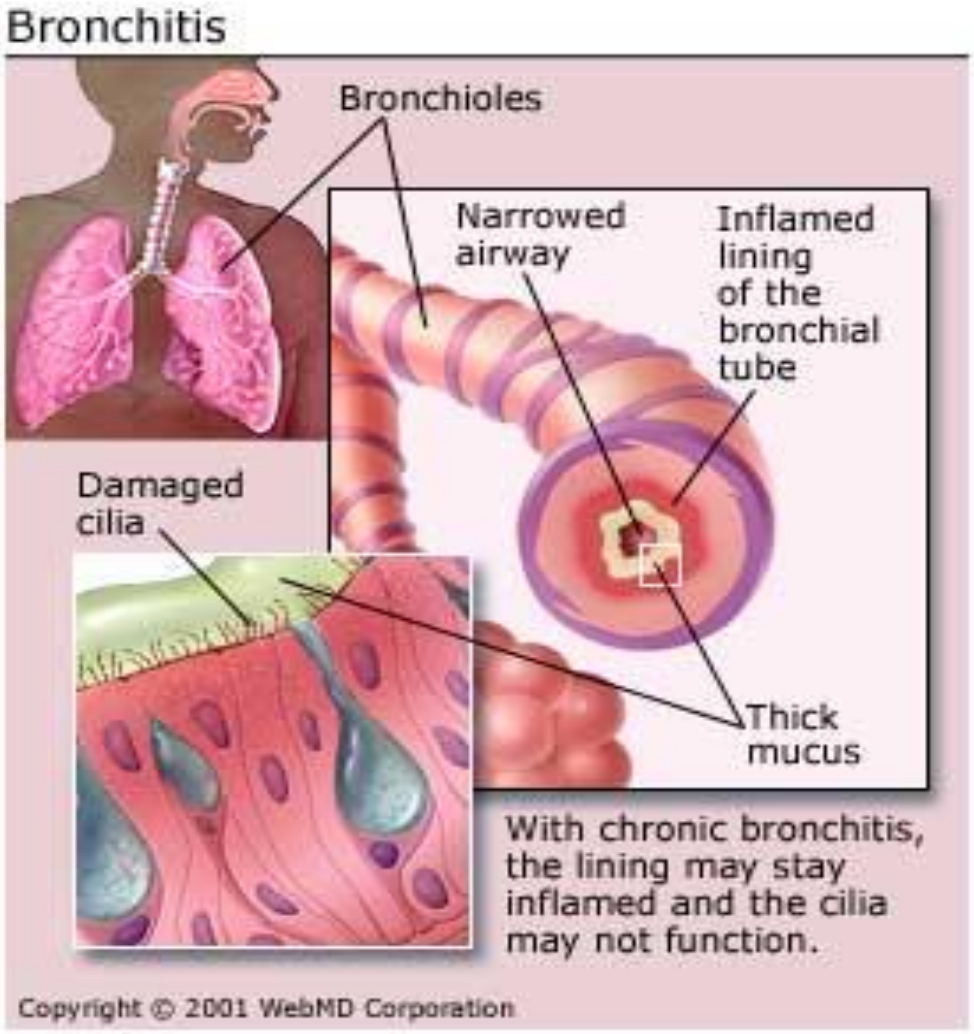
- Antiprotease a1-antitrypsin (AAT) is an antiprotease enzyme which inhibit the proteases (neutrophil elastase).
- Neutrophil elastase is a potent elastolytic enzyme that attack elastin which leads to tissue damage and loss of elasticity.
- Elastin is a major component of alveolar walls.
- Cigarette smoke activate and attract inflammatory cells into the lung, thereby promoting the release of proteases such as elastase.
- Other proteases, including cathepsins and metalloproteinases.
- A hereditary deficiency of AAT results in an increased risk for premature development of emphysema.


Cigarette smoke
Biomass particles and particulates
Host factors and amplifying mechanisms
Anti-oxidants
Anti-proteinases
Lung inflammation
Oxidative stress
Proteinases
COPD pathology
Repair mechanisms

BRONCHIAL WALL



CHRONIC BRONCHITIS



- **Excess mucous secretions**
- **Inflamated lung endothelium**
- **Damaged cilia**
- **Tissue destruction**
- **Airway obstruction**
- **Decreases gas exchange**
- **Infections**
- **Hypoxemia**
- **Pulmonary hypertension**
- **Polycythemia**

EMPHYSEMA

- **Destructive enlargement of air sacs**
- **Dilation and destruction**
- **Impaired gas exchange**
- **Breakdown of elastin**
- **Loss of elasticity**
- **Lack of alpha1 anti trypsin**

2 types

CENTRILOBULAR:

Dilation & destruction of bornchioles, alveolar ducts, alveoli. In COPD

PANACINAR:

Destruction of whole acinus (airway ending). In alpha1 antitrypsin deficiency.

