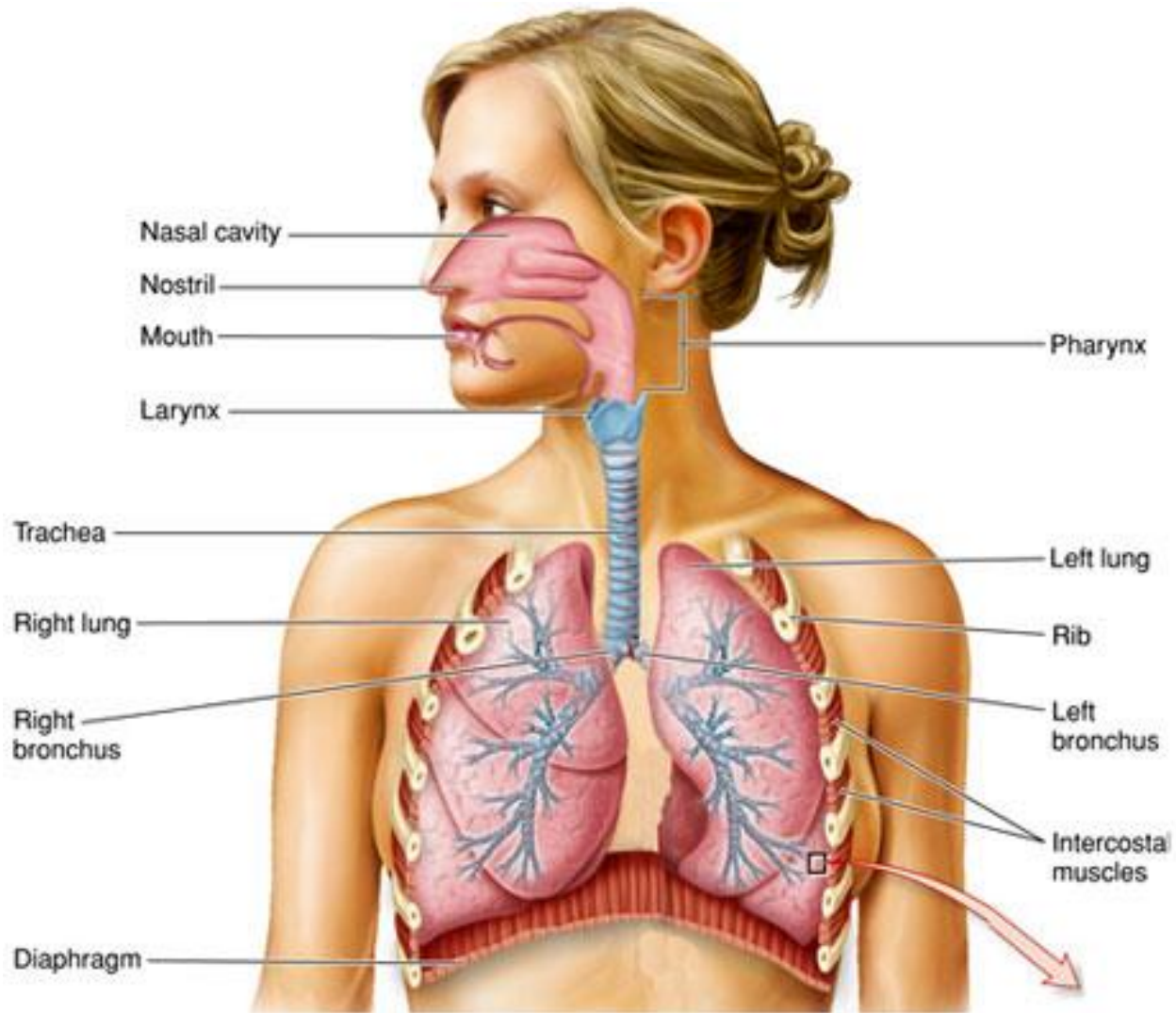


The Breathing System



3.4.4 The Breathing System in the Human

Objectives – What you will need to know from this section

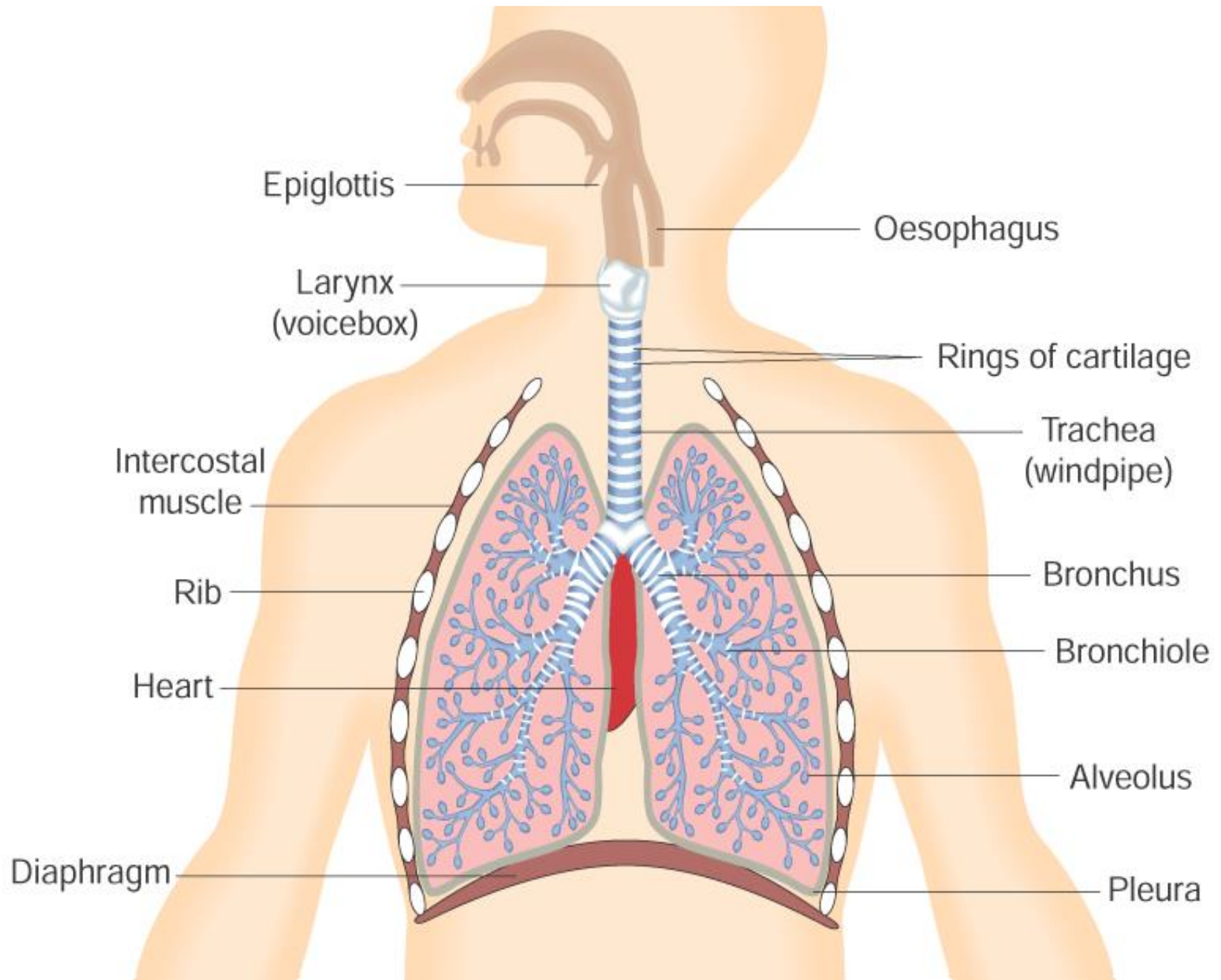
- Outline the macrostructure & function of the breathing tract in humans.
- Outline the essential features of the alveoli & capillaries (as surface) for gas exchange.
- Describe the mechanism of the breathing system in gas exchange .
- Outline a breathing disorder:
Cause/prevention/treatment
(Asthma/Bronchitis)

3.4.4 The Breathing System in the Human

- We get our energy for metabolism by burning food in our cells [respiration].
- We get fresh supplies of oxygen by breathing it in through our lungs.

