
بسم الله الرحمن الرحيم

وَاتَّقُوا اللَّهَ ۖ وَيُعَلِّمُكُمُ اللَّهُ

Bronchial Asthma

BY

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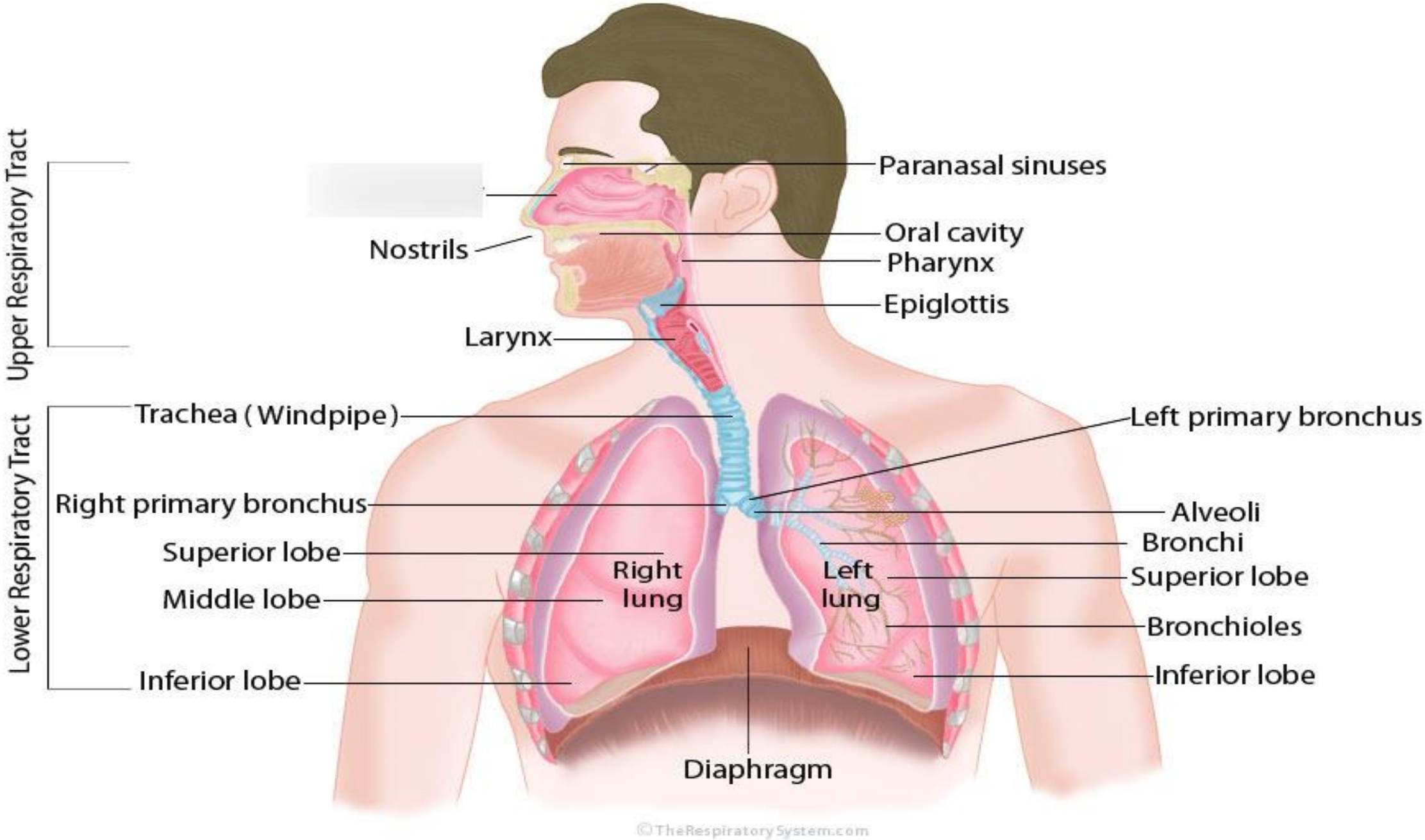
Part 1
INTRODUCTION
ANATOMY & PHYSIOLOGY

WHAT IS RESPIRATORY SYSTEM?

- The **respiratory system** (also **respiratory apparatus, ventilatory system**) is a biological system, consisting of specific organs and structures used for gas exchange in human.

- Organs of Respiratory System:
- Nose and nasal cavity.
- Pharynx
- Larynx
- Trachea
- Two bronchi
- Bronchioles
- Two Lungs


Upper Respiratory Tract
Lower Respiratory Tract
Paranasal sinuses
Nostrils
Oral cavity
Pharynx
Epiglottis
Larynx
Trachea (Windpipe)
Left primary bronchus
Right primary bronchus
Alveoli
Bronchi
Superior lobe
Middle lobe
Right lung
Left lung
Superior lobe
Bronchioles
Inferior lobe
Inferior lobe
Diaphragm
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TRACHEA

- **Position**
- The trachea or **windpipe** is a continuation of the larynx & extends downwards to about the level of **T-5** where it divides into right & left primary bronchi.
- **Length-**10-11cm
- **Relation**

Superiorly-the larynx

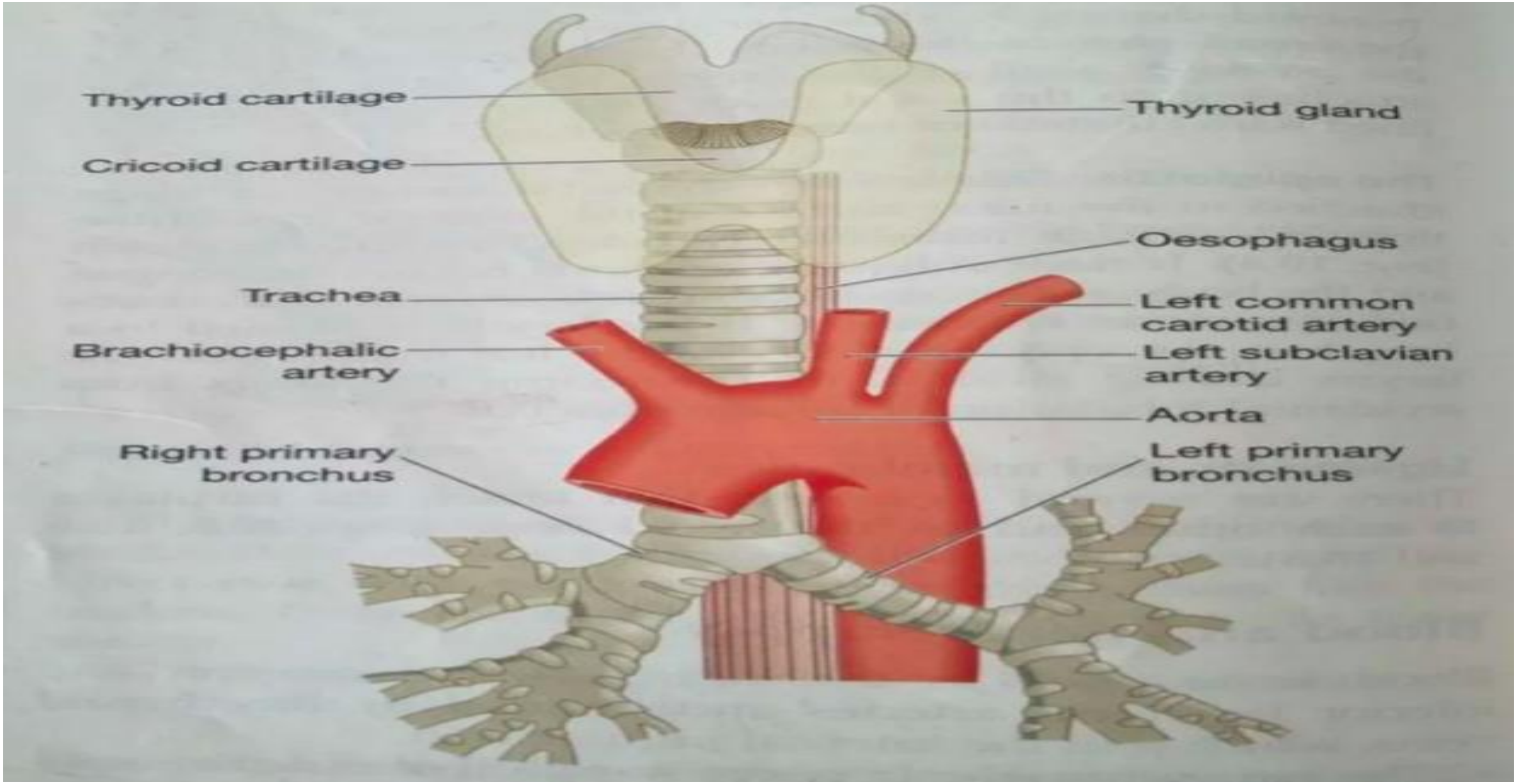
Inferiorly-the right & left bronchi

Anteriorly-upper part-the thyroid gland.

lower part-the arch of aorta & the sternum.