- **Centrilobular emphysema** that primarily affects respiratory bronchioles

- **Panlobular emphysema** is seen in AAT deficiency and extends to the alveolar ducts and sacs.

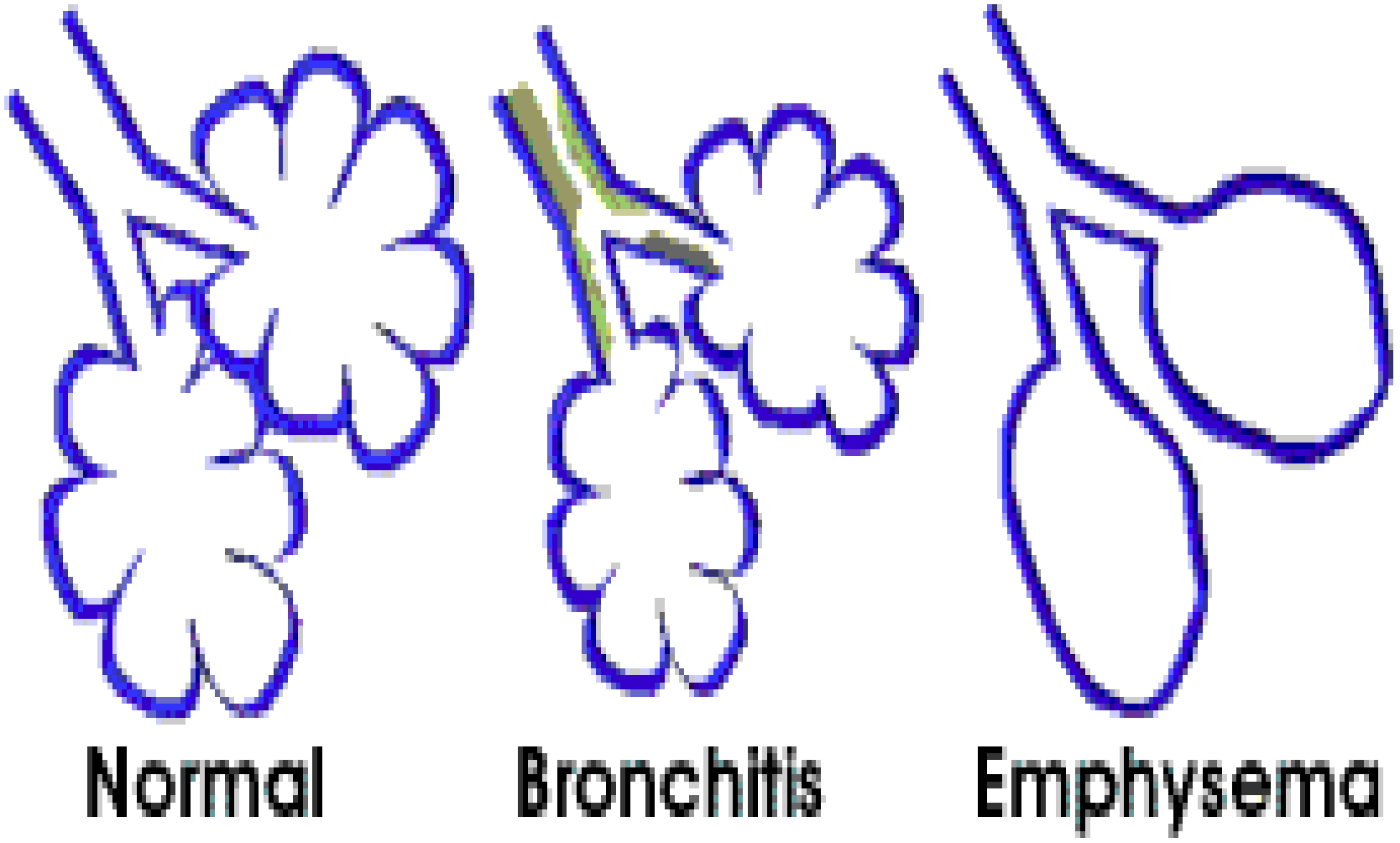
PINK PUFFERS

EMPHYSEMA

BLUE BLOATERS

CHRONIC BRONCHITIS

STRUCTURAL CHANGES IN ALVEOLI



RISK FACTORS

Host Factors

- Genetic predisposition (alfa1-antitrypsin)
- Airway hyper responsiveness
- Impaired lung growth

