UNIT 5- RESPIRATORY SYSTEM

UNIT STRUCTURE

5.1 Learning Objectives
5.2 Introduction
5.3 Structure of respiratory tract
5.4 Mechanism of respiration
5.5 Effect of Yogic Practices on respiratory system
5.6 Let Us Sum Up
5.7 Answers to Check Your Progress
5.8 Further Reading
5.9 Model Questions

5.1 LEARNING OBJECTIVES

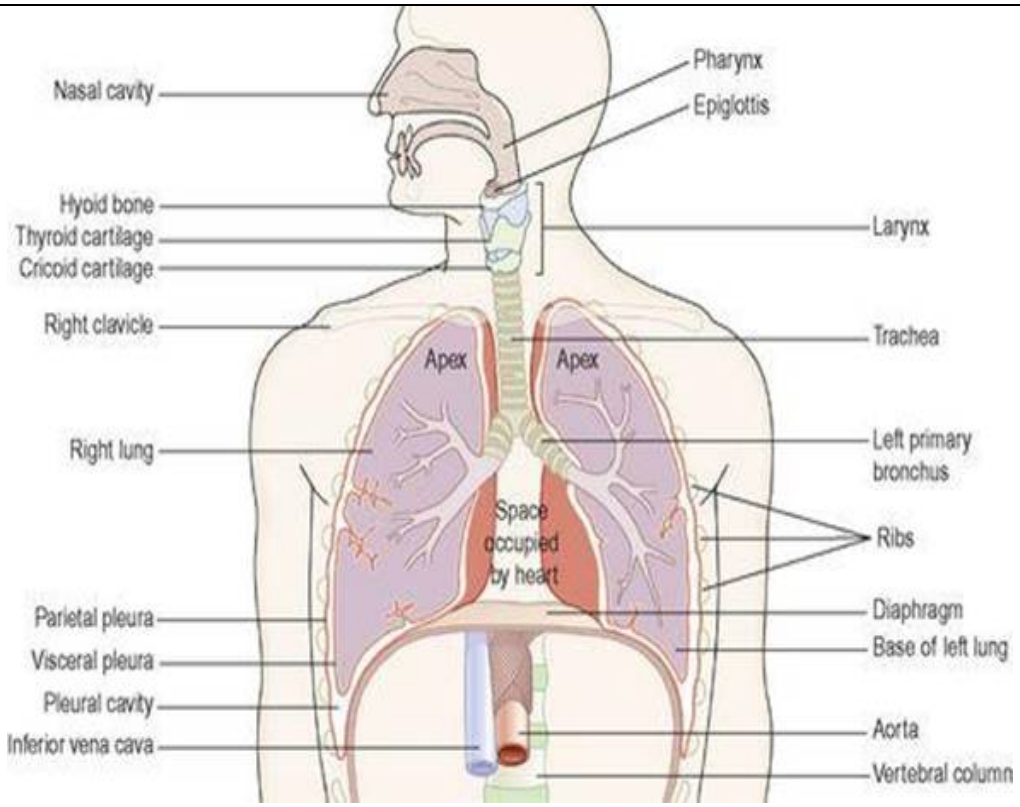
After going through this unit, you will be able to:

- learn the structure and functions of respiratory organs
- know the process of respiration
- understand the effect of yogic practices on excretory system

5.2 INTRODUCTION

Respiration is a natural process that every living organism performs. It is a vital biological system that takes oxygen from the air we breathe and expels unwanted carbon dioxide from the nostrils. Thus, it is mainly used for gaseous exchange. The cells of the body need energy for all their metabolic activities. Most of this energy is derived from chemical reactions, which can only take place in the presence of oxygen (O_2). The main waste product of these reactions is carbon dioxide (CO_2). The respiratory system provides the route by which the supply of oxygen present in the atmospheric air enters the body, and it provides the route of excretion for carbon dioxide. Exchange of gases between the blood and the lungs is called *external respiration* and that between the blood and the cells *is called internal respiration*.