Posteriorly-.the oesophagus

Laterally- the lungs


Thyroid cartilage
Cricoid cartilage
Trachea
Brachiocephalic artery
Right primary bronchus
Thyroid gland
Oesophagus
Left common carotid artery
Left subclavian artery
Aorta
Left primary bronchus

STRUCTURE

- Composed of 3 layers of tissue.
- (i) fibrous & elastic tissue
- (ii) smooth muscle
- (iii) ciliated columnar epithelium
- Held open by between 16-20 incomplete cartilage rings (C-shaped)

Blood supply

Inferior thyroid artery

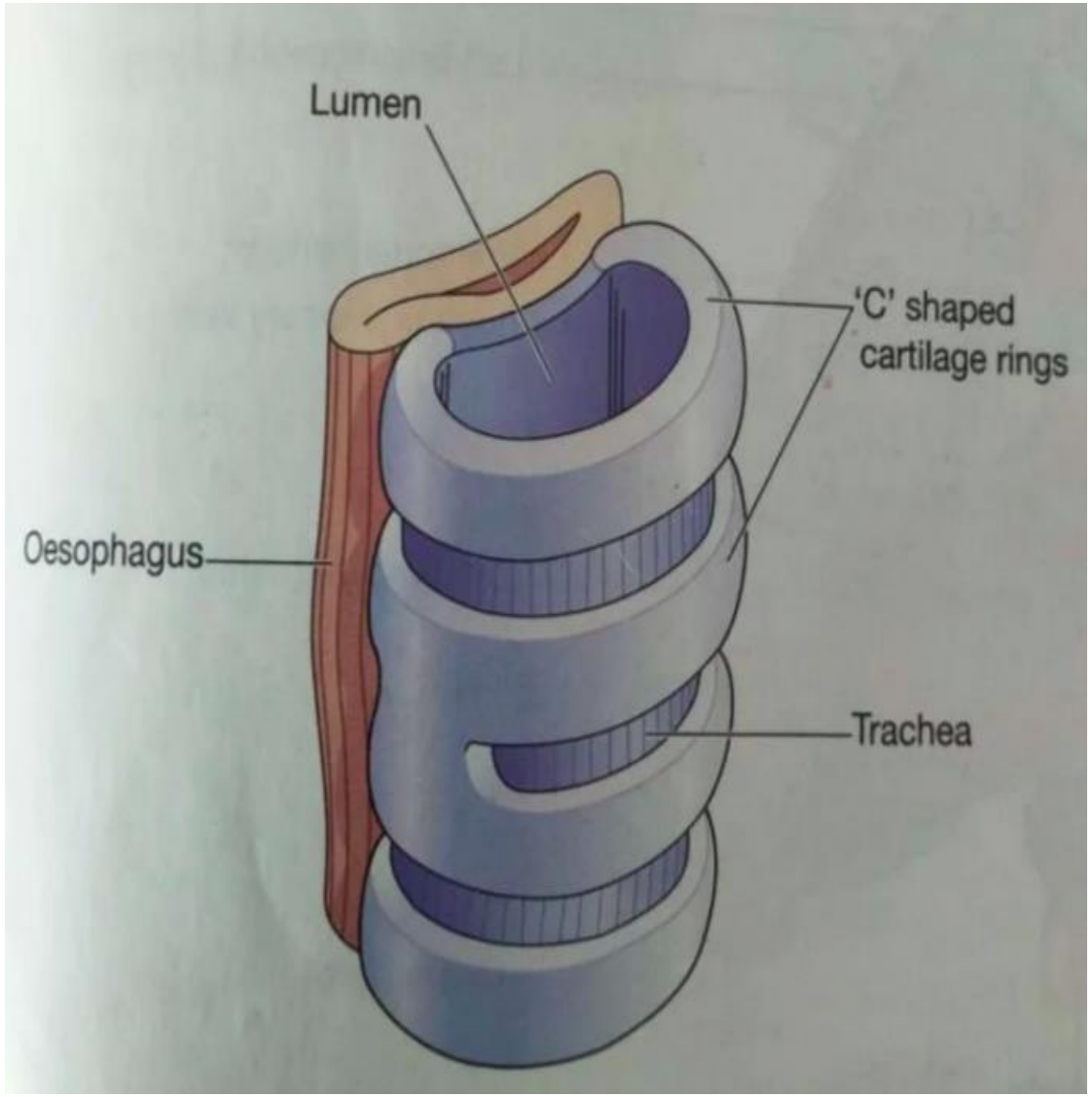
Bronchial artery

Venous drainage

Inferior thyroid veins

Nerve supply

Laryngeal nerve



FUNCTIONS

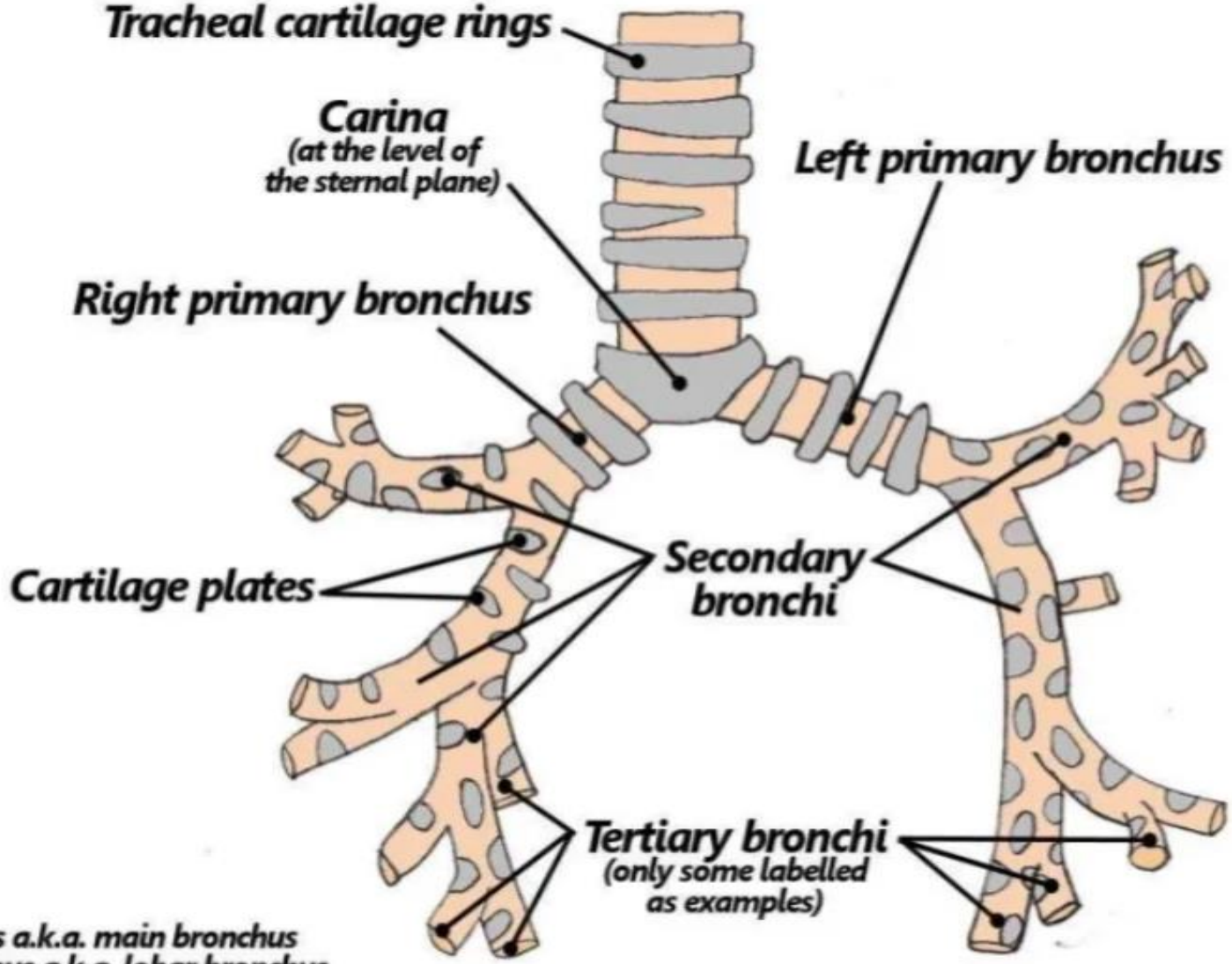
- Support and patency
- Mucociliary escalator
- Cough reflex
- Warming
- Humidifying
- Filtering