Exposures

- Environmental tobacco smoke
- Occupational dusts and chemicals
- Air pollution

AETIOLOGY

1. **Smoking**

   Major cause of COPD and risk increases

pack years = **Number of cigarettes per day x number of years smoked ÷ 20**

2. **Age**

   Increasing age results in ventilatory impairment

3. **Gender**

   Women have greater airway reactivity and experience faster declines in FEV1 and are at more risk than men.

4. **Occupation**

   Coal and gold mining, cement & cotton industries, farming and grain handling.

Aetiology …

5. **Genetic factor**

   Deficiency of α_1 antitrypsin (*strongest risk factor*)

   Genetic disorders involving tissue necrosis factor,

6. **Air pollution**

   Death rates are higher in urban areas than in rural areas

   Indoor air pollution from burning fuel biomass (*In underdeveloped areas*)

7. **Socio-economic status**

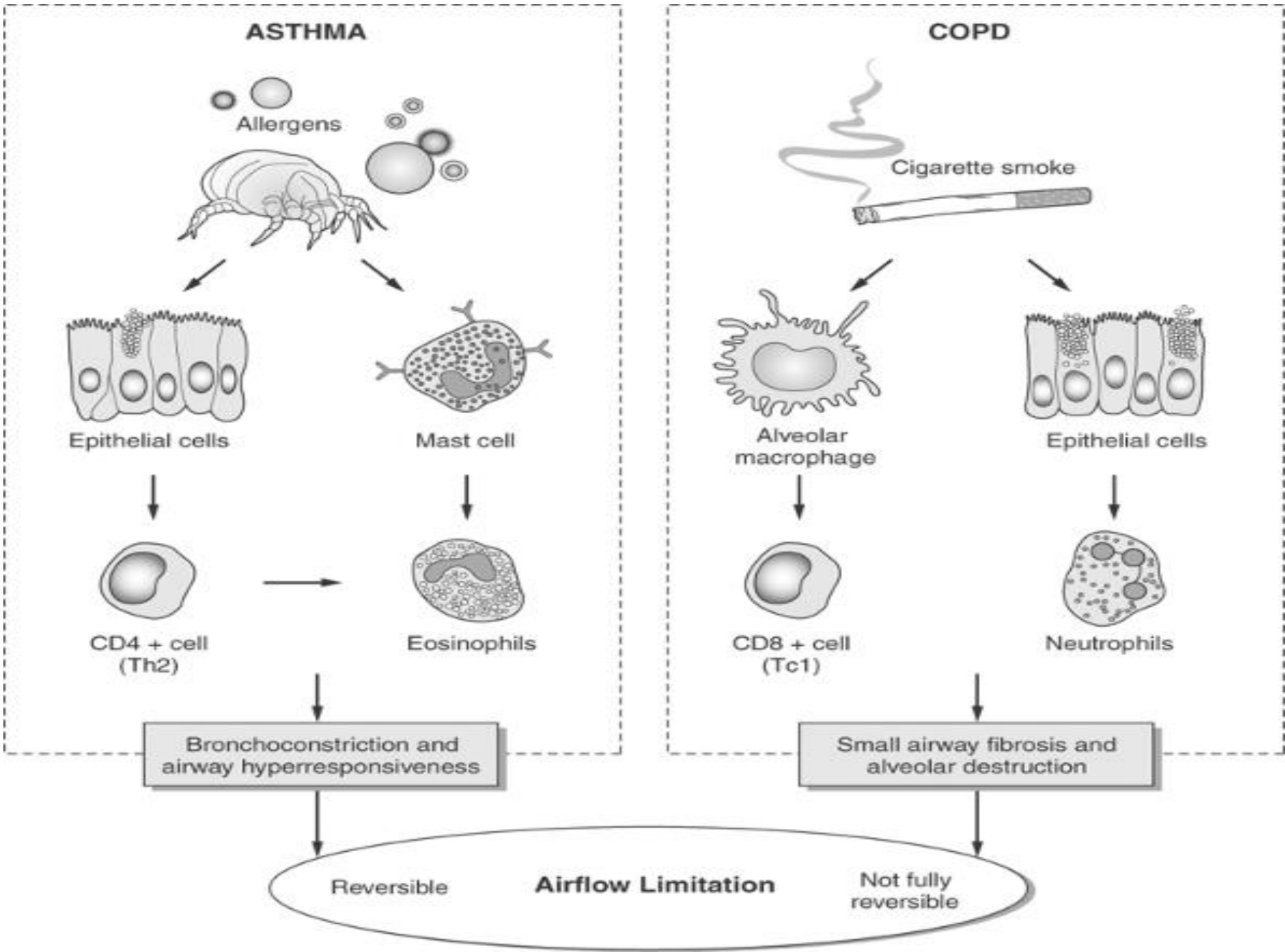
   More common in individuals of low socio-economic status