5.3 STRUCTURE OF RESPIRATORY TRACT:

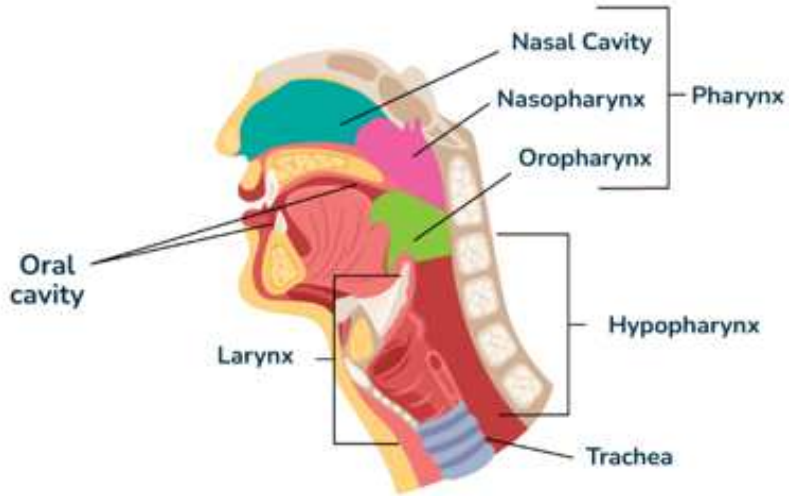


5.3.1 Nose/Nasal cavity

Humans have exterior nostrils, divided by a framework of cartilaginous structure called the septum. This is the structure that separates the right nostril from the left nostril. The nose is the first of the respiratory passages through which the inspired air passes. Tiny hair follicles covering the interior lining of nostrils act as the body's first defence against foreign pathogens. Furthermore, they provide additional humidity for inhaled air. The function of the nose is to begin the process by which the air is warmed, moistened and filtered.

Hairs at the anterior nares trap larger particles. Smaller particles such as dust and bacteria settle and adhere to the mucus. Mucus protects the underlying epithelium from irritation and prevents drying.

5.3.2 Pharynx



The pharynx also known as the throat is a muscular tube 12 to 14 cm long that extends from the base of the skull to the level of the 6th cervical vertebra. It lies behind the nose, mouth and larynx and is wider at its upper end.

The pharynx, or throat, is made up of three main parts: the nasopharynx, oropharynx, and laryngopharynx.

Nasopharynx

- The top part of the throat, located behind the nasal cavity
- The passageway for air in the respiratory tract

Oropharynx

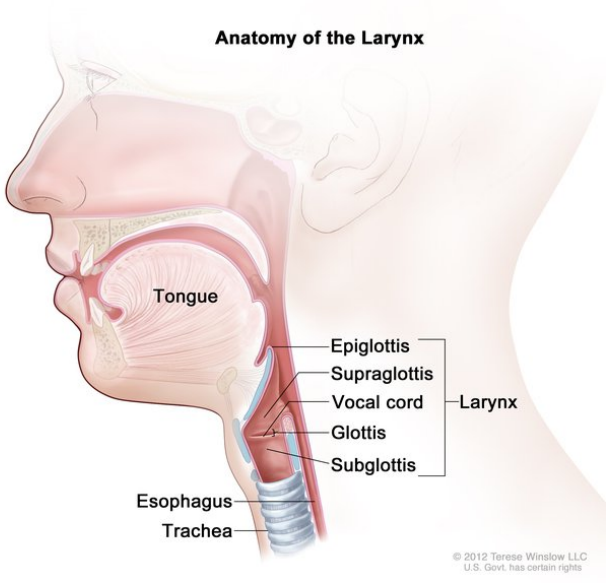
- The middle part of the throat, located behind the mouth
- Starts at the soft palate and ends at the epiglottis

Laryngopharynx

- The bottom part of the throat, located behind the voice box
- Also known as the hypopharynx
- The point where the pharynx divides into the larynx and esophagus

The pharynx connects the nasal and oral airways to the larynx. The pharynx also contains the pharyngeal tonsils, which are part of the immune system and help protect against pathogens.

5.3.3 Larynx:



The larynx, also known as the voice box, is a tube-shaped organ in the throat that controls breathing, swallowing, and voice production.

Function:

- Breathing: The larynx directs air into the lungs.
- Swallowing: The larynx prevents food from entering the windpipe by closing the vocal cords and moving the epiglottis down.
- Voice production: The larynx contains the vocal cords, which vibrate to produce sound waves. The pitch of the sound is determined by the tension of the vocal cords.