BRONCHI & BRONCHIOLES

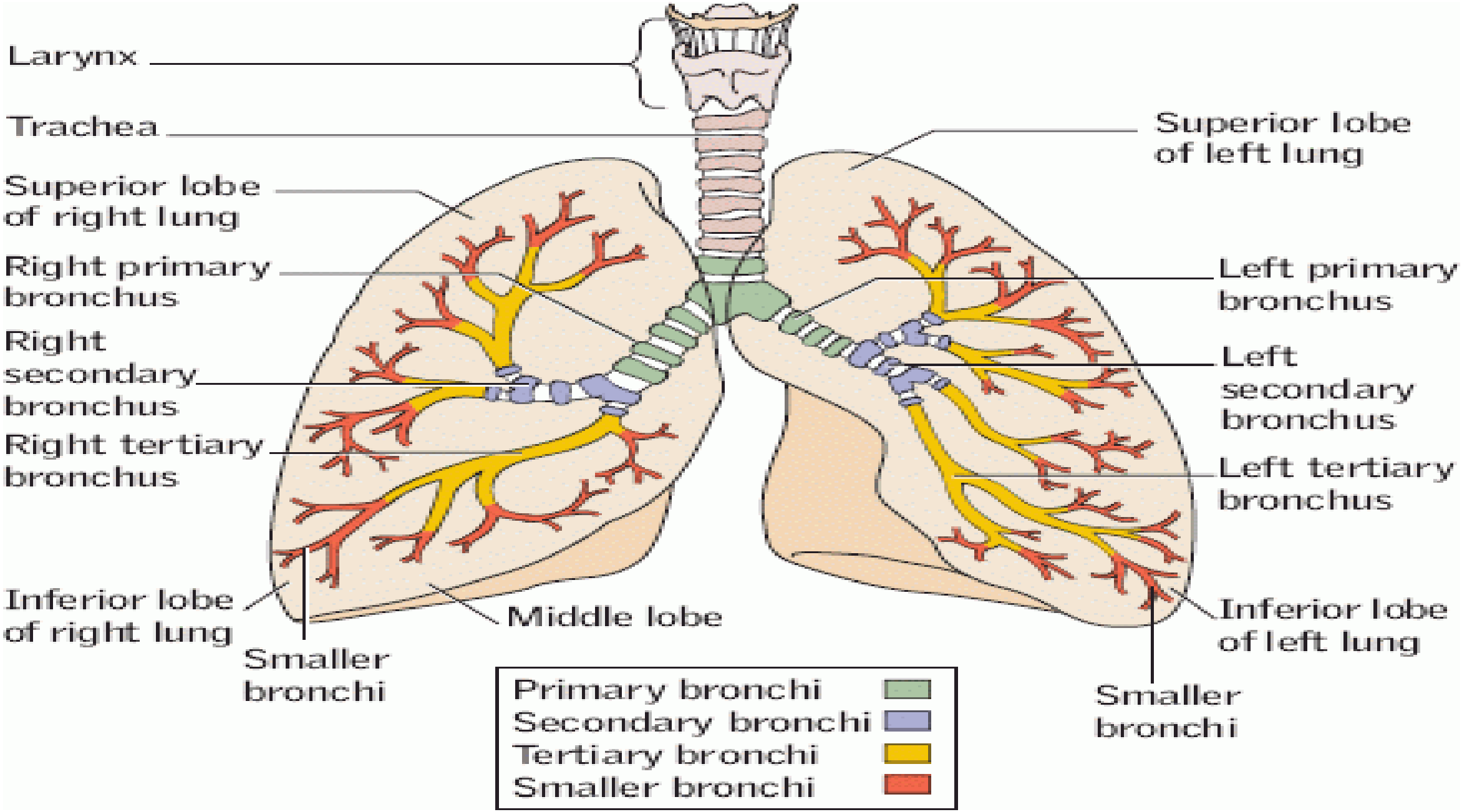
- The two primary bronchi when the trachea divides about the level of T-5.

- **The right bronchus**
- This is wider,shorter and more vertical than the left bronchus.
- Length-2.5cm
- After entering the right lung,it divides into 3 branches,one to each lobe.

- **The left bronchus**
- This is **narrower** than the **right**
- Length-5cm
- After entering the left lung,it divides into 2 branches,one to each lobe.



Note:
Primary bronchus a.k.a. main bronchus
Secondary bronchus a.k.a. lobar bronchus
Tertiary bronchus a.k.a. segmental bronchus


Larynx
Trachea
Superior lobe of right lung
Right primary bronchus
Right secondary bronchus
Right tertiary bronchus
Inferior lobe of right lung
Smaller bronchi
Middle lobe
Superior lobe of left lung
Left primary bronchus
Left secondary bronchus
Left tertiary bronchus
Inferior lobe of left lung
Smaller bronchi
Primary bronchi
Secondary bronchi
Tertiary bronchi
Smaller bronchi

STRUCTURE

- The bronchi are composed of the same issues as the trachea.
- Are lined with **ciliated columnar epithelium.**