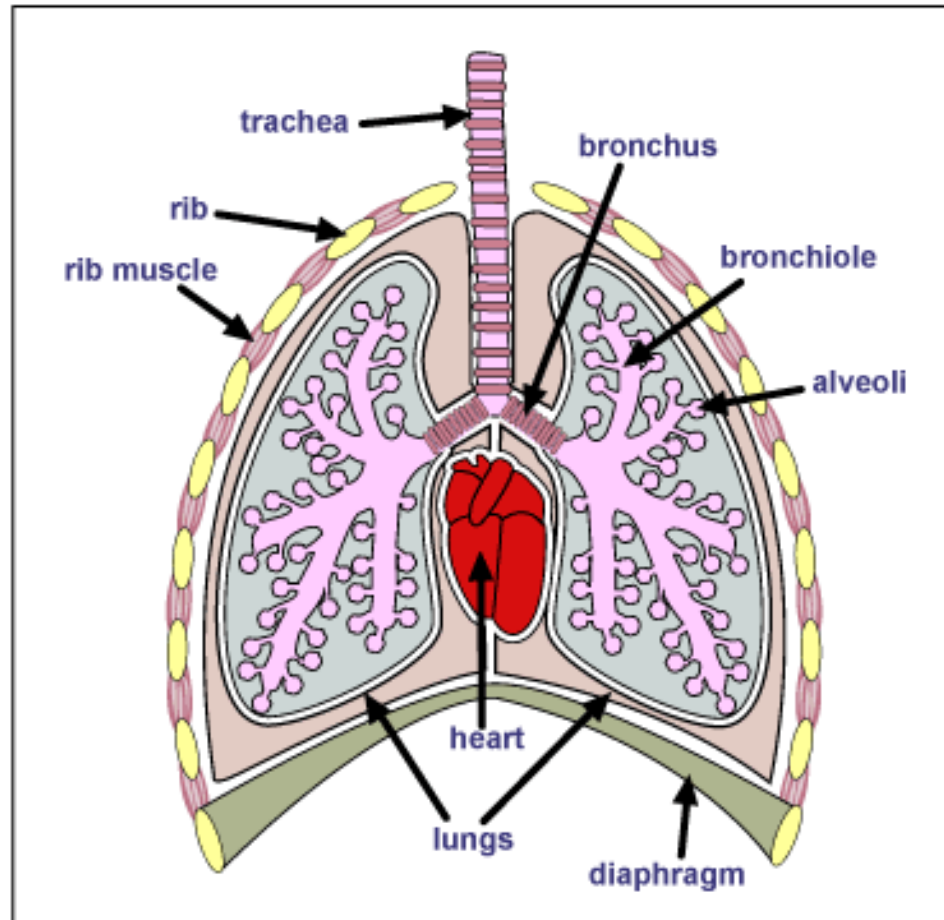


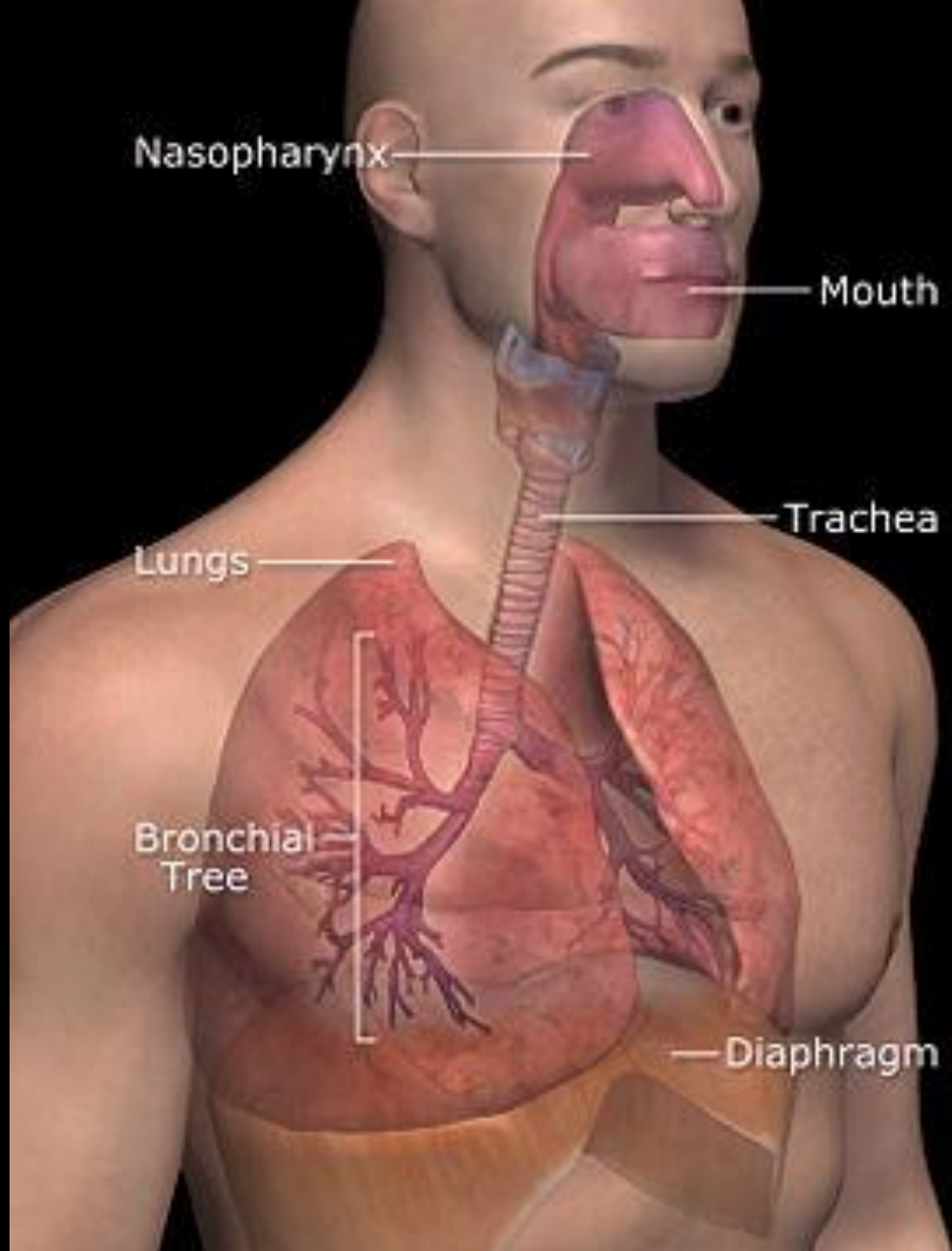
RESPIRATORY [LUNG] SYSTEM



➤ Your lungs are enclosed (along with the heart) between the ribs and the diaphragm [the thorax]

➤ The ribs form a protective cage of twelve pairs of bones.





