

CLASS - 9

DATE 15.07.2024

SUBJECT - BIOLOGY

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CHAPTER 14 Respiratory System

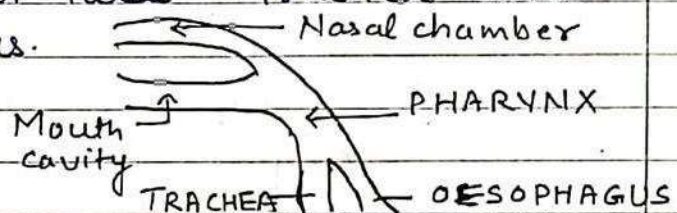
Nose → Pharynx → Larynx → Trachea → Bronchi and Lungs

Nose - Hair and mucus present in nostrils cleans the air (entraps harmful particles). It warms the air as it passes over and adds moisture to the air. So breathe through the nose.

Nose also helps to smell. Sensory cells are located in a special pocket situated high up in the nasal chambers. That is why we sniff, when we have to smell something.

Pharynx - Nasal chamber open at pharynx which is a common passage for air and food. It leads into an air tube - trachea and food pipe - oesophagus.

PHARYNX -
Common passage
for air & food



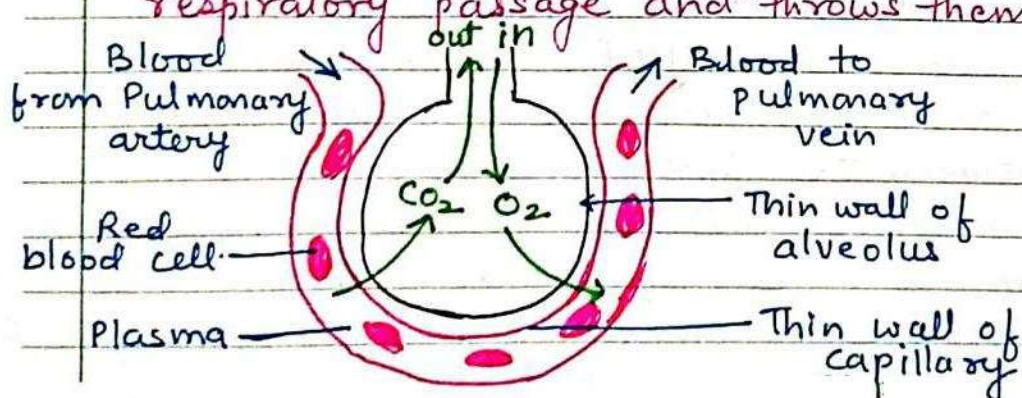
Entrance of trachea is guarded by a flap - epiglottis which closes at the time of swallowing food so that food does not enter the windpipe.

Larynx or voice box (Adam's apple) is located at beginning of windpipe. When you swallow something this part rises and falls. It contains two ligamentous folds called vocal cords. When air is expelled through vocal cords, it produces sound. By adjusting the distance between the two cords and their tension by means of attached muscles a range of sounds can be produced.

Trachea [wind pipe] comes out from larynx. Its walls are strengthened by C-shaped rings of cartilage which provide strength and flexibility to the windpipe. Incomplete part of C shaped rings is towards the back side. Thyroid gland partially covers the trachea.

Bronchi - Close to lungs trachea divides into two tubes called the bronchi which enter into the respective lungs. In the lung each bronchus divides into secondary bronchi which further divides into still finer tertiary bronchi. All these smaller bronchi are also covered with cartilagenous rings. Bronchioles are the subsequent still finer tubes of tertiary bronchi and are without cartilagenous rings. By repeated branching the bronchioles ultimately end in a cluster of tiny air chambers called the air sacs or alveoli. A network of blood capillaries surround the wall of each alveolus. The wall of alveoli is one celled thick so as to allow easy diffusion/exchange of gases through them. Oxygen from air first dissolves in the thin layer of water/fluid that covers the surface of alveoli.

The entire inner lining of the larynx, trachea, bronchi, bronchioles is formed of ciliated epithelium. Cilia are constantly in motion driving any fluid (mucus) or any particle in the respiratory passage and throws them out.