Division of bronchi

↓

Bronchioles

↓

Terminal bronchioles

↓

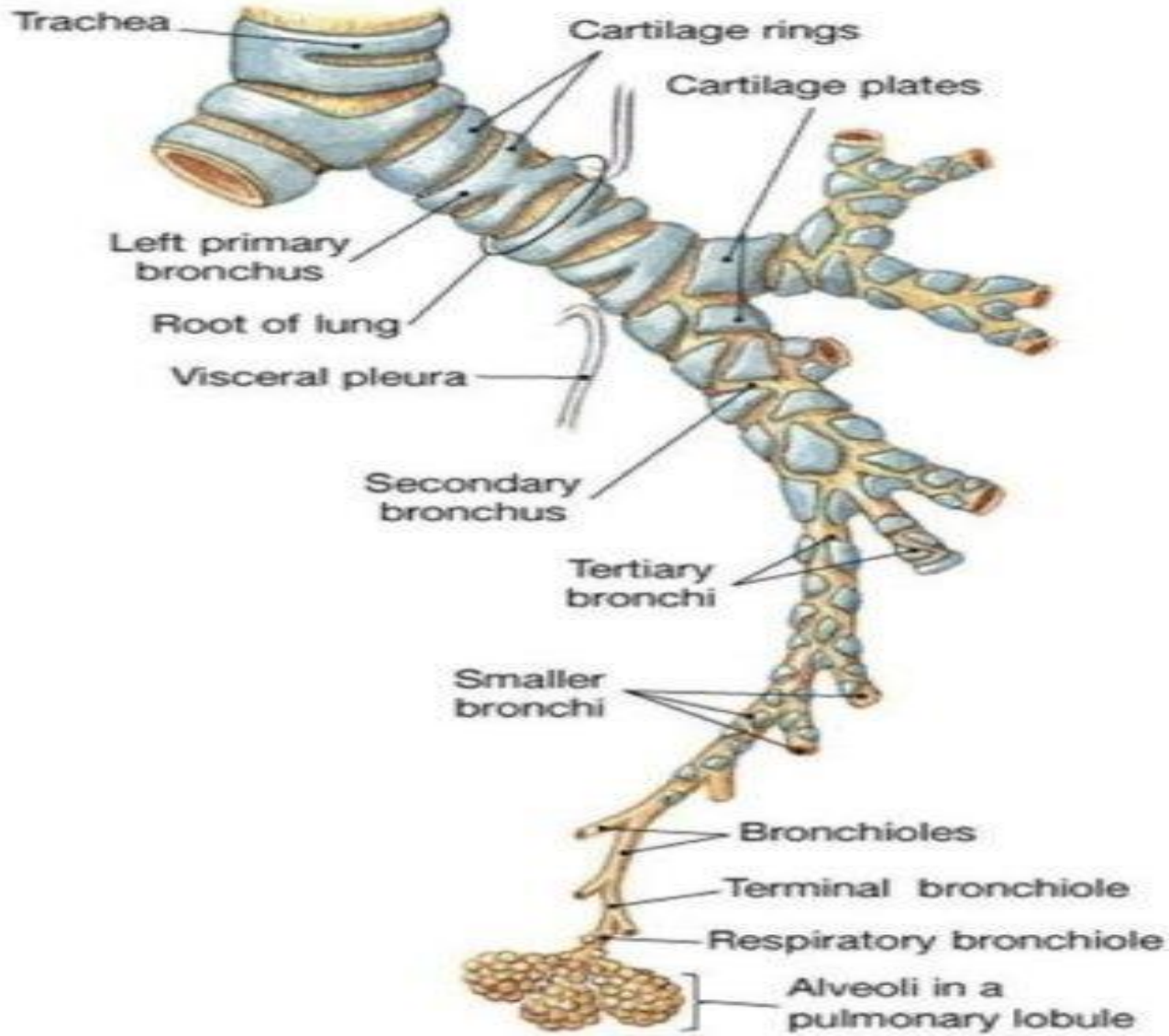
Respiratory bronchioles

↓

Alveolar ducts

↓

Alveoli

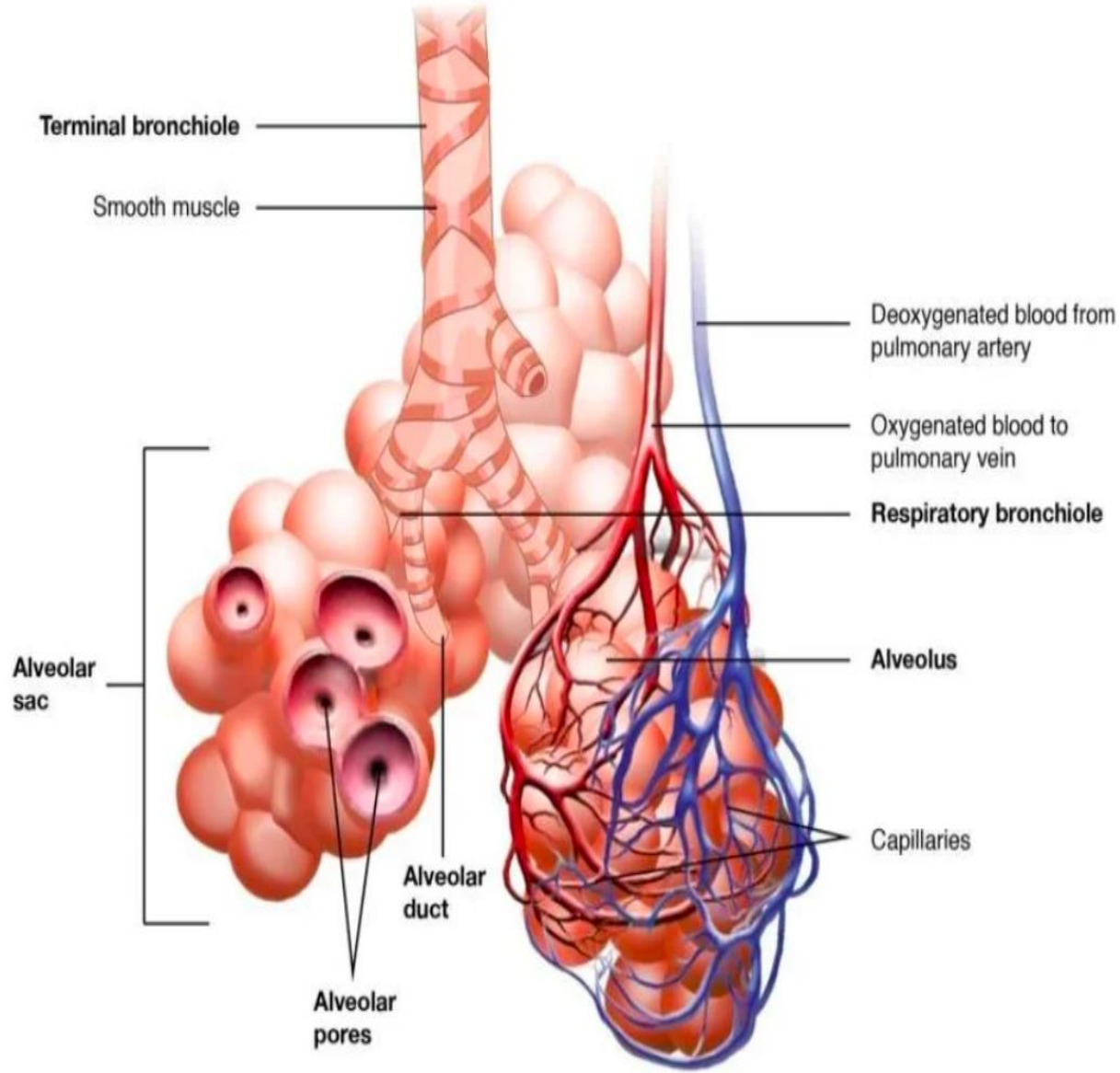


- The wider passages are called **conducting airways**
- Conducting airways,bring air into the lungs & their walls are too thick to permit gas exchange.
- **Blood supply**
- Bronchial arteries
- **Venous drainage**
- Bronchial veins
- **Nerve supply**
- Vagus nerve
- **Lymph drainage**
- The Thoracic duct

FUNCTIONS

- Control of air entry
- Warming & humidifying
- Support & patency
- Removal of particulate matter
- Cough reflex

- **RESPIRATORY BRONCHIOLES & ALVEOLI**
- Each lobule is supplied with air by a terminal bronchiole
- Which further subdivides into respiratory bronchioles,**alveolar ducts** and large numbers of **alveoli** (**air sacs**)
- About **150 million** alveoli in the adult lung
- In these structures that the process of gas exchange occurs.
- As airways progressively divide & become smaller & smaller,their walls gradually become thinner.
- These distal respiratory passages are supported by a loose network of elastic connective tissue.
- Exchange of gases in the lungs takes place in alveoli



RESPIRATION

- The term **respiration** means the exchange of gases between body cells and the environment.
- **Breathing** or **pulmonary ventilation**
- This is movement of air into and out of the lungs.
- **Exchange of gases:**
- This takes place:
- In the lungs:external respiration.
- In the tissues:internal respiration.

BREATHING

- Breathing supplies oxygen to the alveoli,and eliminates carbon dioxide.
- **MUSCLES OF BREATHING**
- Expansion of the chest during inspiration occurs as a result of muscular activity,partly voluntary and partly involuntary.
- The main muscles used in normal quiet breathing are the **INTERCOSTAL MUSCLES** and the **DIAPHRAGM**.
- During difficult or deep breathing they are assisted by muscles of the neck,shoulders and abdomen.