Nasopharynx

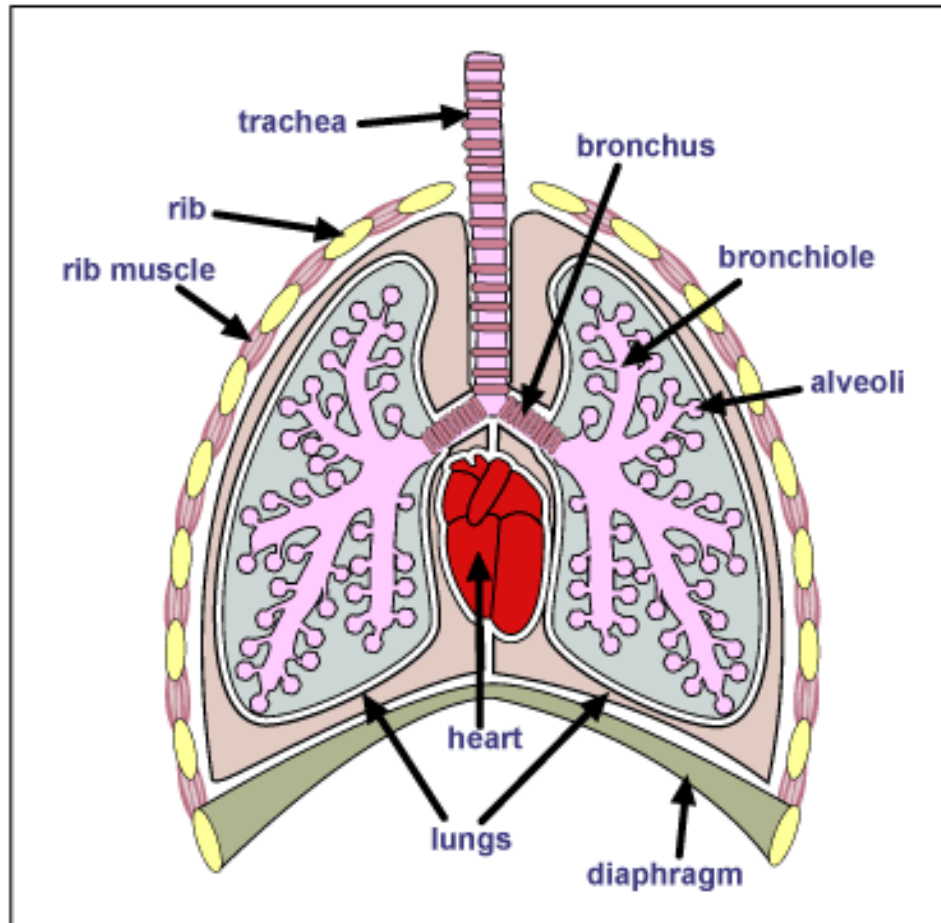
Mouth

Trachea

Lungs

Bronchial
Tree

Diaphragm



➤ Intercostal muscles, attached between the ribs, move the rib cage up or down.

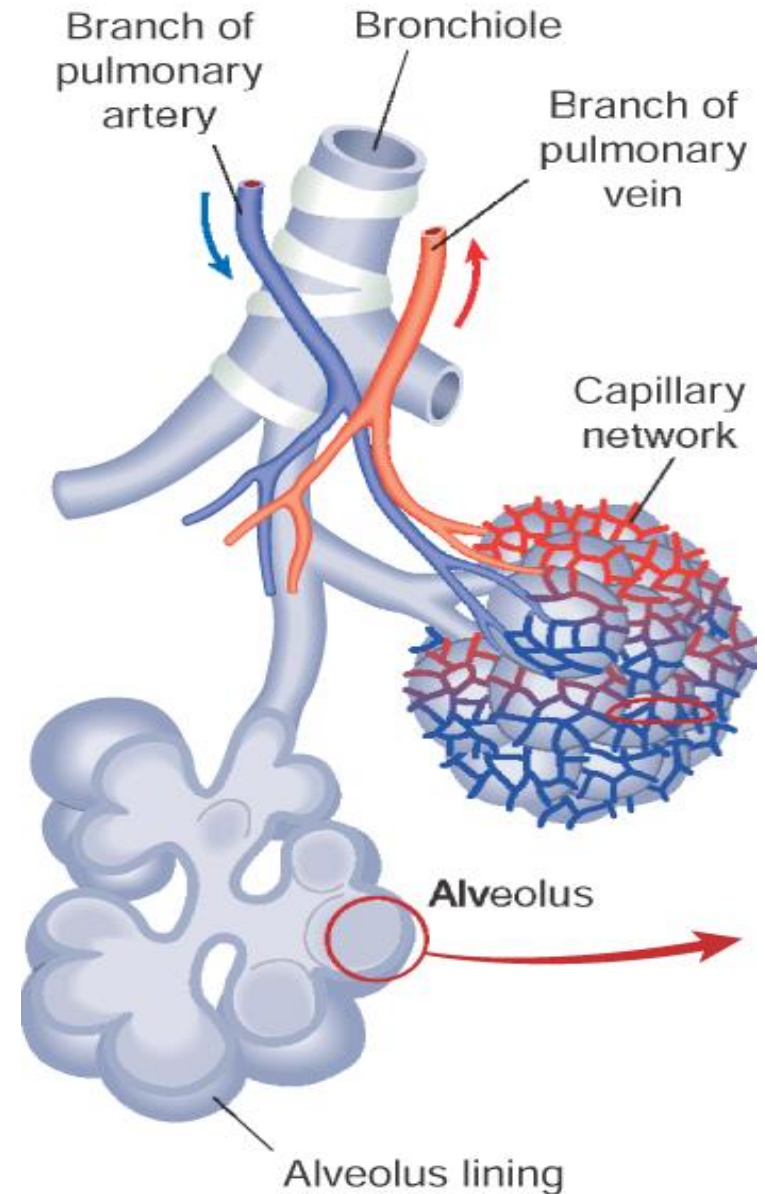


- The diaphragm is a sheet of muscle at the base of the rib cage.

LEARNING CHECK

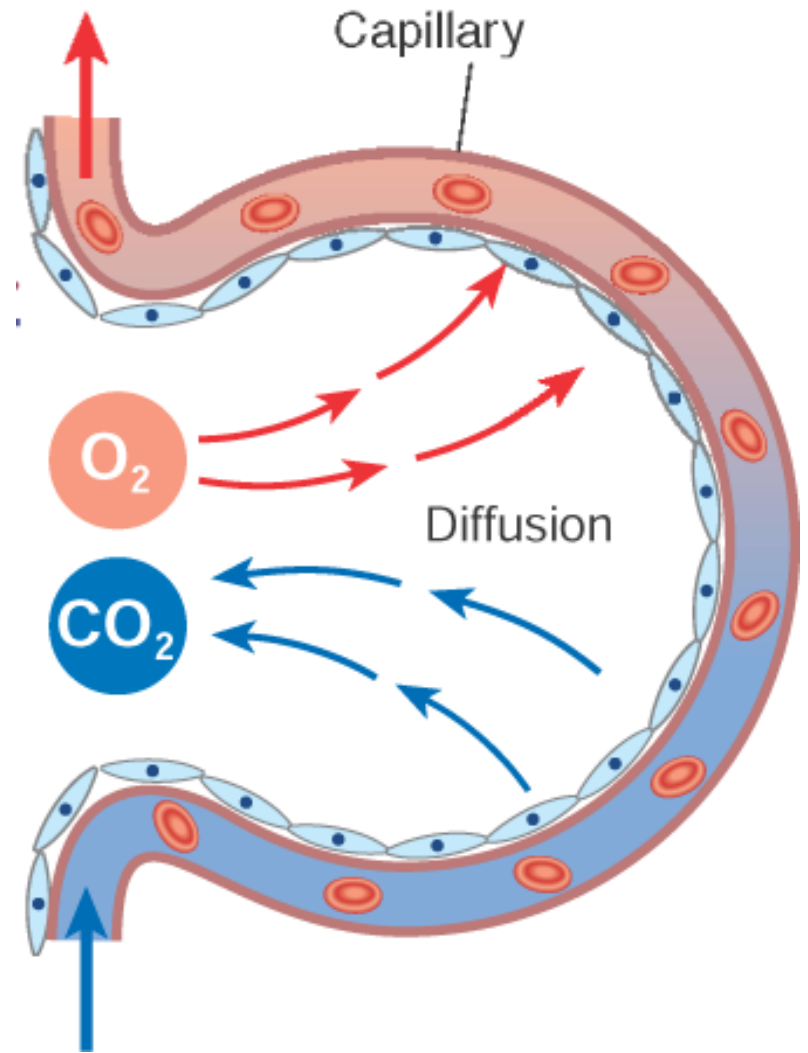
- What is metabolism?
- What is respiration?
- Your lungs are enclosed by what parts of the body?
- What is the function of your ribs?
- What is your diaphragm?