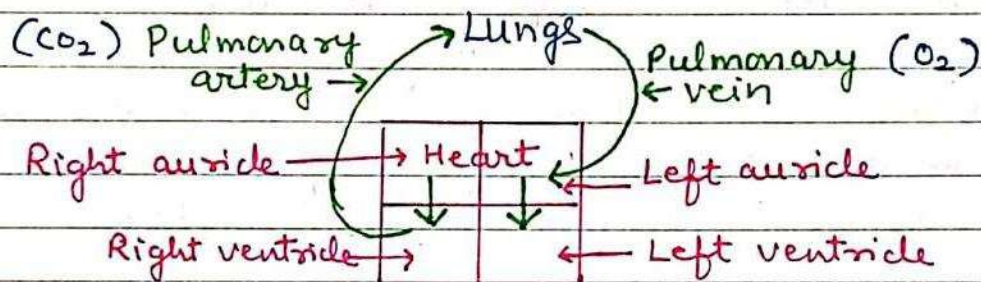
GASEOUS
Exchange
in Alveolus

Lungs.

Two lungs roughly cone shaped spongy elastic organs tapering at the top and broad at the bottom. Left lung has two lobes and right lung has three. Left lung is slightly smaller to accommodate the heart in between.

Each lung is covered by two membranes -

the inner visceral pleura and outer parietal pleura with a watery fluid pleural fluid in between the two membranes. This arrangement provides lubrication for free movement of lungs while inhaling and exhaling the air. The lower bases of the lungs rest on the diaphragm.

Blood supply to Lungs

Right atrium of heart receives deoxygenated blood from body and pumps it to right ventricle which in turn pumps it to lungs through pulmonary artery. Lungs receive deoxygenated blood which reaches the blood capillaries surrounding the alveoli. CO₂ from the blood enters into the alveoli through simple diffusion and similarly oxygen from the alveoli enters the blood through diffusion. Thus this oxygenated blood is now taken from the lungs through the pulmonary veins and poured into the left atrium of the heart.