Part 2

BRONCHIALASTHMA

Definition

Bronchial asthma is a chronic inflammatory disease of airways, preferably of allergic genesis, characterised by reversible airway obstruction, increased airway responsiveness to a variety of stimuli - bronchial hyper-responsiveness, and manifested by asthma attacks, episodic wheezing, feeling of tightness in the chest, dyspnea and cough (dry or productive with expectoration of mucous viscous sputum).

Causes:

- Asthma is caused by a combination of complex and incompletely understood environmental and genetic interactions.
- **Environmental : allergens, pollens , air pollution & other chemicals.**
- **Smoking**
- **Chemical exposure(formaldehyde, pesticides)**
- **Use of antibiotics in early life**
- **Genetic**

Bronchial asthma Classifications

Asthma may be categorized into types

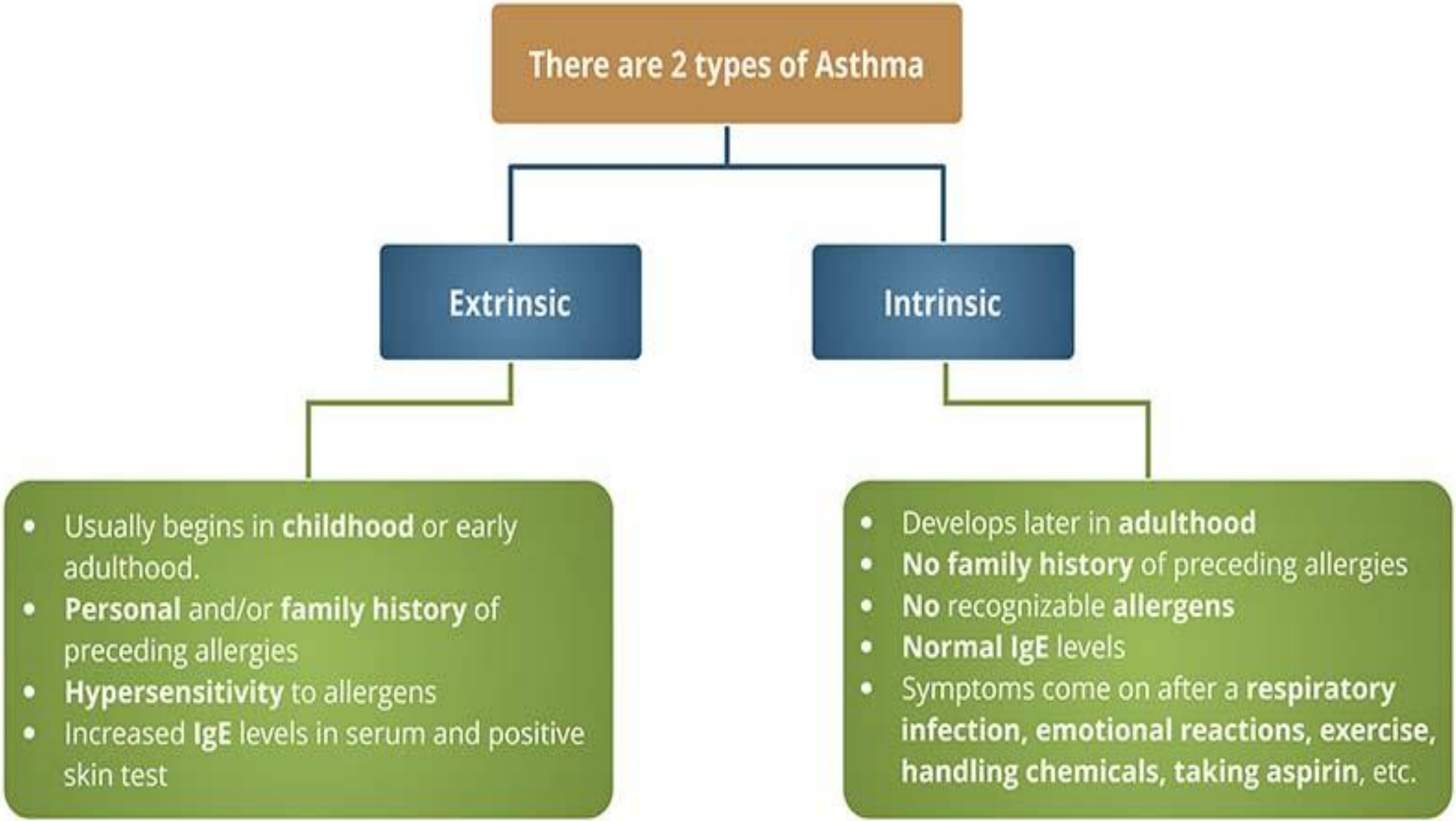
1- Atopic type (**allergic sensitization**, **Extrinsic**).

2 - Non-atopic type (**No allergic sensitization**).

3- Bronchoconstriction triggering agents - include

(a) **Seasonal** asthma (b) **Exercise-induced** asthma.
(c) **Drug-induced** asthma (e.g., **aspirin & NSAID**).
(d) **Occupational** asthma
(e) Eemotional asthma .
(f) **Asthmatic bronchitis** in smokers.

4-Recent studies added three subphenotypes of Asthma , based on **Airway inflammation pattern**.


There are 2 types of Asthma
Extrinsic
Intrinsic
Usually begins in childhood or early adulthood.
Personal and/or family history of preceding allergies
Hypersensitivity to allergens
Increased IgE levels in serum and positive skin test
Develops later in adulthood
No family history of preceding allergies
No recognizable allergens
Normal IgE levels
Symptoms come on after a respiratory infection, emotional reactions, exercise, handling chemicals, taking aspirin, etc.

Asthma Types

- 1- **Atopic asthma** (**allergic sensitization, Extrinsic**) :

- ***Classic example of type I IgE-mediated hypersensitivity reaction.***
- Usually encountered in patient known case of **rhinitis, eczema.**

- **Genetic predisposition.**
- **A positive family history of asthma is common.**
- **Begins in childhood.**

- **Triggered by environmental allergens, such as dusts, pollens, roach or animal dander, and certain types of foods., etc…**

- **Diagnosis: clinical diagnosis is essential +……**
- **(a) Skin test : Using the offending antigen → immediate wheal-and-flare reaction.**

- **(b) Serum radioallergosorbent tests (called RAST): TO identify the presence of IgE specific for a panel of allergens.**

Asthma Types

2. Non-atopic asthma:

- Non allergic.