- Air enters the nose, travels down the windpipe, the bronchus and the bronchioles, to the alveoli.
- Each alveolus is covered in a net of thin-walled blood capillaries.
- The lining of an alveolus is only one cell thick



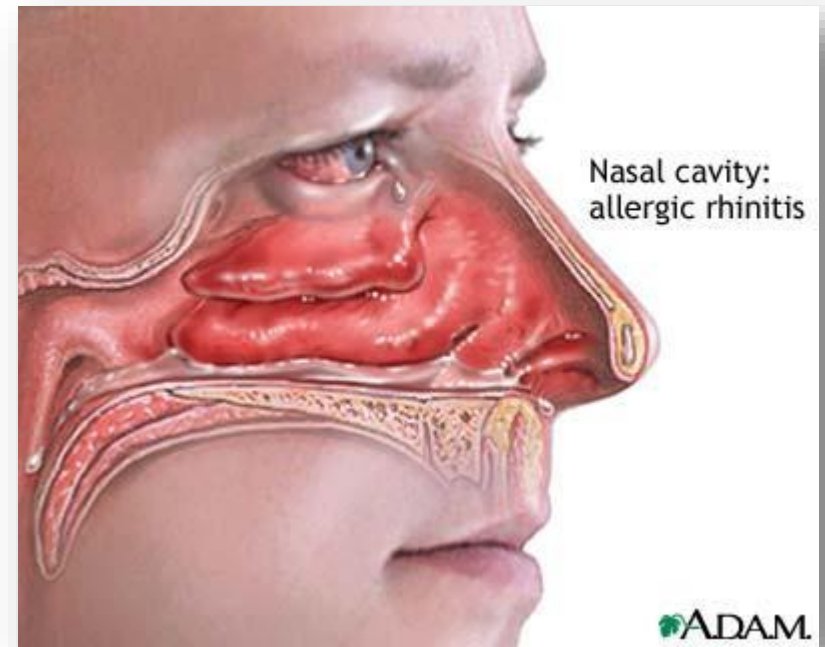
ALVEOLUS STRUCTURE

- Oxygen diffuses through the alveolus and capillary linings, and attaches to red blood cells.
- At the same time, carbon dioxide diffuses from the plasma into the alveolus.

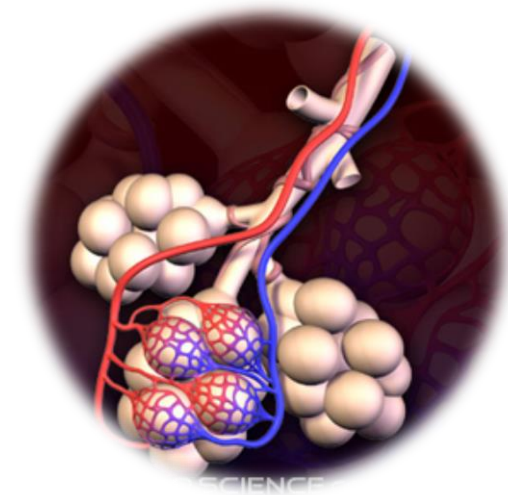


Diffusion is the movement of molecules from a region of high concentration to a region of lower concentration

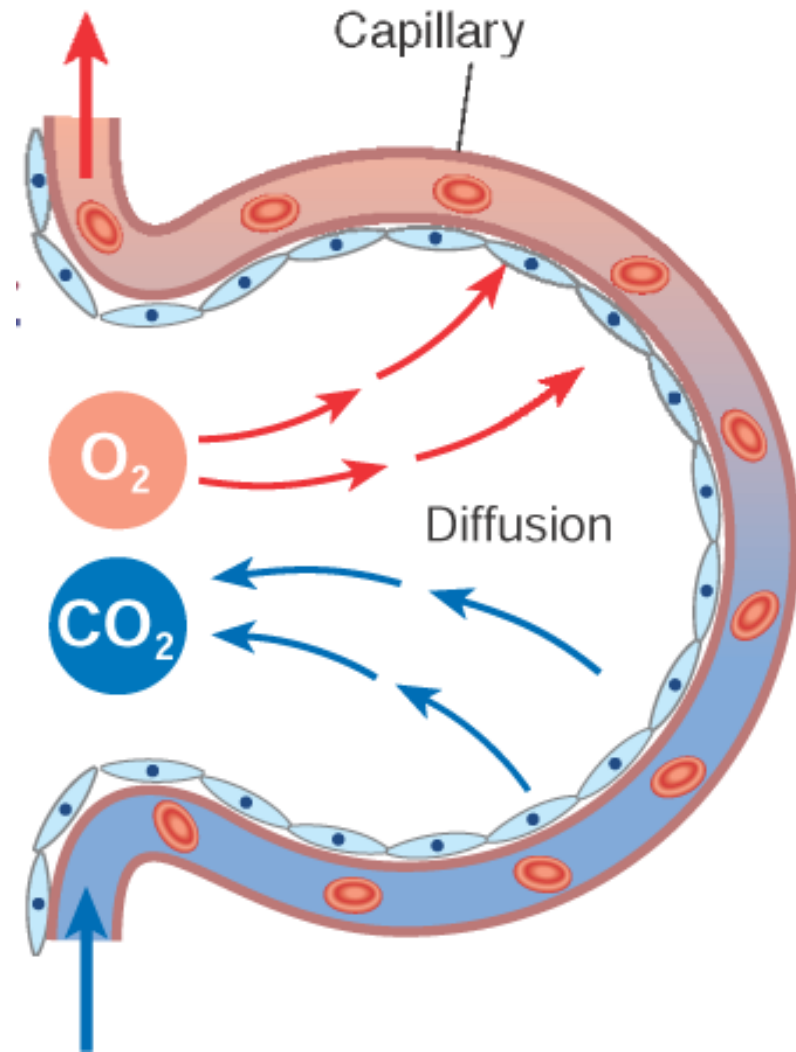
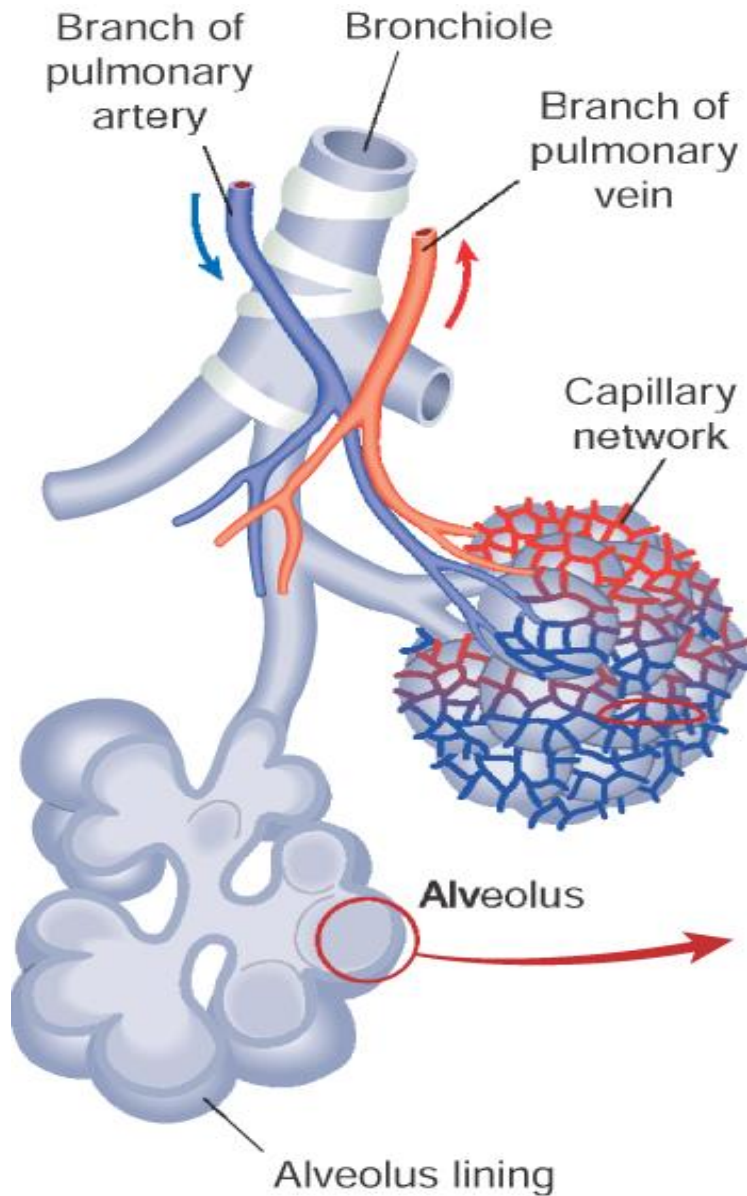
➤ The lining cells of the nose, trachea and bronchi produce a sticky mucus that traps dust and germs.



➤ White blood cells in the alveoli can engulf bacteria and foreign matter.



ALVEOLUS STRUCTURE



Adaptations of the Lungs for Gas Exchange

- Alveoli have a large surface area
[90m²]
- Short distance between air and blood
- Walls of alveoli are elastic

COMPOSITION OF AIR IN THE LUNGS

	% Volume	
	Inhaled air	Exhaled air
Oxygen	21	16
Carbon dioxide	0.04	4
Nitrogen	79	79
Water vapour	Varies	Saturated

LEARNING CHECK

- List the pathway of air from our nose to alveolus.
- How is the alveolus adapted to gas exchange?
- Explain the differences between inhaled and exhaled air.
- How are the lungs protected against infection?