Location:

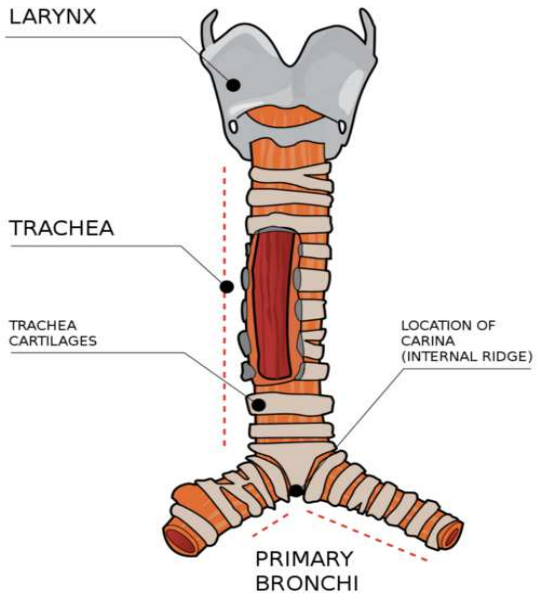
- The larynx is located in the neck, above the windpipe (trachea) and in front of the gullet (oesophagus).
- The larynx is held in place by muscles and ligaments.

Structure

- The larynx is made up of three parts: the supraglottis, the glottis, and the subglottis.
- The larynx is supported by nine cartilages, three unpaired and three paired.

- The epiglottis is a lid-like structure at the top of the larynx that closes to prevent food from entering the windpipe.

5.3.4 Trachea:



The trachea, also known as the windpipe, is a tube that carries air from the larynx to the lungs. It's part of the airway system, which also includes the bronchi and lungs.

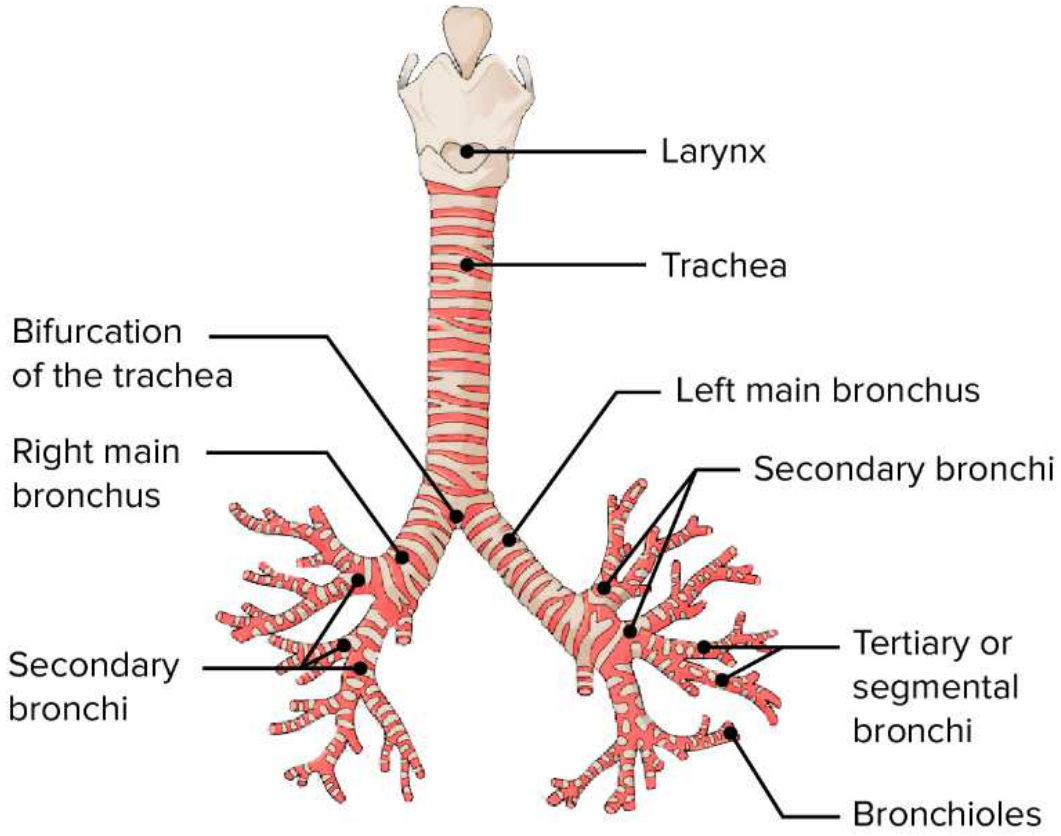
How it works:

- When you inhale, air moves from your nose, through your larynx, and down your trachea.
- The trachea widens and lengthens as you breathe.
- The trachea splits into two bronchi, which lead to the lungs.
- The bronchi divide into smaller tubes that resemble an upside-down tree.

5.3.5 Bronchi:

The bronchi are the main airways that branch off from the trachea (windpipe) and lead into the Lungs. They play a crucial role in the respiratory system by carrying air in and out of the lungs.

Structure of the Bronchi:

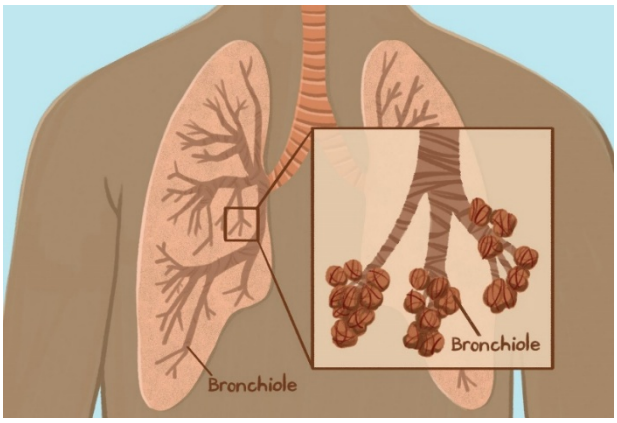


1. Primary (main) Bronchi- Two main bronchi (right and left) branch from the trachea. The bronchus is wider, shorter, and more vertical than the left.
2. Secondary (Lober) Bronchi- Each primary bronchus divides into secondary bronchi, with three in the right lung and two in the left lung.
3. Tertiary (Segmental) Bronchi- These further divides into smaller bronchioles, eventually leading to the alveoli, where gas exchange occurs.

Function

- The bronchi distribute air to the lungs as you breathe and your lungs expand.
- Oxygen inhaled into the lungs passes through the alveoli and into the bloodstream.

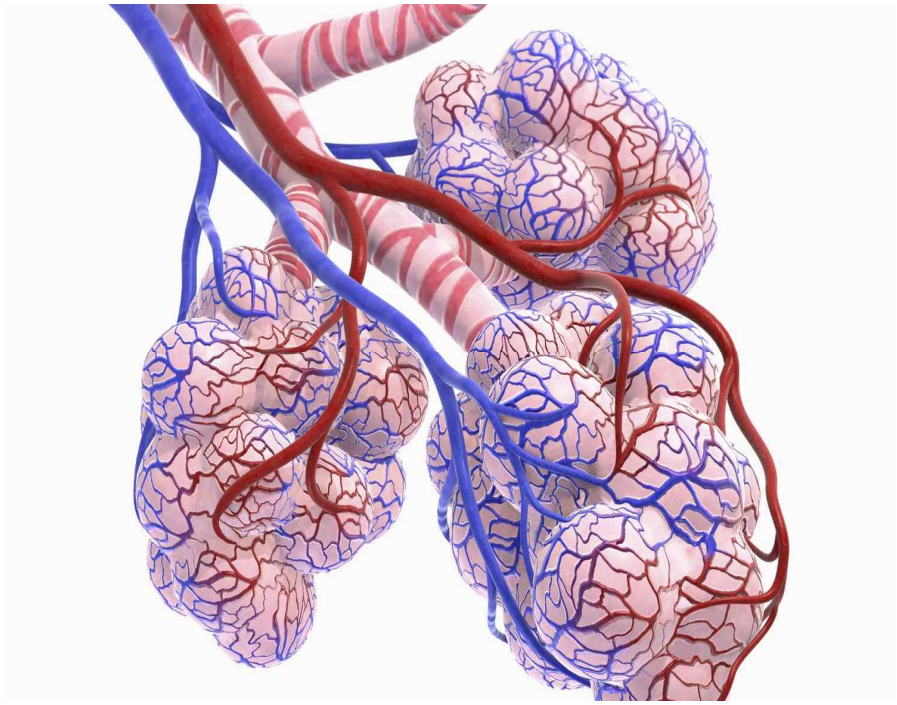
5.3.6 Bronchioles:



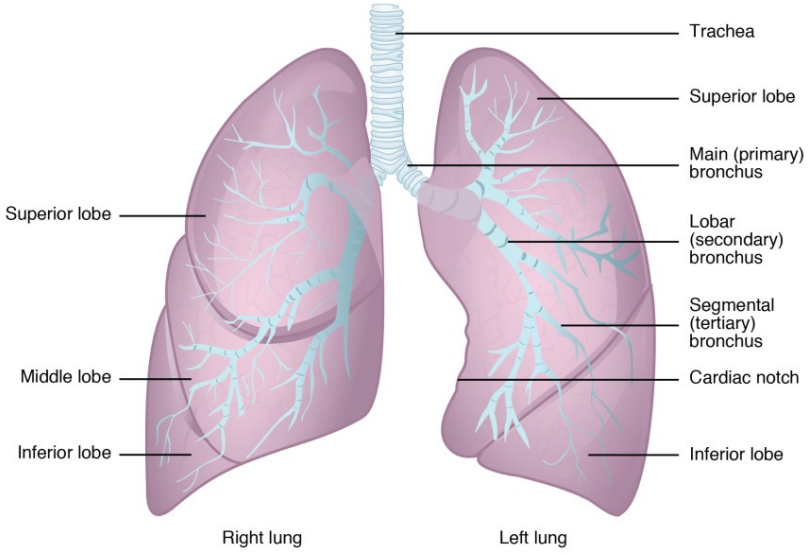
Bronchioles are some of the smallest airways in our lungs. Inhaled air passes through tiny ducts from the bronchioles into elastic air sacs (alveoli).

5.3.7 Alveoli:

Alveoli are microscopic air sacs in the lungs that facilitate the exchange of oxygen and carbon dioxide between the lungs and blood.



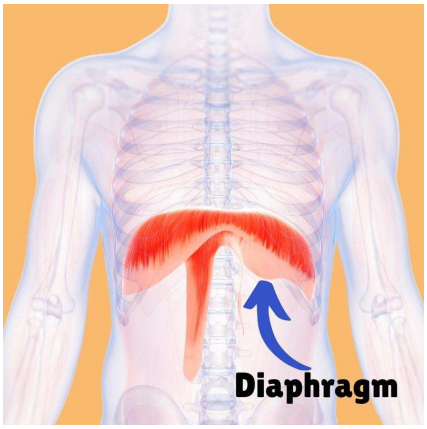
5.3.8 Lungs:



The lungs are vital organs responsible for breathing and gas exchange. They take in oxygen from the air and expel carbon-dioxide, which is a waste product of metabolism. The lungs are located in the chest, protected by the ribcage, and work with the diaphragm and other respiratory muscles to facilitate breathing.

Each lung is divided into lobes- three in the right lung and two in the left (to make room for heart). Inside the lungs, the airways branch into smaller tubes called bronchi and bronchioles, ending in tiny air sacs called alveoli. These alveoli are where oxygen enters the bloodstream, and carbon dioxide is removed.

5.3.9 Diaphragm:



The diaphragm is a dome-shaped muscle that separates the chest from the abdomen. It's the main muscle used for breathing and is also involved in other bodily functions.

How it works

- When you inhale, the diaphragm contracts and flattenswhich increases the size of the chest cavity. This creates a vacuum that pulls air into the lungs.
- When you exhale, the diaphragm relaxes and returns to its dome shape, forcing air out of the lungs.

Other functions

- The diaphragm also increases pressure in the abdomen, which helps with urination and defecation.
- It helps prevent acid reflux by putting pressure on the oesophagus.

5.4 MECHANISM OF RESPIRATION:

Respiration, or breathing, is the process of exchanging oxygen and carbon dioxide in the body. It involves two phases: inspiration (inhaling) and expiration (exhaling).