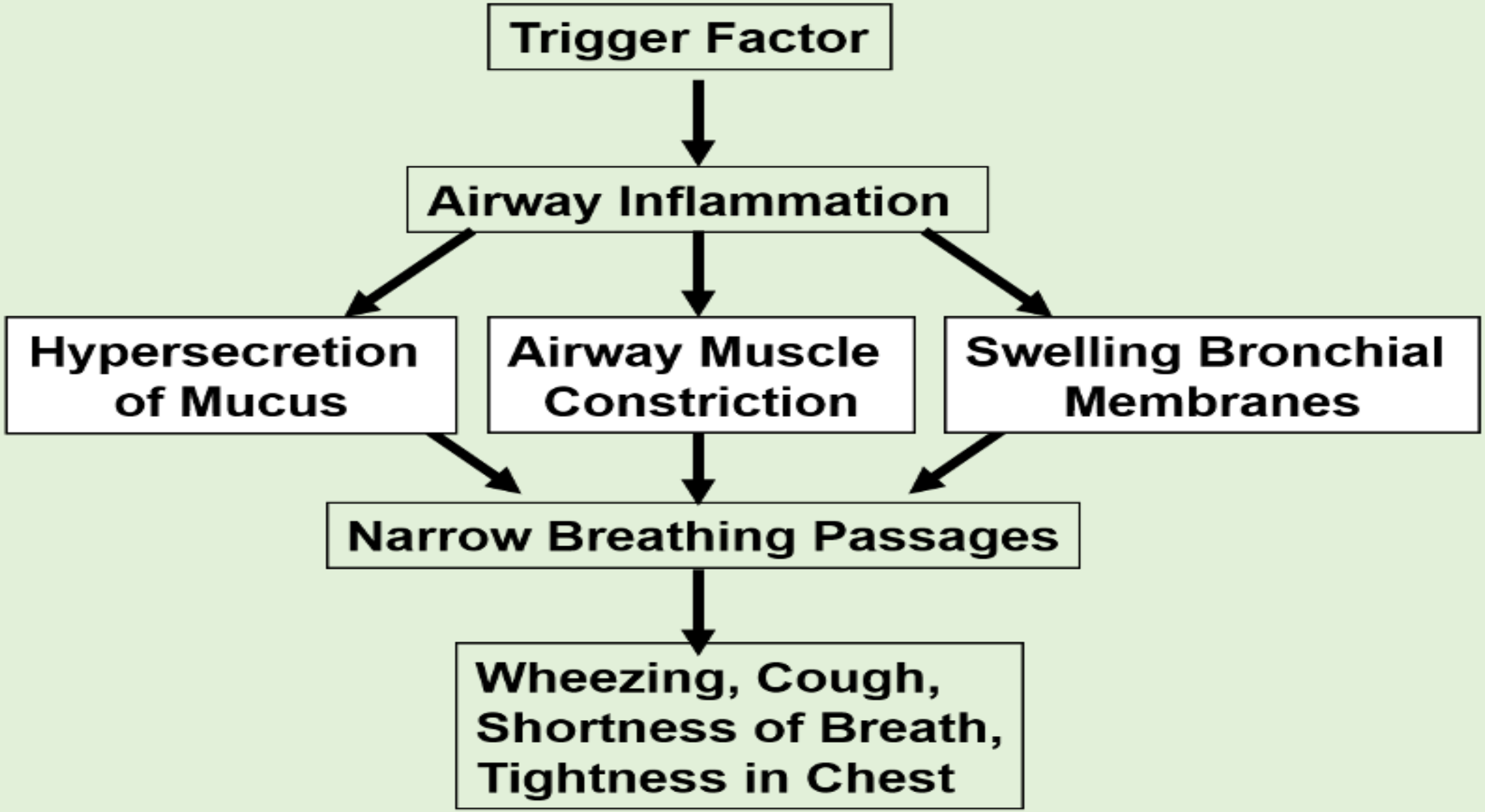
- Triggered commonly → by Respiratory infection due to viruses (e.g., rhinovirus, parainfluenza virus).

- Family history: less common.

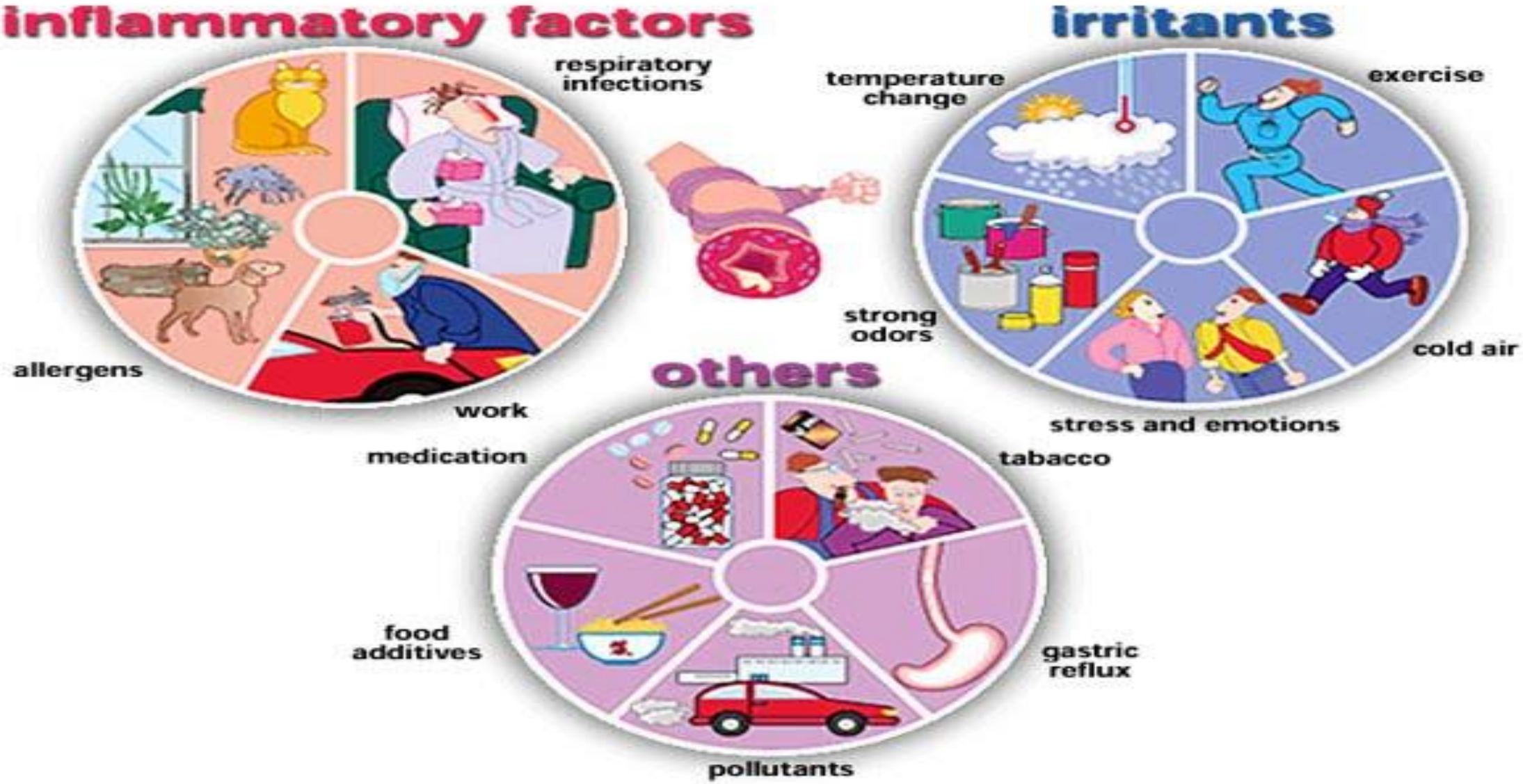
- Skin test: reveals negative reaction.

- Mechanism:

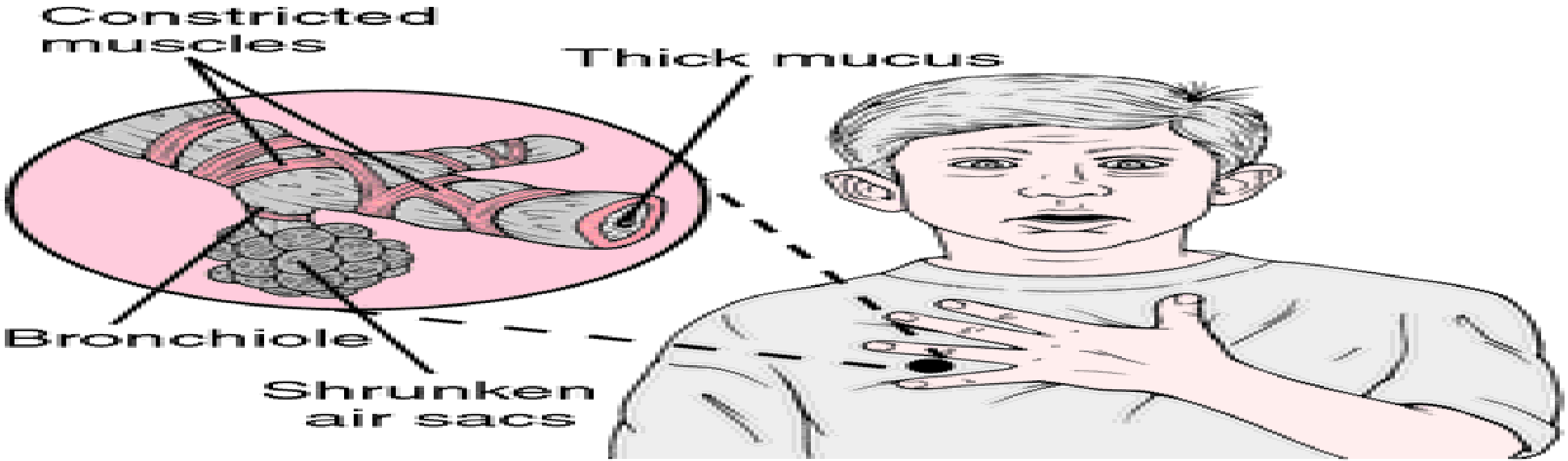
It is thought that virus-induced inflammation of the respiratory mucosa → lowers the threshold of the subepithelial vagal receptors to irritants.


