

## Ninth Lecture

### 9. Respiratory system

#### *Summary of previous lectures*

In the previous lectures we talked about the basic elements of the medical word: word root, combining form, suffix, and prefix. The meaning of a word is determined by how these elements are combined. Detailed information about suffixes is mentioned. Suffix linking and suffix types are explained in detail and many examples related to the surgical, diagnostic, pathological, grammatical and plural suffixes are also provided. Detailed information about prefixes is also mentioned. Prefix linking and prefix types are explained in detail and many examples related to different types of prefixes are provided.

*The basic structural and functional organization of the body from the cellular level to the organism level is also presented. Additionally, terms used to describe planes of the body, body cavities, quadrants and regions of the abdominal cavity, and divisions of the spinal column are presented. These terms are considered as an essential part of medical terminology and are used in all body systems. We moved on to talk about the body systems in detail.*

*Starting with the digestive system, also called the gastrointestinal (GI) system, it is mentioned that it consists of a digestive tube called the GI tract or alimentary canal, and several accessory organs whose primary function is to break down food, prepare it for absorption, and eliminate waste. The GI tract, extending from the mouth to the anus, varies in size and structure in several distinct regions. Many terms related to the digestive system are also introduced.*

## 9.1. Anatomy and Physiology<sup>188</sup>

The respiratory system is responsible for the exchange of oxygen (O<sub>2</sub>) and carbon dioxide (CO<sub>2</sub>). Oxygen is essential for life. It is carried to all cells of the body in exchange for CO<sub>2</sub>, a waste product. The cardiovascular system helps in this vital function by providing blood vessels for carrying these gases. Failure or deficiency in either system has the same effect on the body: disturbance of homeostasis and O<sub>2</sub> starvation in tissues that may cause death.

The lungs and airways bring in fresh, oxygen-enriched air and expel waste CO<sub>2</sub> by a process called breathing, or ventilation. Breathing helps regulate the pH (acidity-alkalinity) of the blood, thereby maintaining homeostasis.

### 9.1.1. Anatomy and Physiology Key Terms

This section introduces important respiratory system terms and their definitions. Word analyses for selected terms are also provided.

Term	Pronunciation <sup>189</sup>	Arabic <sup>190</sup>	Meaning
carbon dioxide (CO <sub>2</sub> )	'kɑ:bən daɪ'ɒksaɪd	ثاني أكسيد الكربون	Tasteless, colourless, odourless gas produced by body cells during the metabolic process A product of cell respiration, CO <sub>2</sub> is carried by the blood to the lungs and exhaled.
cartilage	'kɑ:tɪlɪdʒ	غُضْرُوف	Tough, elastic connective tissue that is more rigid than ligaments but less dense than bone The tip of the nose and the outer ear are composed of cartilage.
Cilia	'sɪlɪə	أهداب	Any hair-like structure Cilia in the trachea move particles upward to the pharynx, where they are removed by coughing, sneezing, or swallowing. This mechanism is called the cilia escalator. Habitual smoking destroys the cilia escalator.
diffuse	dɪ'fju:z	يَنْتَشِر	Moving or spreading out of a substance at random, rather than by chemical reaction or application of external forces

<sup>188</sup> Medical Terminology Systems - A Body Systems Approach: Respiratory System - Anatomy and Physiology p. 148

<sup>189</sup> Oxford Advanced Learner's Dictionary, 8<sup>th</sup> ed. or: <http://dictionary.reference.com/>

<sup>190</sup> <http://www.emro.who.int/Unified-Medical-Dictionary.html>

homeostasis homeo-: same, alike -stasis: standing still	,həʊmiə'steɪsɪs	الاستتباب	State in which the regulatory mechanisms of the body maintain a constant internal environment The regulatory mechanisms of the body control temperature, acidity, and the concentration of salt, food, and waste products.
mucous membrane muc: mucus -ous: pertaining to	'mju:kəs 'membreɪn	الغشاء المخاطي	Moist tissue layer lining hollow organs and cavities of the body that open to the environment; also called mucosa
oxygen (O <sub>2</sub> )	'ɒksɪdʒən	أكسجين	Tasteless, odourless, colourless gas essential for human respiration O <sub>2</sub> makes up about one fifth (by volume) of the atmosphere.
pH	,pi: 'ertʃ		Symbol that indicates the degree of acidity or alkalinity of a substance Increasing acidity is expressed as a number less than 7; increasing alkalinity as a number greater than 7, with 7 being neutral.
septum	'septəm	حاجز	Wall dividing two cavities, such as the nasal septum, which separates the two nostrils
serous membrane ser: serum -ous: pertaining to, relating to	'sɪərəs 'membreɪn	غشاء مصلّي	Thin layer of tissue that covers internal body cavities, the cells of which secrete a fluid that keeps the membrane moist; also called serosa