INHALING [INSPIRATION]

INHALING

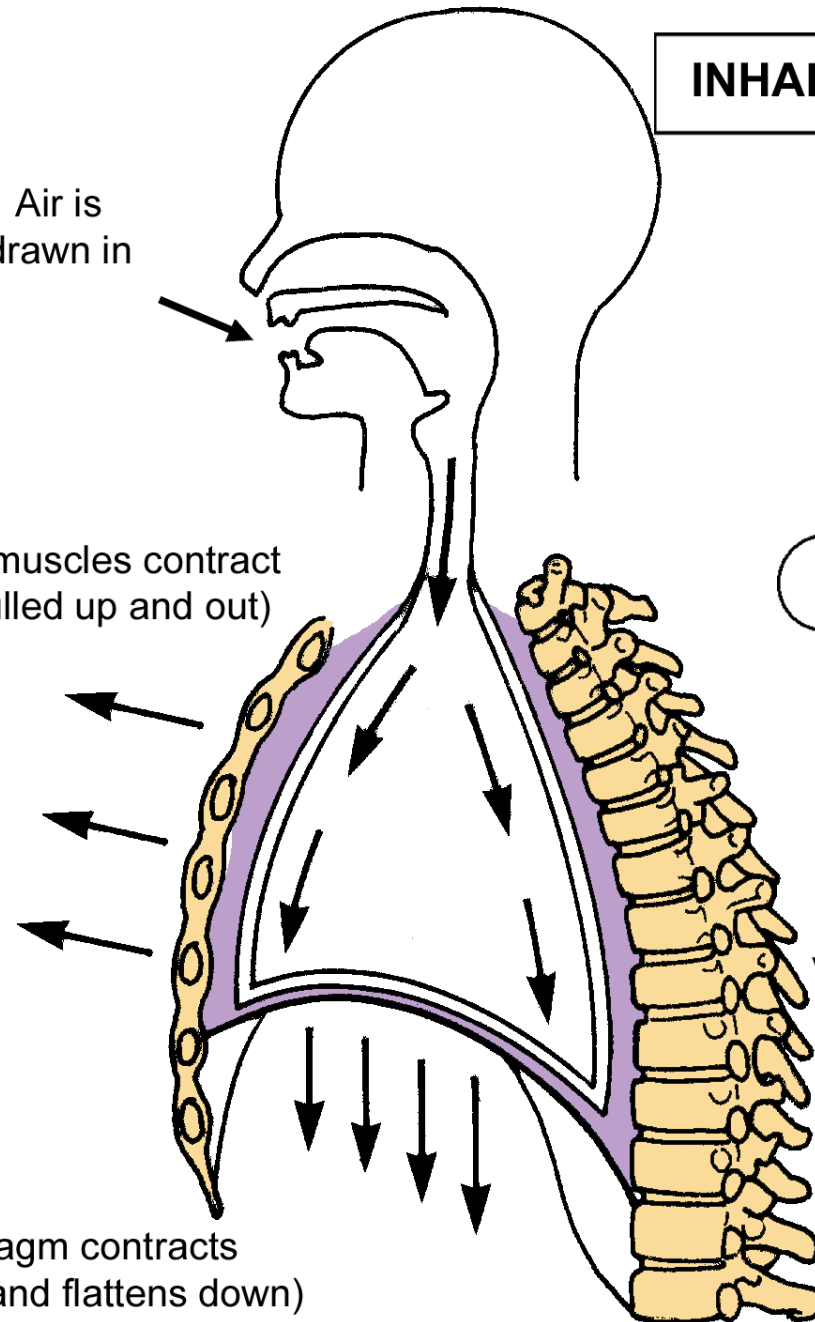
4 Air is drawn in

1a Intercostal muscles contract (ribcage pulled up and out)

3 Air pressure drops

2 Volume of lungs increases

1b Diaphragm contracts (shortens and flattens down)



➤ Inhaling means breathing in.

➤ The brain sends signals to the rib muscles and diaphragm to contract

➤ The ribs are pulled up and out, and the diaphragm flattens downwards;

INHALING [INSPIRATION]