8. **Airway- hyper responsiveness &allergies**

   Smokers show high IgE & eosnophils & airway hyper responsiveness

SYMPTOMS

- Chronic cough
- Dyspnea
- Sputum production
- Bluish discoloration of lips and nail beds
- Increased resting respiratory rate
- Shallow breathing
- Pursed lips during expiration
- Weight loss


ASTHMA
Allergens
Epithelial cells
Mast cell
CD4 + cell
(Th2)
Eosinophils
Bronchoconstriction and
airway hyperresponsiveness
COPD
Cigarette smoke
Alveolar
macrophage
Epithelial cells
CD8 + cell
(Tc1)
Neutrophils
Small airway fibrosis and
alveolar destruction
Reversible
Airflow Limitation
Not fully
reversible

Characteristic	Asthma	COPD
Age at onset	Usually < 40 yr	Usually > 40 yr
Smoking history	Not causal, but worsens control	Usually >10 pack-years
Sputum production	Infrequent	Common
Allergies	Common	Infrequent
Clinical symptoms	Intermittent and variable	Persistent and progressive
Course of disease	Stable (with exacerbations)	Progressive worsening (with exacerbations)
Importance of nonrespiratory comorbid illnesses	Not usually important	Often important
Spirometry results	Often normalize over time	May improve, but do not normalize over time
Airway inflammation	Eosinophilic	Neutrophilic

*Adapted with permission from the *Canadian Pharmacists Journal*: 140[Suppl 3], 2007.[22]

CLINICAL PRESENTATION

Symptoms

- Chronic cough
- Sputum production
- Dyspnea

Exposure to Risk Factors

- Tobacco smoke
- α_1-Antitrypsin deficiency
- Occupational hazards

Physical Examination

- Cyanosis of mucosal membranes
- Barrel chest
- Increased resting respiratory rate
- Shallow breathing
- Pursed lips during expiration
- Use of accessory respiratory muscles

Diagnostic Tests

- Spirometry with reversibility testing
- Radiograph of chest
- Arterial blood gas (not routine)

Symptoms

- Increased sputum volume
- Acutely worsening dyspnea
- Chest tightness
- Presence of purulent sputum
- Increased need for bronchodilators
- Malaise, fatigue
- Decreased exercise tolerance

Physical Examination

- Fever
- Wheezing, decreased breath sounds

Diagnostic Tests

- Sputum sample for Gram stain and culture
- Chest radiograph to evaluate for new infiltrates

TABLE 29-5 Classification of Chronic Obstructive Pulmonary Disease Severity

Stage I: mild
$FEV_1/FVC < 70\%$
$FEV_1 \geq 80\%$
With or without symptoms

Stage II: moderate
$FEV_1/FVC < 70\%$
$50\% < FEV_1 < 80\%$
With or without symptoms

Stage III: severe
$FEV_1/FVC < 70\%$
$30\% < FEV_1 < 50\%$
With or without symptoms

Stage IV: very severe
$FEV_1/FVC < 70\%$
$FEV_1 < 30\%$ or $< 50\%$ with presence of chronic respiratory failure or right heart failure

TABLE 29-7 Staging Acute Exacerbations of Chronic Obstructive Pulmonary Disease[a]

Mild (type 1)	One cardinal symptom[a] plus at least one of the following: URTI within 5 days, fever without other explanation, increased wheezing, increased cough, increase in respiratory or heart rate >20% above baseline
Moderate (type 2)	Two cardinal symptoms[a]
Severe (type 3)	Three cardinal symptoms[a]