### 9.1.2. Upper Respiratory Tract

The breathing process begins with inhalation. (See [Figure 9-1](#)). Air is drawn into the (1) nasal cavity, a chamber lined with mucous membranes and tiny hairs called cilia (singular, cilium). Here, air is filtered, heated, and moistened to prepare it for its journey to the lungs. The nasal cavity is divided into a right and left side by a vertical partition of cartilage called the nasal septum.

Olfactory<sup>191</sup> neurons<sup>192</sup> are receptors for the sense of smell. They are covered with a layer of mucus and located deep in the nasal cavity, embedded among the epithelial<sup>193</sup> cells lining the nasal tract. Because they are located higher in the nasal

<sup>191</sup> Olfactory: /ɒl'fæktəri/ connected with the sense of smell

<sup>192</sup> Neuron: /'njʊərən/ a cell that carries information within the brain and between the brain and other parts of the body; a nerve cell

<sup>193</sup> Epithelium: /,epɪ'thi:lɪəm/ membranous tissue composed of one or more layers of cells separated by very little intercellular substance and forming the covering of most internal and external surfaces of the body and its organs

passage than air normally travels during breathing, a person must sniff or inhale deeply to identify weak odours. Air passes from the nasal cavity to the throat (pharynx), a muscular tube that serves as a passageway for food and air. The pharynx consists of three sections: the (2) nasopharynx, posterior to the nose; the (3) oropharynx, posterior to the mouth; and the (4) laryngopharynx, superior to the larynx<sup>194</sup>.

Within the nasopharynx is a collection of lymphoid tissue known as (5) adenoids<sup>195</sup> (pharyngeal tonsils). The (6) palatine tonsils, more commonly known as tonsils, are located in the oropharynx. They protect the opening to the respiratory tract from microscopic organisms that may attempt entry by this route. The (7) larynx (voice box) contains the structures that make vocal sounds possible. A leaf-shaped structure on top of the larynx, the (8) epiglottis, seals off the air passage to the lungs during swallowing. This function ensures that food or liquids do not obstruct the flow of air to the lungs. The larynx is a short passage that joins the pharynx with the (9) trachea (windpipe). The trachea is composed of smooth muscle embedded with C-shaped rings of cartilage, which provide rigidity to keep the air passage open.

### 9.1.3. Lower Respiratory Tract

The trachea divides into two branches called (10) bronchi (singular, bronchus). One branch leads to the (11) right lung and the other to the (12) left lung. The inner walls of the trachea and bronchi are composed of mucous membrane (mucosa) embedded with cilia. This membrane traps incoming particles, and the cilia move the entrapped material upward into the pharynx, where it is coughed out, sneezed out, or swallowed. Like the trachea, bronchi contain C-shaped rings of cartilage.

Each bronchus divides into smaller and smaller branches, eventually forming (13) bronchioles<sup>196</sup>. At the end of the bronchioles are tiny air sacs called (14) alveoli<sup>197</sup> (singular, alveolus). An alveolus resembles a small balloon because it expands and contracts with inflow and outflow of air. The (15) pulmonary capillaries lie next to the thin tissue membranes of the alveoli. Carbon dioxide diffuses from the blood within the pulmonary capillaries and enters the alveolar spaces, while O<sub>2</sub> from the

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<sup>194</sup> Larynx: /'læɪŋks/ (pl. larynges /lə'ɪndʒi:z/) the area at the top of the throat that contains the vocal cords

<sup>195</sup> Adenoids: /'ædənɔɪdz/ pieces of soft tissue at the back of the nose and throat, that are part of the body's immune system and that can swell up and cause breathing difficulties, especially in children

<sup>196</sup> Bronchiole: /'brɒŋki, əʊl/ any of the smallest bronchial tubes, usually ending in alveoli

<sup>197</sup> Alveolus: /æ'lvi:ələs; ,ælvɪ'əʊləs/ (pl. alveoli /æ'lvi:əlaɪ; ,ælvɪ'əʊlaɪ/) one of the many small spaces in each lung where gases can pass into or out of the blood

alveoli diffuses into the blood. After the exchange of gases, freshly oxygenated blood returns to the heart. It is now ready for delivery to all body tissues.