INHALING

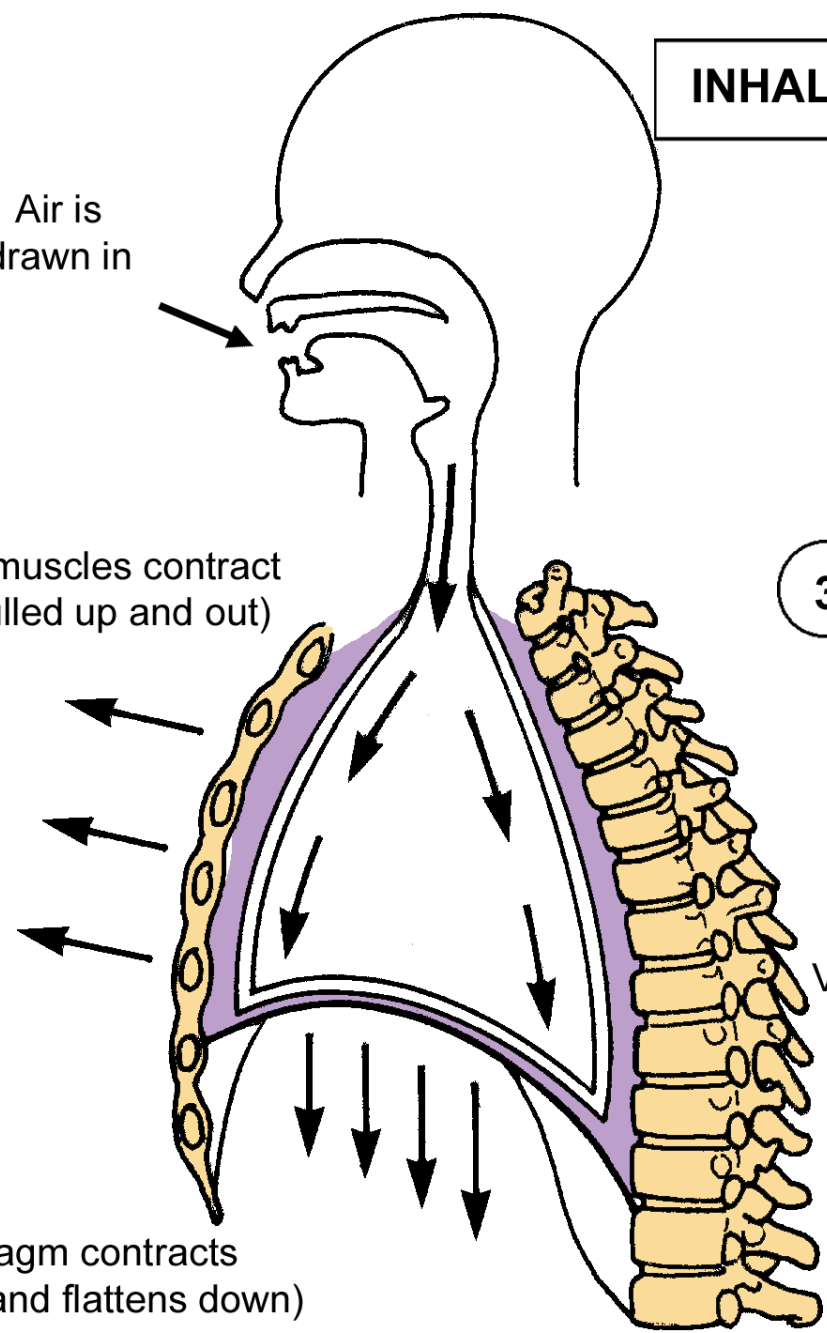
4 Air is drawn in

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3 Air pressure drops

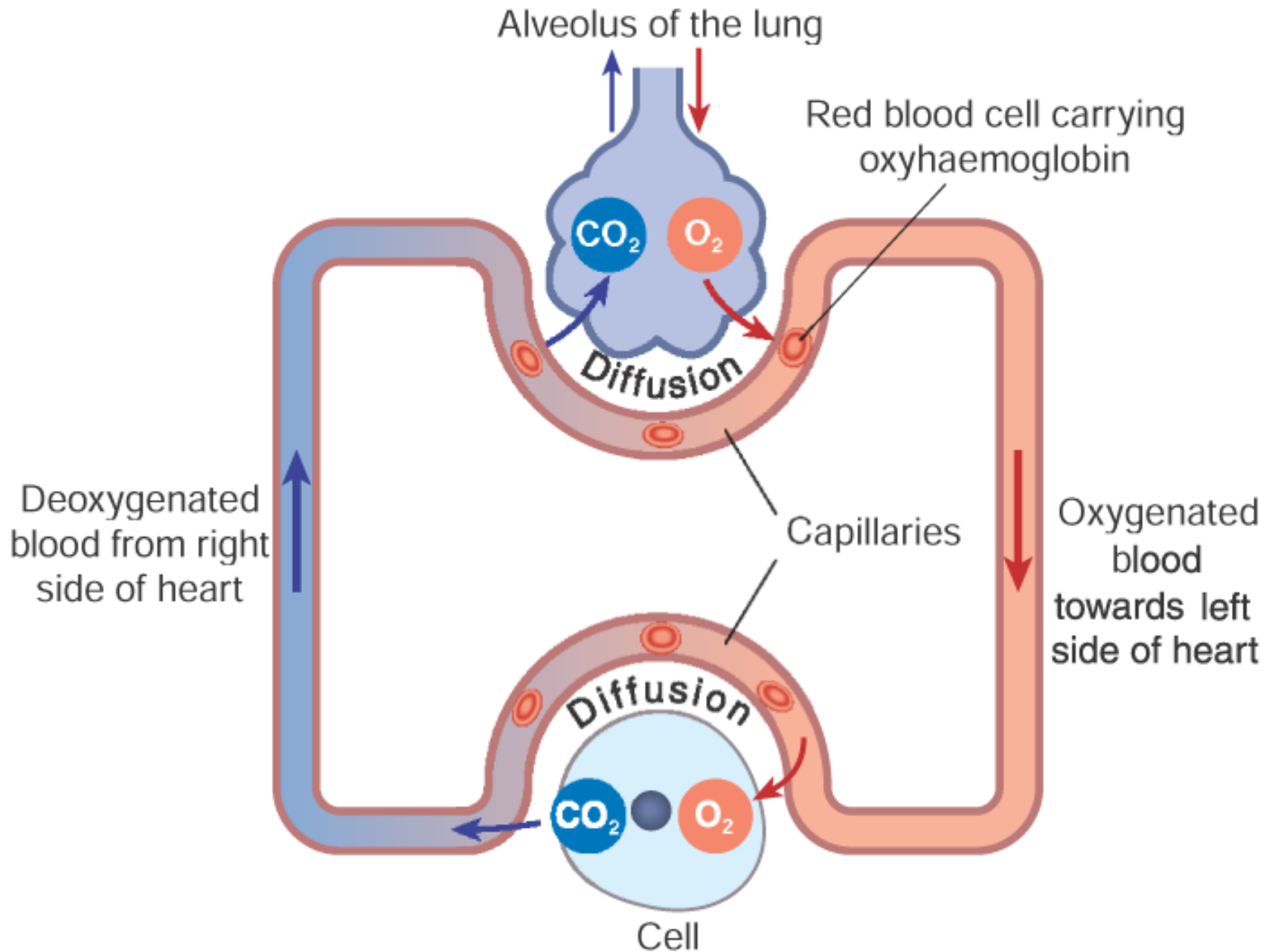
2 Volume of lungs increases

1b Diaphragm contracts (shortens and flattens down)



➤ the volume of the chest increases, so air pressure drops and more air is drawn into the lungs and alveoli.

GAS EXCHANGE IN THE LUNGS & TISSUES



Transport of Oxygen in blood

- Red blood cells have haemoglobin in them
- Red blood cells carry 97% of the oxygen
- The other 3% is carried in the plasma

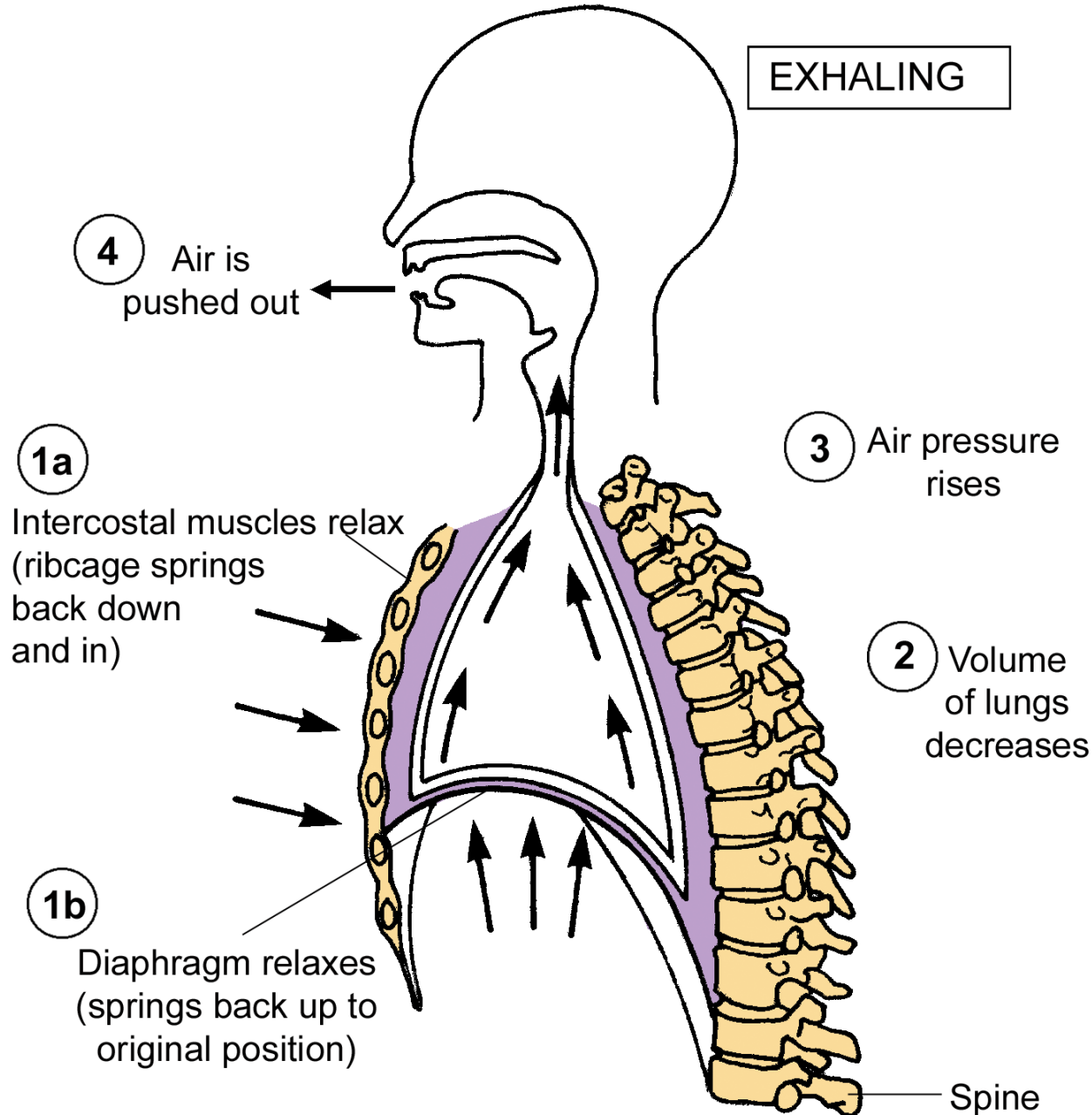


Transport of Carbon Dioxide

- Most is carried in the Plasma as bicarbonate ions or as dissolved carbon dioxide
- A small % is carried by the red cells

EXHALING [Expiration]