Inspiration

1. The brainstem sends motor impulses to the diaphragm and external intercostal muscles
2. The diaphragm contracts and moves downward
3. The thoracic cavity expands, increasing its volume and decreasing the pressure inside
4. Air rushes into the lungs from the higher pressure outside
5. The oxygenated air reaches the alveoli

6. Oxygen passes through the alveoli walls into the blood capillaries

Expiration

1. The diaphragm relaxes and moves upward
2. The thoracic cavity decreases in volume, increasing the pressure inside
3. The lungs contract and force air out
4. Carbon dioxide is pushed out of the body

The respiratory control system regulates the rate and strength of breathing. The brainstem sends signals to the muscles, and the sensory input system sends signals to the brain based on metabolic demand.

5.5 EFFECT OF YOGA ON RESPIRATORY SYSTEM

Yoga can positively impact the respiratory system in a number of ways, including:

- **Improved breathing**: Yoga practices like Pranayama (controlled breathing) can improve respiratory functions like forced vital capacity (FVC), forced expiratory volume (FEV1), and peak expiratory flow rate (PEFR). Yoga can also reduce resting respiratory rate.
- **Improved endurance**: Yoga can improve endurance capacity during exercise.
- **Improved asthma**: Yoga can help with symptom control and quality of life for people with asthma.
- **Improved airway reactivity**: Pranayama can improve airway reactivity for people with asthma.
- **Strengthened chest muscles**: Poses like Plank, Side Plank, and Upward Plank can strengthen the chest wall muscles.
- **Strengthened back and chest muscles**: Poses like Cobra Pose and Upward-Facing Dog Pose can strengthen the back and front chest muscles.

5.6 LET US SUM UP

The respiratory system plays a crucial role in sustaining life by ensuring the continuous exchange of oxygen and carbon dioxide. It supports cellular function, maintains blood pH, and works closely with the circulatory system to distribute oxygen throughout the body. A well-functioning respiratory system is essential for overall health, and maintaining it requires good habits such as regular exercise, avoiding pollutants, and proper medical care. Any disruption in its function can lead to serious health issues, highlighting the importance of respiratory health in daily life.

5.7 FURTHER READING

Waugh, A. & Grant, A. (2014). *Ross & Wilson Anatomy and physiology in health and illness,* Elsevier Health Sciences

1. Pearce, E. (1993). *Anatomy and physiology for Nurses*, Jaypee Brothers Medical Publishers
2. Tortora, G.J. & Derrickson, B. *Principles of Anatomy and Physiology,* John Wiley & Sons Inc
3. Gray, H. *Anatomy of the Human Body*, Lea &Febiger, Philadelphia
4. Guyton, Arthur C. *Textbook of Medical Physiology*, W.B.Saunders Co. Philadelphia

5.8 ANSWERS TO CHECK YOUR PROGRESS

Q.1 What is the primary function of the respiratory system?

Ans: Oxygen exchange

Q.2 What is the main muscle responsible for breathing?

Ans: Diaphragm

Q.3 What is the name of the tiny air sacs in the lungs where gas exchange occurs?

Ans: Alveoli

Q.4 Which gas is primarily exhaled during respiration?

Ans: Carbon dioxide

Q.5 Who prevents food from entering into the Trachea?

Ans: Epiglottis

Q.6 What type of blood vessels surrounds the alveoli for gas exchange?

Ans: Capillaries

Q.7 Which lung is slightly smaller due to the presence of the heart?

Ans: Left lung

Q.8 What happens to the diaphragm during inhalation?

Ans: It contracts and moves downward.

Q.9 What is another name of voice box?

Ans: Larynx

Q.10 The process of breathing in is called-

Ans: Inhalation

Q:11 The exchange of gases in the lungs occurs through which process?

Ans: Diffusion

⍰ 5.9 MODEL QUESTIONS

A) Short Questions:

Q.1 Which organ filters the air we breathe?

Q.2 What is the main organ of the respiratory system?

Q.3 What is the windpipe also known as?

Q.4 Discuss in brief about mechanism of respiration.

Q.5 Discuss in brief about structure and function of Trachea.

Q.6 Discus in brief about the Lungs.

B) Essay Questions:

Q.1 Describe the path of air from the nose to the alveoli.

Q.2 Discuss in detail about the effect of yoga on repertory system.

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