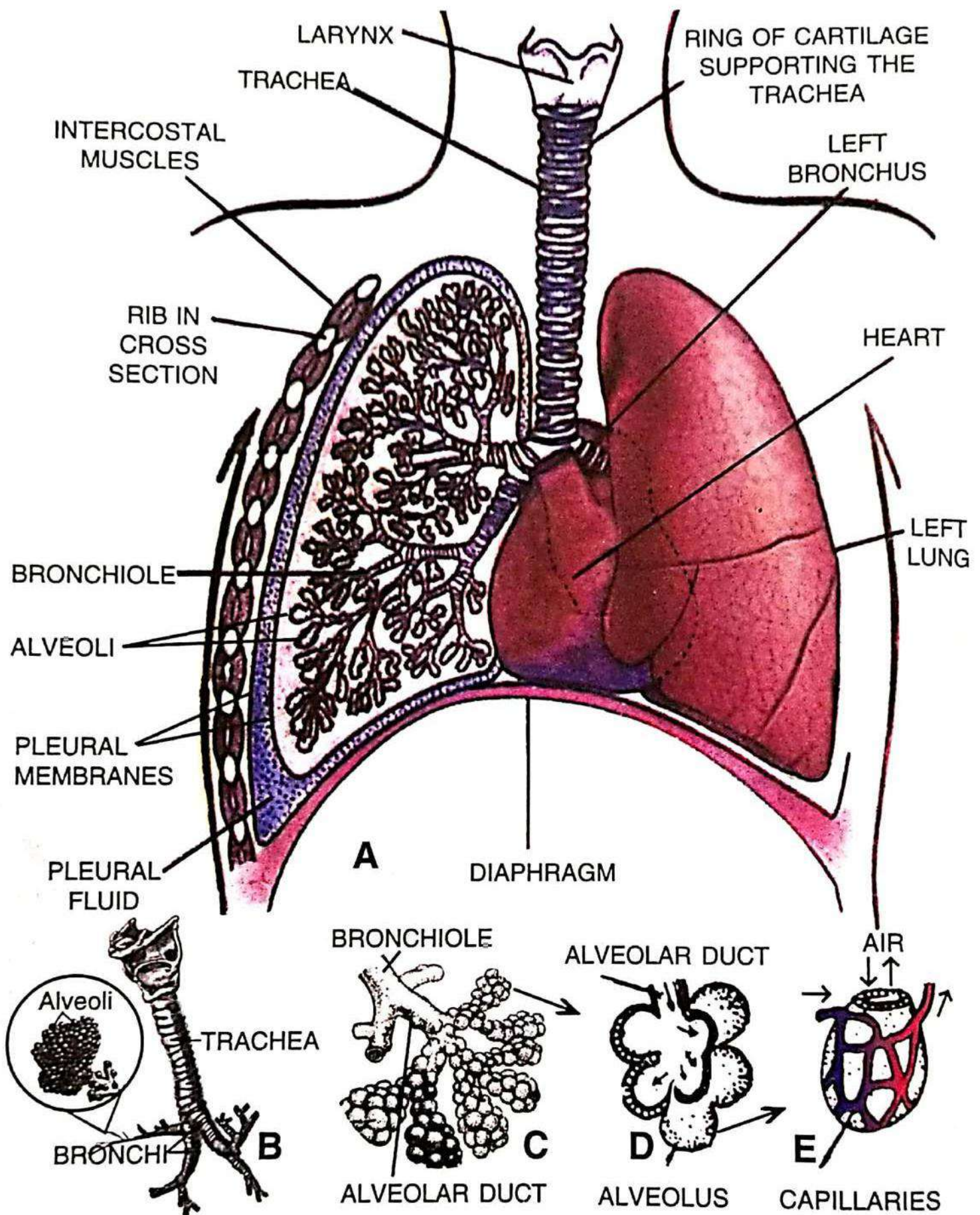


Fig. 14.3 A – Human respiratory system (front view, with right lung shown from inside, B. Scheme of branching of air passage from the trachea onward up to alveoli, and the terminal parts of the air passages (C, D, E).

Breathing cycle - Respiratory cycle consists of

Inspiration [breathing in]

Expiration [breathing out] and

a short respiratory pause.

In normal adult breathing rate is 12-18 breaths per minute and 60 times per minute in a new born baby. Increase in CO_2 in blood increases the breathing rate.

Inspiration [Inhalation] brings following changes -

Ribs - move upwards and outwards due to contraction of intercostal muscles [external] External intercostal muscles are present between ribs. The internal intercostal muscles are relaxed. This enlarges the chest cavity all around.

Diaphragm [a muscular sheet situated at base of Lungs. It normally is dome shaped, arched upwards. During inhalation it contracts and flattens to an almost horizontal plane and thus enlarges the chest cavity lengthwise.

Abdominal organs - As the diaphragm flattens, it presses the organs inside the abdomen and with the abdominal muscles relaxed, the abdominal wall moves outwards leading to increase in volume of chest cavity. You must have observed the outward rise and inward fall of people's belly alternately with inspiration and expiration.

Air pressure - Decreases

With increase in the chest cavity air pressure decreases inside the lungs thus drawing the air inward. The outside air being at a greater pressure, rushes in to equalize the pressure.