Trigger Factor
Airway Inflammation
Hypersecretion of Mucus
Airway Muscle Constriction
Swelling Bronchial Membranes
Narrow Breathing Passages
Wheezing, Cough, Shortness of Breath, Tightness in Chest

TRIGGERS




Symptom of asthma
Rapid breathing
Shortness of breath
Spasmodic cough
Pale and sweaty face
Severe wheezing
Tightness in chest
Blue lips and/or fingernails
Anxiousness
Tightness in neck muscles
Difficulty in talking
Chocking sensation

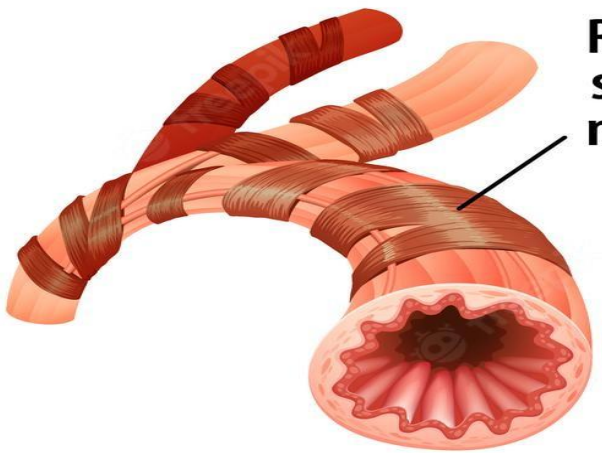


Symptoms
- Shortness of breath
- Wheezing
- Difficult breathing
- Cough
- Anxiety

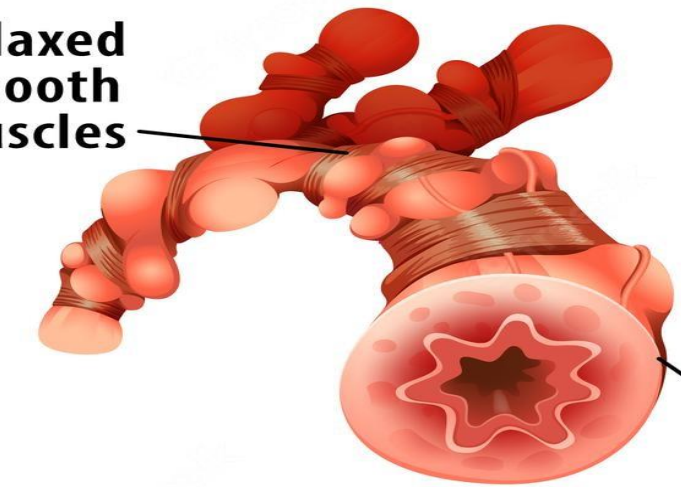
Physical findings
- Rapid, shallow respirations
- Rapid pulse
- Pallor or cyanosis
- Diminished breath sounds
- Generalized retractions
- Frequent pausing to catch the breath when talking
- Hyperexpansion of the chest

ASTHMA

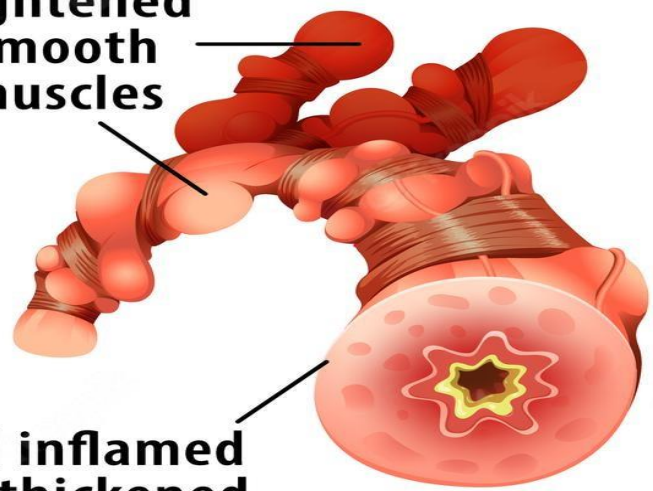
Lung



Relaxed smooth muscles



Tightened smooth muscles



Wall inflamed and thickened

Normal airway

Asthmatic airway

Asthmatic airway during attack

Classification	Symptoms	Treatment
Mild Intermittent	Daytime: ≤ 2/wk HS: ≤ 2/month Asymptomatic or normal PEF between brief exacerbations Lung fnx: FEV1 or PEF ≥ 80% & variability < 20%	No daily medication Bronchodilators prn symptoms (short-acting inhaled B2 agonist) – use as needed
Mild Persistent	Daytime: > 2/wk but < 1/day QHS: > 2/month Lung fnx: FEV1 or PEF ≥ 80%; PEF variability 20-30%	Daily: low dose inhaled corticosteroid Bronchodilator prn symptoms (short-acting B2 agonist)
Moderate Persistent	Daytime: daily symptoms & daily use of inhaled short-acting B2 agonists QHS: > 1/wk Exacerbations > 2/week Lung fnx: FEV1 or PEF 60-79% PEF variability > 30%	Low dose corticosteroids & long-acting B2 agonist -OR- Medium dose corticosteroids Bronchodilator prn symptoms (short-acting B2 agonist)
Severe Persistent	Daytime: continual symptoms with limited physical activity Frequent QHS symptoms & frequent exacerbations Lung fnx: FEV1 or PEF ≤ 60 % PEF variability > 30%	High dose inhaled corticosteroids & long-acting B2 agonist +/- Corticosteroids PO With attempts to ↓ use of PO corticosteroids Bronchodilator prn symptoms (short-acting B2 agonist)