EXHALING



➤ Exhaling means breathing out

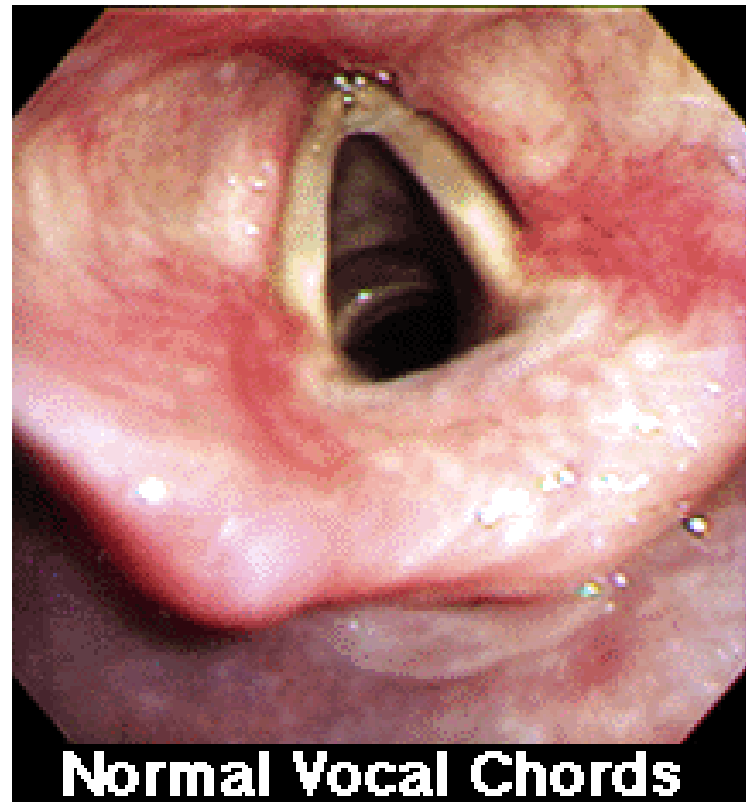
➤ The rib muscles and diaphragm relax, springing back to their original positions,

➤ So air pressure in the lungs increases, and air is pushed out from the alveoli.

LEARNING CHECK

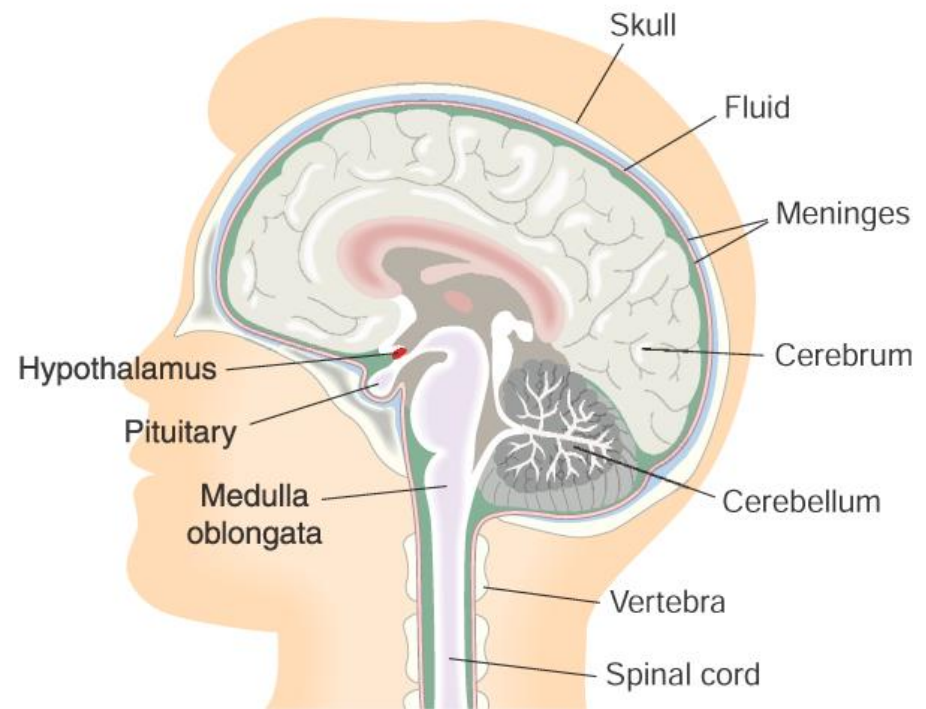
- Name the two sets of muscles involved in inhalation.
- List the steps involved in inhaling air.
- What happens the oxygen absorbed into the blood?
- Where does the extra CO_2 in the blood come from?
- What does oxygeneated blood mean?

Our voice box (larynx), is made of two sheets of muscle that vibrate as the air passes between them and so we can produce sounds and speech, in co-operation with our tongue, mouth and teeth.



We breathe automatically by involuntary reflex action. It is controlled by **medulla oblongata** of the brain.

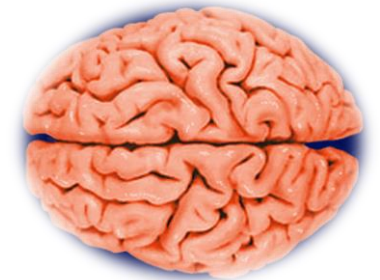
CO₂ AND BREATHING RATE



- The rate of breathing is continually adjusted to meet the body's needs (an example of homeostasis).

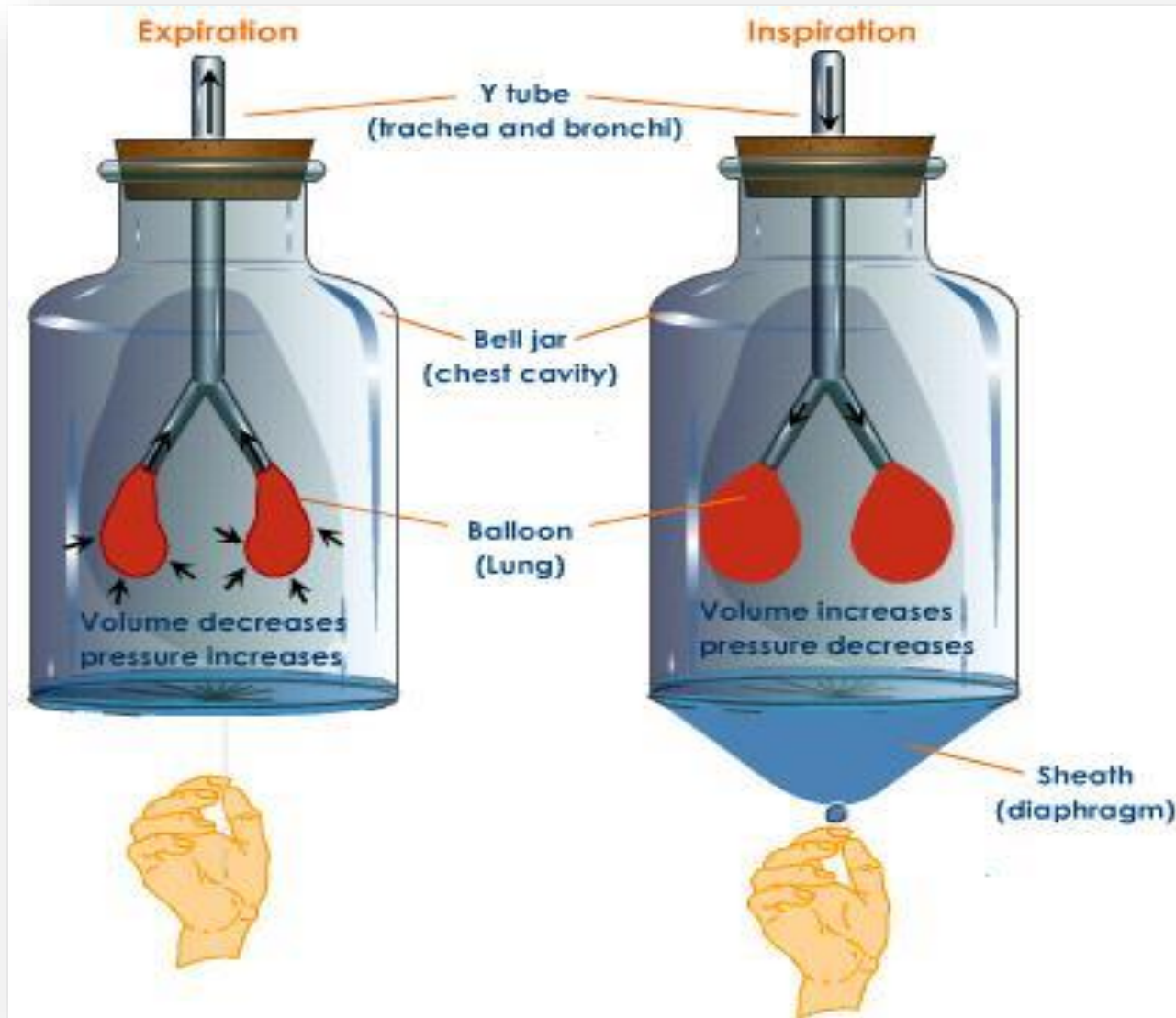
Role of the Brain in Breathing

- Mostly breathing rhythm is unconsciously set by the brain
- We can voluntarily change the rate at which we breath
- You can't hold your breath forever
- Your brain won't let you