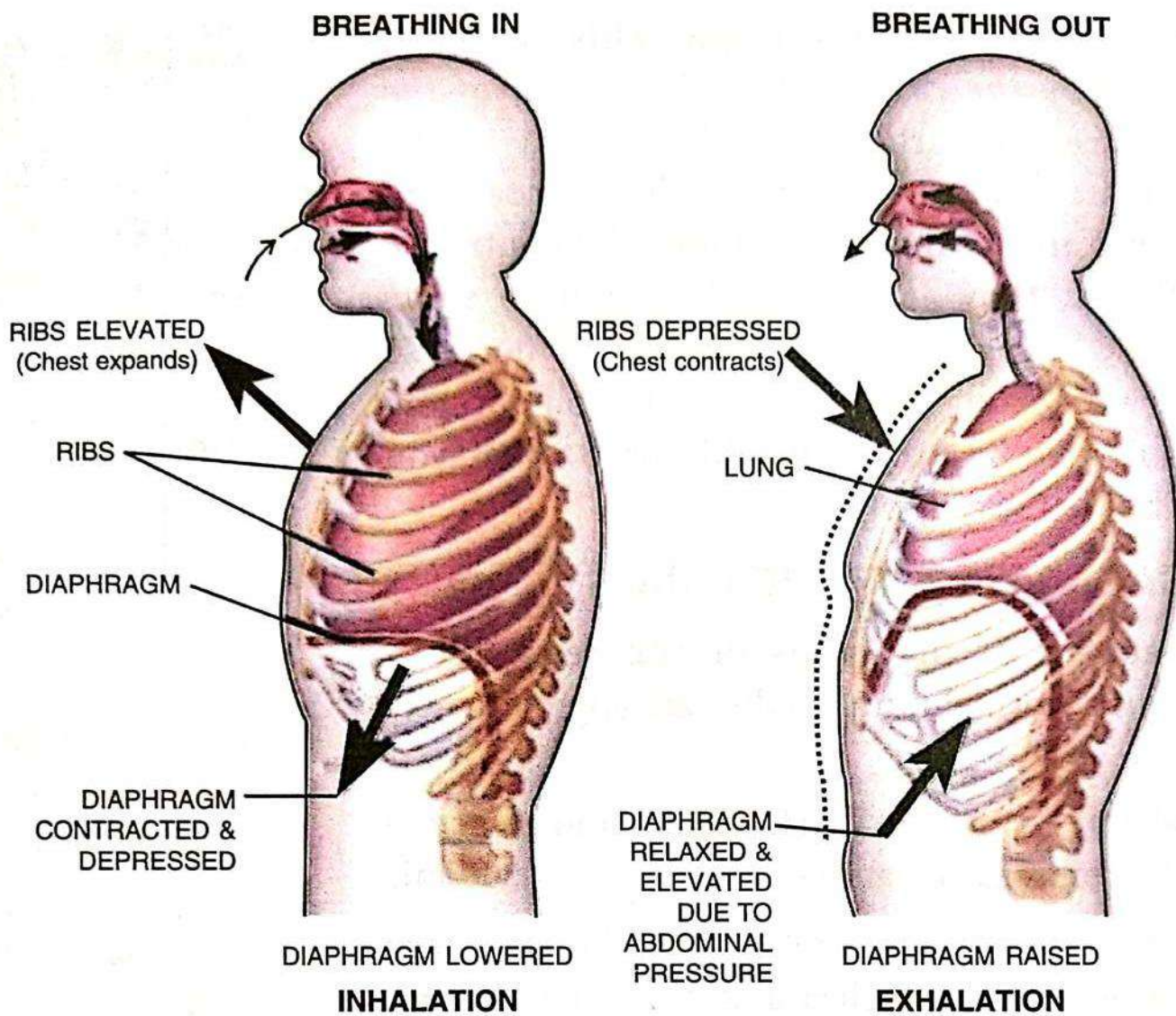


Fig. 14.7 Ribs and diaphragm movements during breathing (inhalation and exhalation)

Expiration [Exhalation] reverse movements of the ribs and diaphragm. External intercostal muscles relax and the ribs move in automatically. Diaphragm relaxes and moves upwards to dome shape. As a result of the above mentioned movements of ribs and diaphragm, the volume of chest cavity is decreased and the air pressure increases inside the lungs, thus forcing the air out into the atmosphere by thorax compression and elastic recoil of lungs.

Control of breathing movements

Respiratory centre is located in medulla oblongata of the brain which is stimulated by the CO_2 content of the blood. More the CO_2 content in the blood, faster is the breathing rate.

Capacities of the lungs

- 1) Tidal volume - Air breathed in and out in a normal breathing = 500 ml
- 2) Dead air space - Some tidal air is left in respiratory passages such as trachea and bronchi where no diffusion of gases can occur = 150 ml
- 3) Alveolar air - Air [Tidal air] contained in air sacs (alveoli) = 350 ml
- 4) Inspiratory reserve volume - Air that can be drawn in forcibly over and above the tidal air (also called complementary air) = 3000 ml
- 5) Inspiratory capacity - Total volume of air a person can breathe in after a normal expiration = 3500 ml
- 6) Expiratory reserve volume - Air that can be forcibly expelled out after normal expiration (also called supplemental air) = 1000 ml

- 7) Vital capacity - The volume of air that can be taken in and expelled out by maximum inspiration and expiration = 4500 ml
- 8) Residual volume - Some air is always left in the lungs even after forcibly breathing out. This is leftover (residual) air = 1500ml
- 9) Total lung capacity - Maximum air which can at any time be held in two lungs = 6000ml

Home Assignment

- 1.) Do the following "Review questions" [given on Page 148-149 of your text book] in your note book.

C. Short answer type

Q No 2 and 5

D Long answer type

Q No 5

E structure /Application /skill type

Q No 1 and 3.

- 2) Draw a well labelled diagram of human Respiratory System in your notebooks