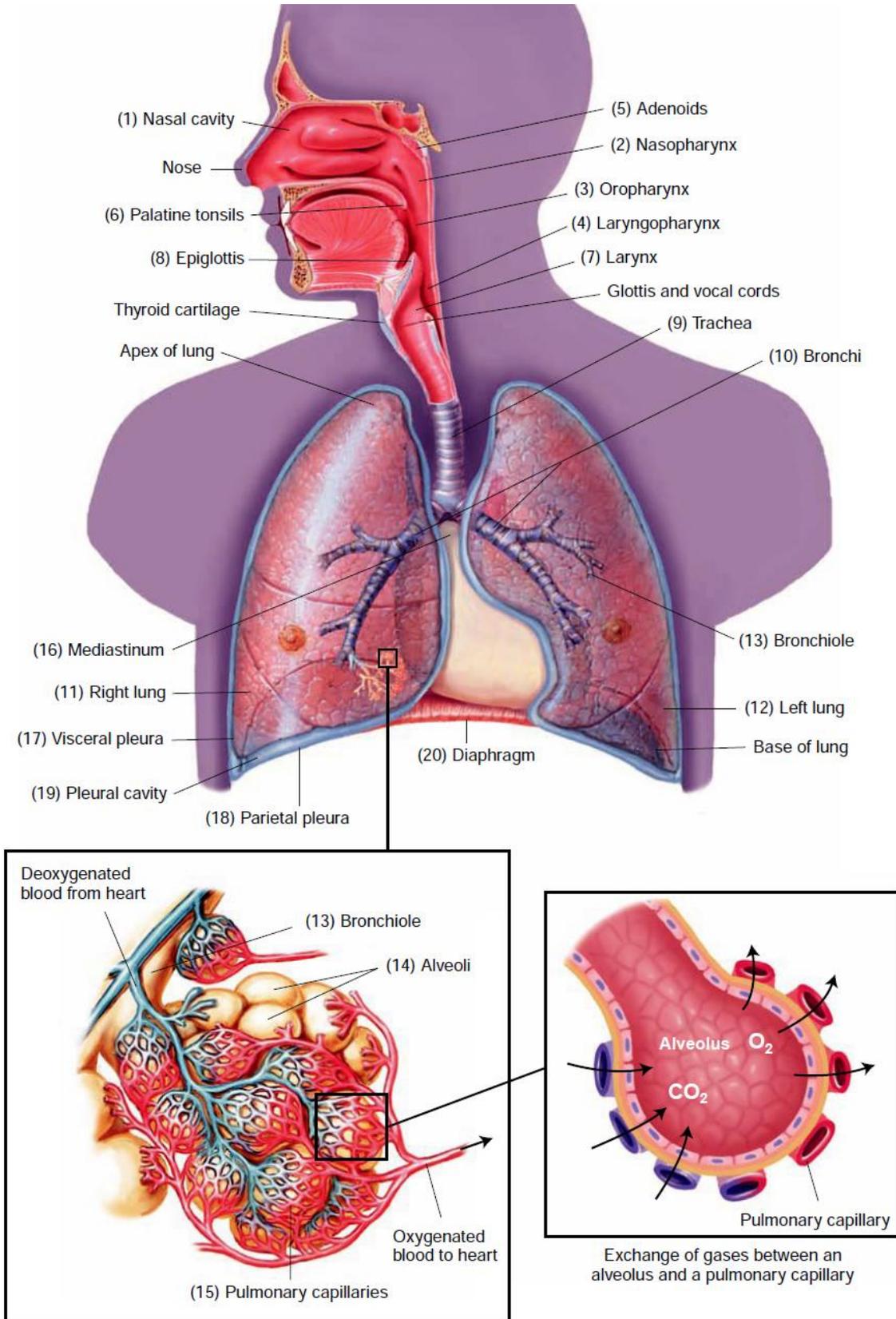


Figure 9-1: Anterior view of the upper and lower respiratory tracts

The lungs are divided into lobes: three lobes in the right lung and two lobes in the left lung. The space between the right and left lungs is called the (16) mediastinum<sup>198</sup>. It contains the heart, aorta<sup>199</sup>, oesophagus, and bronchi. A serous membrane, the pleura<sup>200</sup>, covers the lobes of the lungs and folds over to line the walls of the thoracic cavity. The membrane lying closest to the lung is the (17) visceral<sup>201</sup> pleura; the membrane that lines the thoracic cavity is the (18) parietal<sup>202</sup> pleura. The space between these two membranes is the (19) pleural cavity. It contains a small amount of lubricating fluid, which permits the visceral pleura to glide smoothly over the parietal pleura during breathing.