Table 2

Categorization of severity of asthma

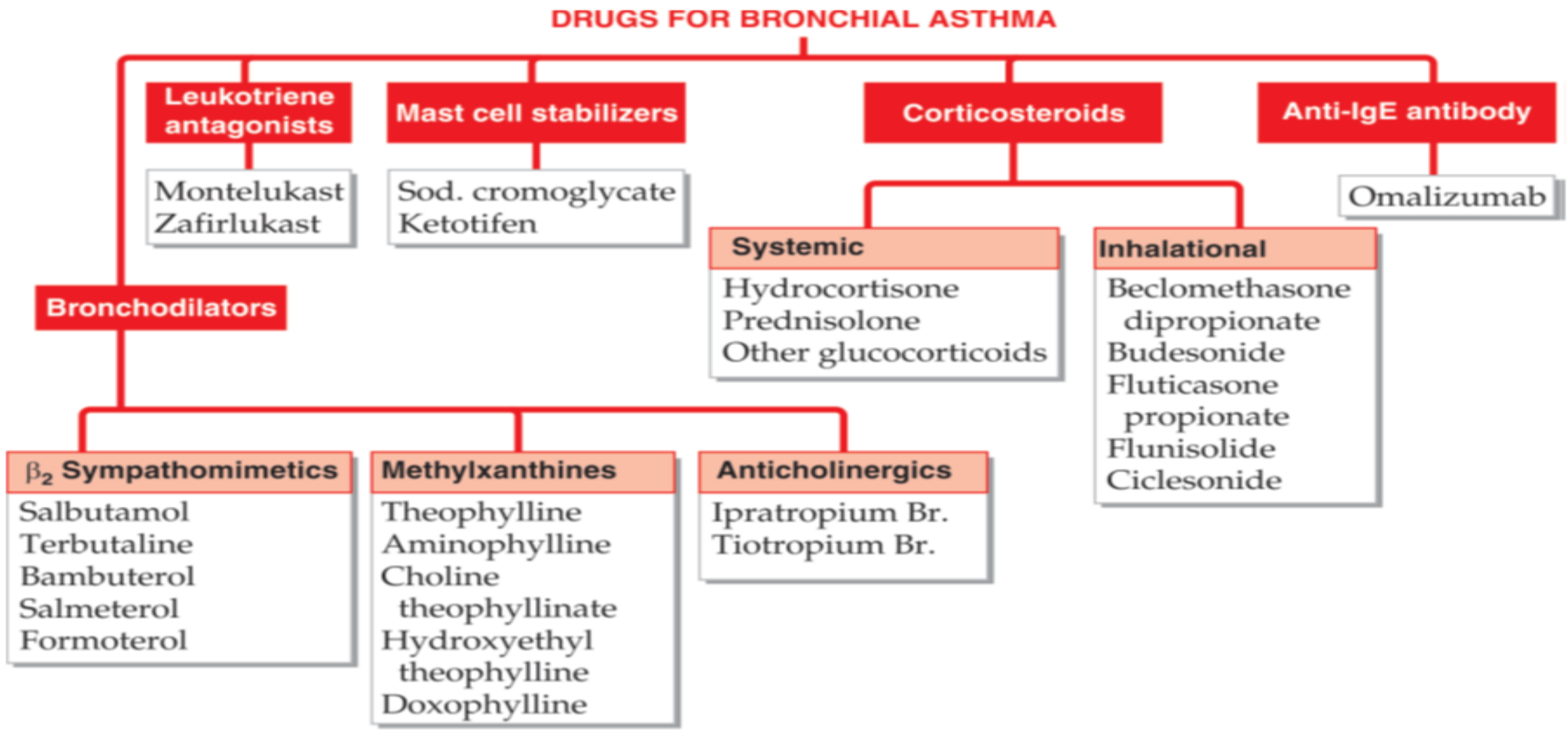
	Symptoms	Nocturnal symptoms	FEV1/PEFR
Stage 4 Severe persistent	Continuous	Frequent	<60% predicted variability >30%
Stage 3 Moderate persistent	Daily	>1 time a week	60-80% predicted variability >30%
Stage 2 Mild persistent	>1 time a week but <1time a day	>2 times a month	>80% predicted variability 20-30%
Stage 1 Intermittent	<1 time a week	<2 times a month	>80% predicted

Level of Asthma Control

Characteristic	Controlled (All of the ff)	Partly Controlled (Any measure present in any week)	Uncontrolled
Daytime symptoms	None (2x or </wk.)	More than 2x/wk	Three or more features of partly controlled asthma present in any week
Limitations of activities	None	Any	
Nocturnal symptoms/ awakening	None	Any	
Need for reliever/rescue tx	None (2x or less/week)	More than 2x/ wk	
Lung function (PEF or FEV1)+	Normal	<80% predicted or personal best (if known)	
Exacerbations	None	One or more/ yr*	One in any wk‡

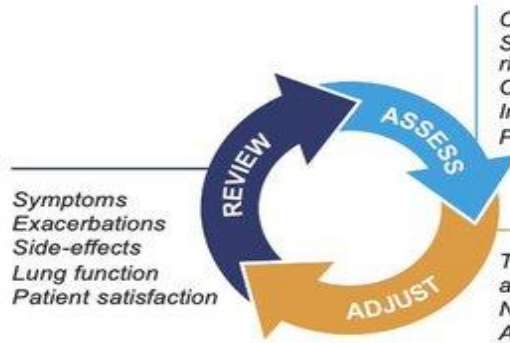
** Any exacerbation should prompt review of maintenance treatment to ensure that it is adequate.*
+ By definition, an exacerbation in any week makes that an uncontrolled asthma week.
‡ Lung function testing is not reliable for children 5 years and younger.

GINA 2006



Adults & adolescents 12+ years

Personalized asthma management
Assess, Adjust, Review
for individual patient needs



Confirmation of diagnosis if necessary
Symptom control & modifiable risk factors (see Box 2-2B)
Comorbidities
Inhaler technique & adherence
Patient preferences and goals

Symptoms
Exacerbations
Side-effects
Lung function
Patient satisfaction

Treatment of modifiable risk factors and comorbidities
Non-pharmacological strategies
Asthma medications (adjust down/up/between tracks)
Education & skills training

CONTROLLER and **PREFERRED RELIEVER** (Track 1). Using ICS-formoterol as reliever reduces the risk of exacerbations compared with using a SABA reliever

STEPS 1 – 2	STEP 3	STEP 4	STEP 5
As-needed low dose ICS-formoterol	Low dose maintenance ICS-formoterol	Medium dose maintenance ICS-formoterol	Add-on LAMA Refer for assessment of phenotype. Consider high dose maintenance ICS-formoterol, ± anti-IgE, anti-IL5/5R, anti-IL4R, anti-TSLP
RELIEVER: As-needed low-dose ICS-formoterol			

See GINA severe asthma guide

CONTROLLER and **ALTERNATIVE RELIEVER** (Track 2). Before considering a regimen with SABA reliever, check if the patient is likely to be adherent with daily controller

STEP 1	STEP 2	STEP 3	STEP 4	STEP 5
Take ICS whenever SABA taken	Low dose maintenance ICS	Low dose maintenance ICS-LABA	Medium/high dose maintenance ICS-LABA	Add-on LAMA Refer for assessment of phenotype. Consider high dose maintenance ICS-LABA, ± anti-IgE, anti-IL5/5R, anti-IL4R, anti-TSLP
RELIEVER: As-needed short-acting beta$_2$-agonist				

Other controller options for either track (limited indications, or less evidence for efficacy or safety)	*Low dose ICS whenever SABA taken, or daily LTRA, or add HDM SLIT*	*Medium dose ICS, or add LTRA, or add HDM SLIT*	*Add LAMA or LTRA or HDM SLIT, or switch to high dose ICS*	*Add azithromycin (adults) or LTRA. As last resort consider adding low dose OCS but consider side-effects*

GINA 2022, Box 3-5A

Part 4

DIFFERENCES BETWEEN B.A & COPD

Traditional Differences Between Asthma and COPD

Asthma

- **Onset early in life**
- **Symptoms more variable within and between days**
- **Cough/Symptoms worse at night**
- **Post-exertional Wheezing/Dyspnea**
- **Allergic rhinitis and/or eczema also present**
- **Largely reversible airflow limitation**

COPD

- Onset in midlife
- Symptoms slowly progresssive/ more consistent
- Cough/symptoms throughout the day
- Predominantly Exertional Dyspnea
- Long Smoking History
- Partially reversible airflow limitation

Global Initiative for Chronic Obstructive Lung Disease. *Global Strategy for the Diagnosis, Management, and Prevention of Chronic Obstructive Pulmonary Disease—Updated 2003.* Bethesda, Md: National Institutes of Health, National Heart, Lung, and Blood Institute; 2003. Available at: www.goldcopd.com/revised.pdf.

	Asthma	COPD
Age of onset	Usually <40 years	Usually >40 years
Smoking history	Not causal	Usually >10 pack-years
Sputum production	Infrequent	Often
Allergies	Often	Infrequent
Disease course	Stable (with exacerbations)	Progressive worsening (with exacerbations)
Spirometry	Often normalizes	Never normalizes
Clinical symptoms	Intermittent and variable	Persistent

COPD Vs Asthma

	COPD	bronchial asthma
Smoker or ex-smoker	most	possibly
Symptoms under age 35	rare	common
Chronic productive cough	common	uncommon
breathlessness	Persistent and progressive	variable
Waking at night time with breathlessness or wheeze	uncommon	common
Significant diurnal or day to day variability of symptoms	Uncommon	common
FEV1 and FEV1/FVC ratio return to normal with drug therapy	Never with significant disease	probably

Global Initiative for Chronic Obstructive Lung Disease

POCKET GUIDE TO COPD DIAGNOSIS, MANAGEMENT, AND PREVENTION

A Guide for Health Care Professionals

2022 REPORT