SPIROMETER

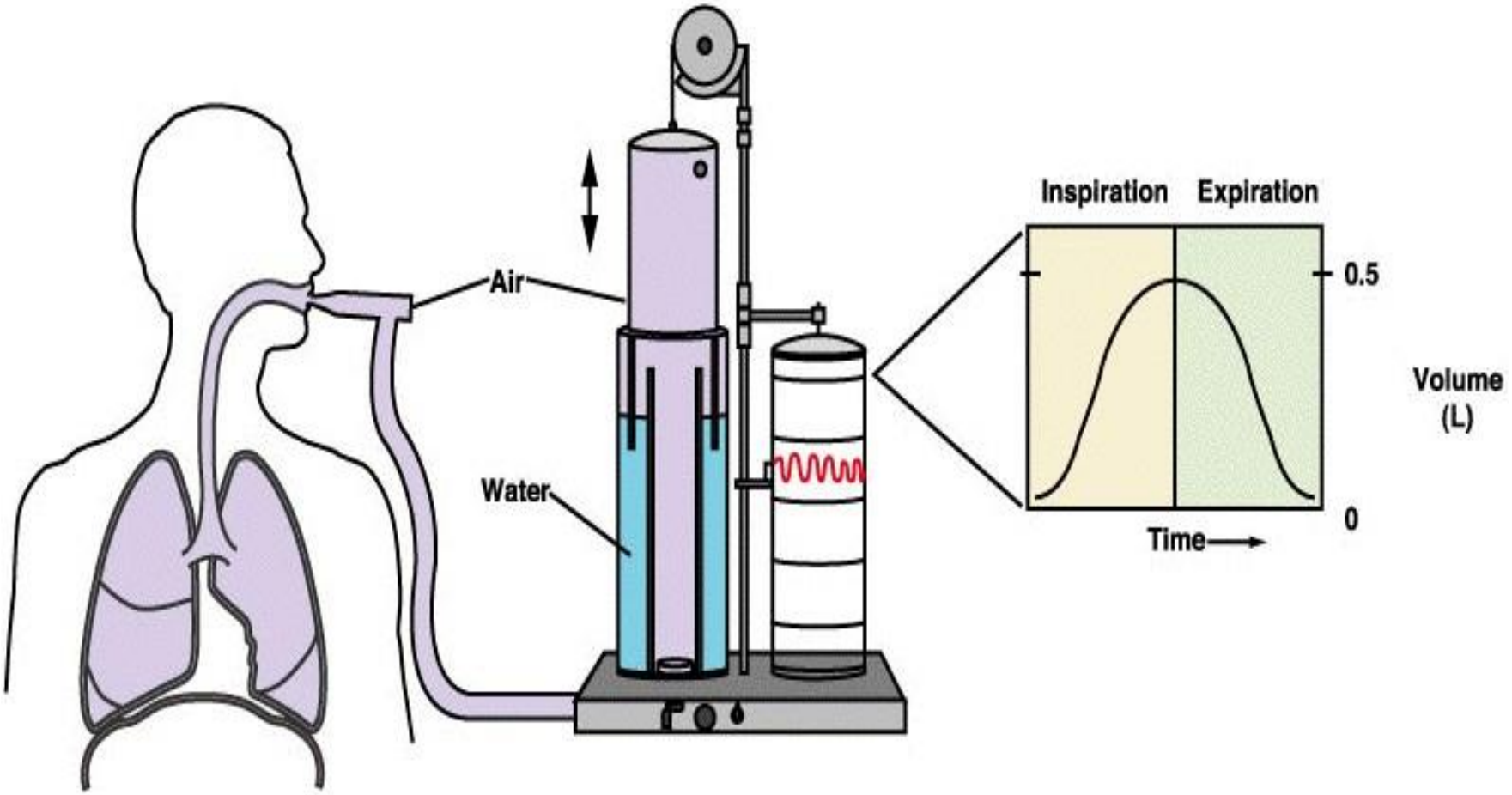


TABLE 29-6 Modified Medical Research Council (MRC) Dyspnea Scale

Grade 0	No dyspnea	Not troubled by breathlessness except with strenuous exercise
Grade 1	Slight dyspnea	Troubled by shortness of breath when hurrying on a level surface or walking up a slight hill
Grade 2	Moderate dyspnea	Walks slower than normal based on age on a level surface due to breathlessness or has to stop for breath when walking on level surface at own pace
Grade 3	Severe dyspnea	Stops for breath after walking 100 yards or after a few minutes on a level surface
Grade 4	Very severe dyspnea	Too breathless to leave the house or becomes breathless while dressing or undressing