Mechanism of breathing

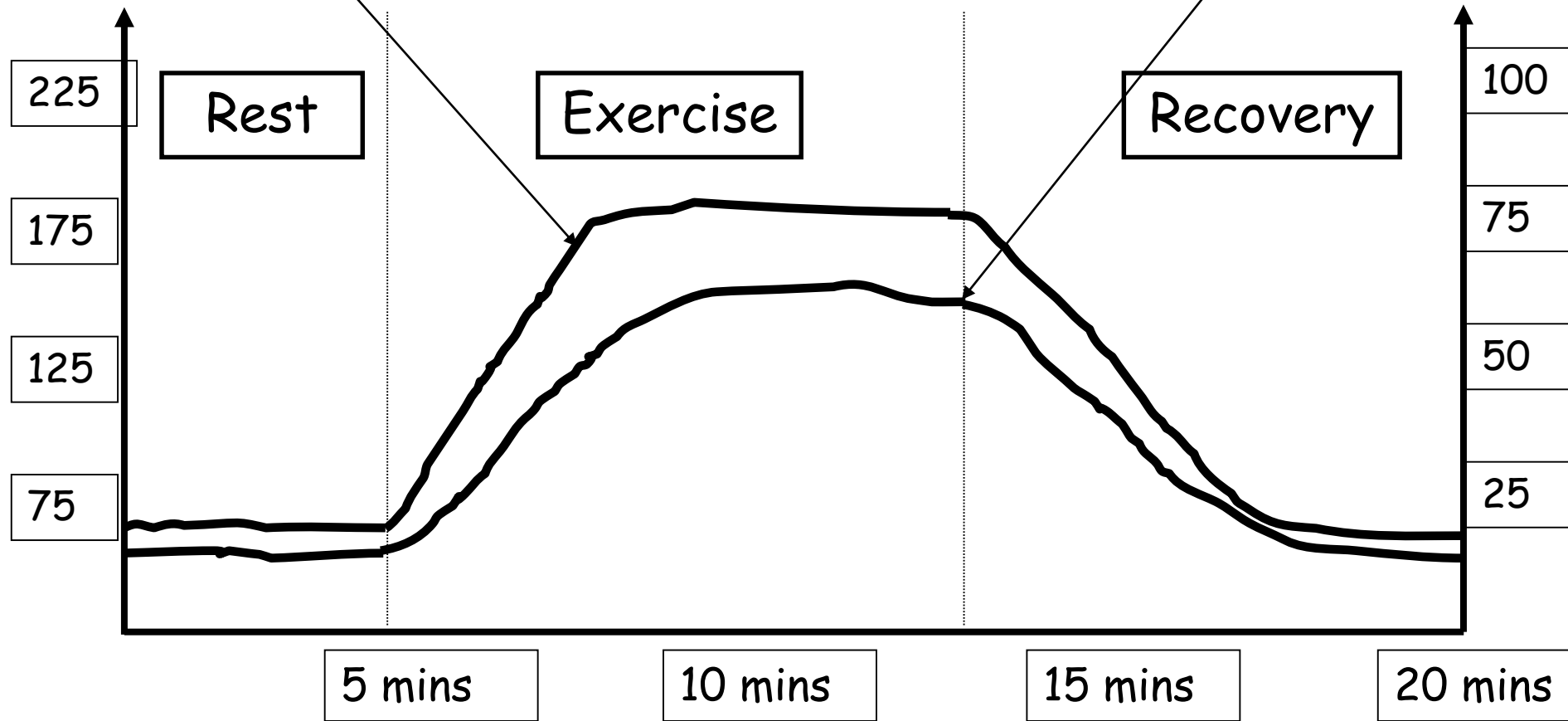
Bell Jar Model



The Effect of Exercise

Heart rate/min

Breathing rate/min

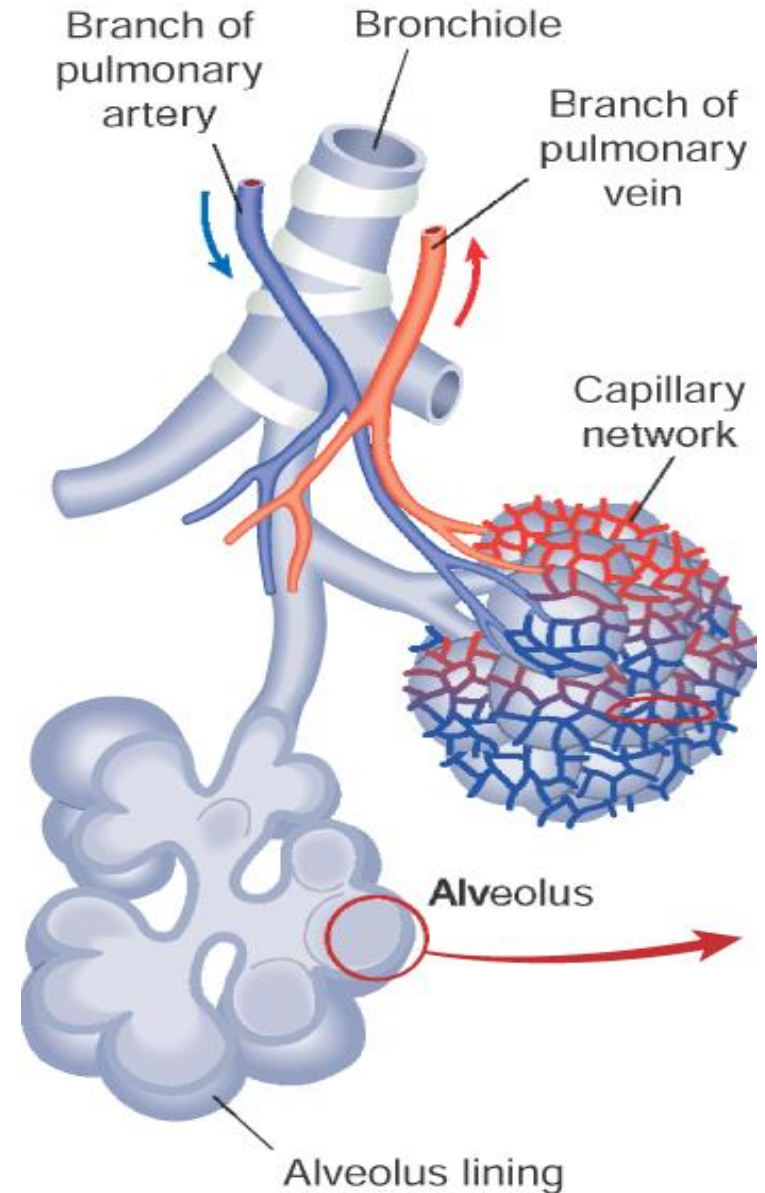


Breathing Disorders

- Asthma – inflammation & constriction of bronchi
- Bronchitis - inflammation of the bronchial tubes (bronchi),
- Emphysema — (Chronic obstructive pulmonary disease (COPD))
destruction of alveoli
- TB – elasticity reduced (bacteria)
- Pneumonia – Lungs fill with fluid

ASTHMA

- Asthma is a narrowing of the bronchioles due to some irritant (dust mite, pollen, cold virus) and so the sufferer finds it difficult to inhale enough oxygen.
- Removing the offending agent can prevent it and treatment is by use of inhalers that dilate the tubes again.



Asthma symptoms

- Coughing
- Wheezing
- Breathlessness
- Chest tightness

Asthma: Causes

- Pollen
- Animals
- Smoke
- Dust mites
- Chemicals
- Exercise

Asthma -- Prevention and Treatment

- Identify triggers
 - avoid or remove
- Use specific drug treatments
 - Bronchodilators
 - Steroids



LEARNING CHECK

- What role does the brain play in breathing?
- What happens your breathing rate when you exercise?
- What advantage is this for you?
- Name a disorder of the breathing system.
- What are its symptoms?
- What are its Causes?
- What are its Treatments?