Ventilation depends on a pressure differential between the atmosphere and chest cavity. A large muscular partition, the (20) diaphragm, lies between the chest and abdominal cavities. The diaphragm assists in changing the volume of the thoracic cavity to produce the needed pressure differential for ventilation. When the diaphragm contracts, it partially descends into the abdominal cavity, thus decreasing the pressure within the chest and drawing air into the lungs (inspiration). When the diaphragm relaxes, it slowly re-enters the thoracic cavity, thus increasing the pressure within the chest. As the pressure increases, air leaves the lungs (expiration). The intercostal muscles assist the diaphragm in changing the volume of the thoracic cavity by elevating and lowering the rib cage. (See [Figure 9-2](#)).

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<sup>198</sup> Mediastinum: /,mi:diə'staɪnəm/ (pl. -na /-nə/) a membrane between two parts of an organ or cavity such as the pleural tissue between the two lungs. The part of the thoracic cavity that lies between the lungs, containing the heart, trachea, etc.

<sup>199</sup> Aorta: /eɪ'ɔ:tə/ the main artery that carries blood from the heart to the rest of the body once it has passed through the lungs

<sup>200</sup> Pleura: /'plʊərə/ (pl. pleurae /'plʊəri:/) one of the two membranes that surround the lungs

<sup>201</sup> Viscera: /'vɪsərə/ the large organs inside the body, such as the heart, lungs and stomach

<sup>202</sup> Parietal: /pə'ri:ɪtəl/ of, relating to paries (/ 'peəri,i:z/ the wall of an organ or bodily cavity)

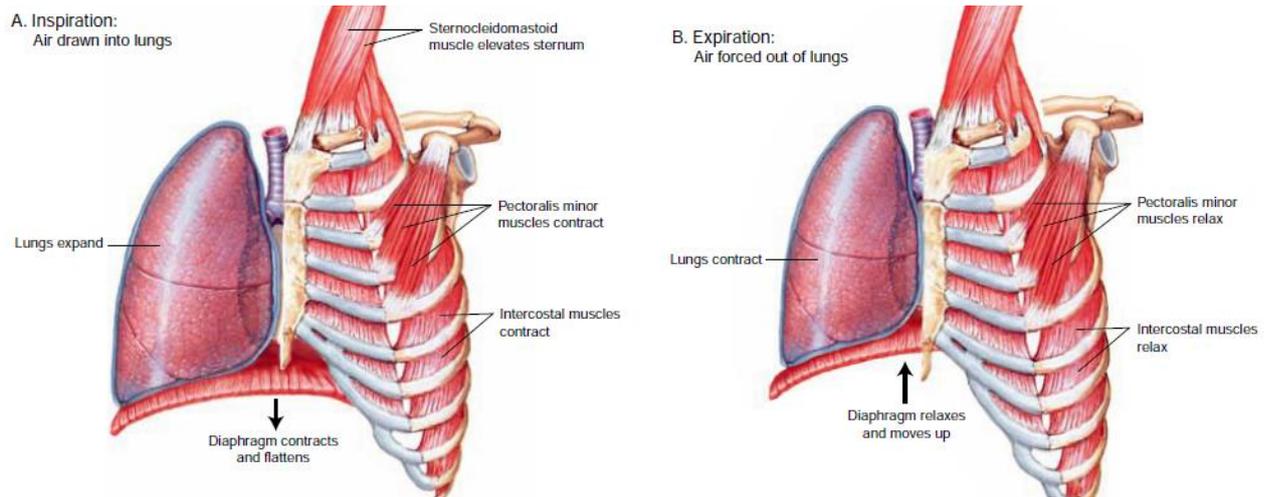


Figure 9-2: Breathing muscles