

# Human Respiratory System

BIO103  
Lecture-18

# Lecture Plan

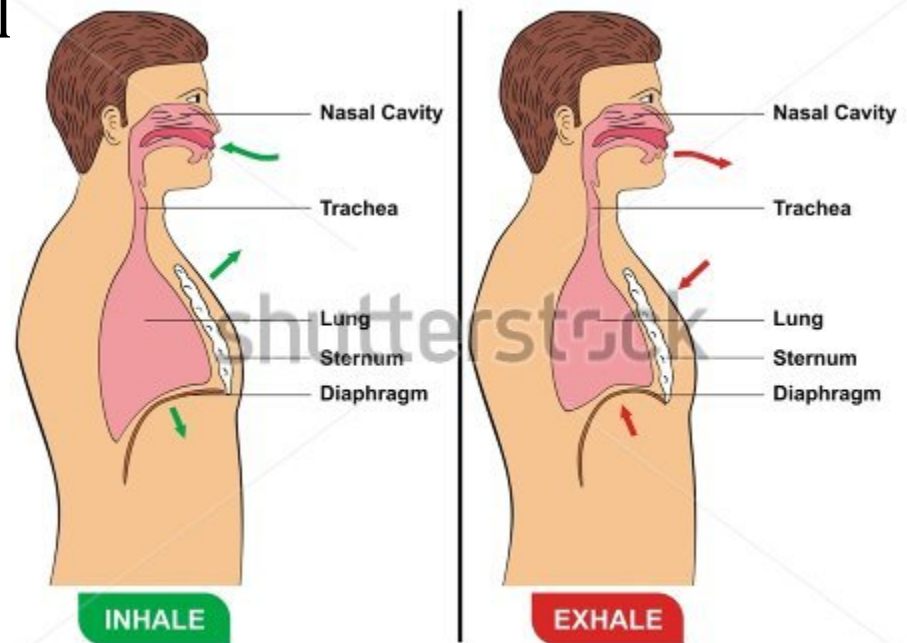
- **Gas Exchange and Breathing**
- **Cellular Respiration vs. Breathing**
- **The Human Respiratory or Gas Exchange System**
- **Gas Exchange in Lungs**

# Introduction

- All animals must exchange gases between themselves and their environment on a continual basis.
- Simple animals exchange gases throughout their entire body surfaces, whereas more complex animals have respiratory systems.
- Complex organisms rely on breathing to simultaneously move oxygen gas from the air into the body and remove carbon dioxide from the body and return it to the air.
- *Respiration* is the entire process of taking air in, exchanging oxygen for carbon dioxide and releasing air out.

# Gas Exchange and Breathing

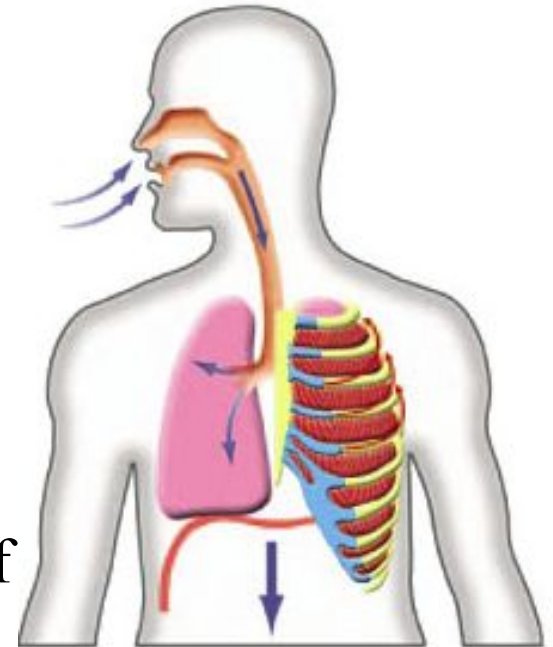
- Most animals are aerobic, that is, they need oxygen
- ***Carbon dioxide*** also affects animals, since too much of it can be harmful
- The *respiratory* and *circulatory systems* work together to deliver oxygen to cells and remove carbon dioxide in a two-phase process called
- Two phases:
  - ***Inhalation***
  - ***Exhalation***



# Gas Exchange and Breathing

## ● *Inhalation*

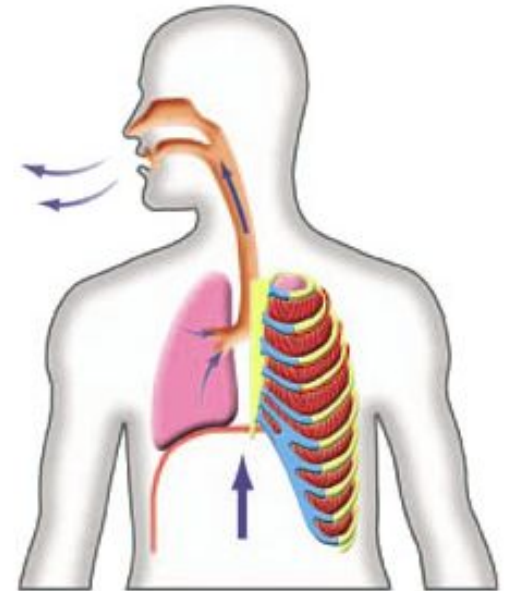
- Inhalation brings air from outside the body into the lungs.
- Oxygen in the air moves from the lungs through blood vessels to the heart,
- Heart pumps the oxygen-rich blood to all parts of the body.
- Oxygen then moves from the bloodstream into cells, which completes the first phase of respiration.
- In the cells, oxygen is used in a separate energy-producing process called *cellular respiration*, which produces carbon dioxide as a by-product.



# Gas Exchange and Breathing

## ● *Exhalation*

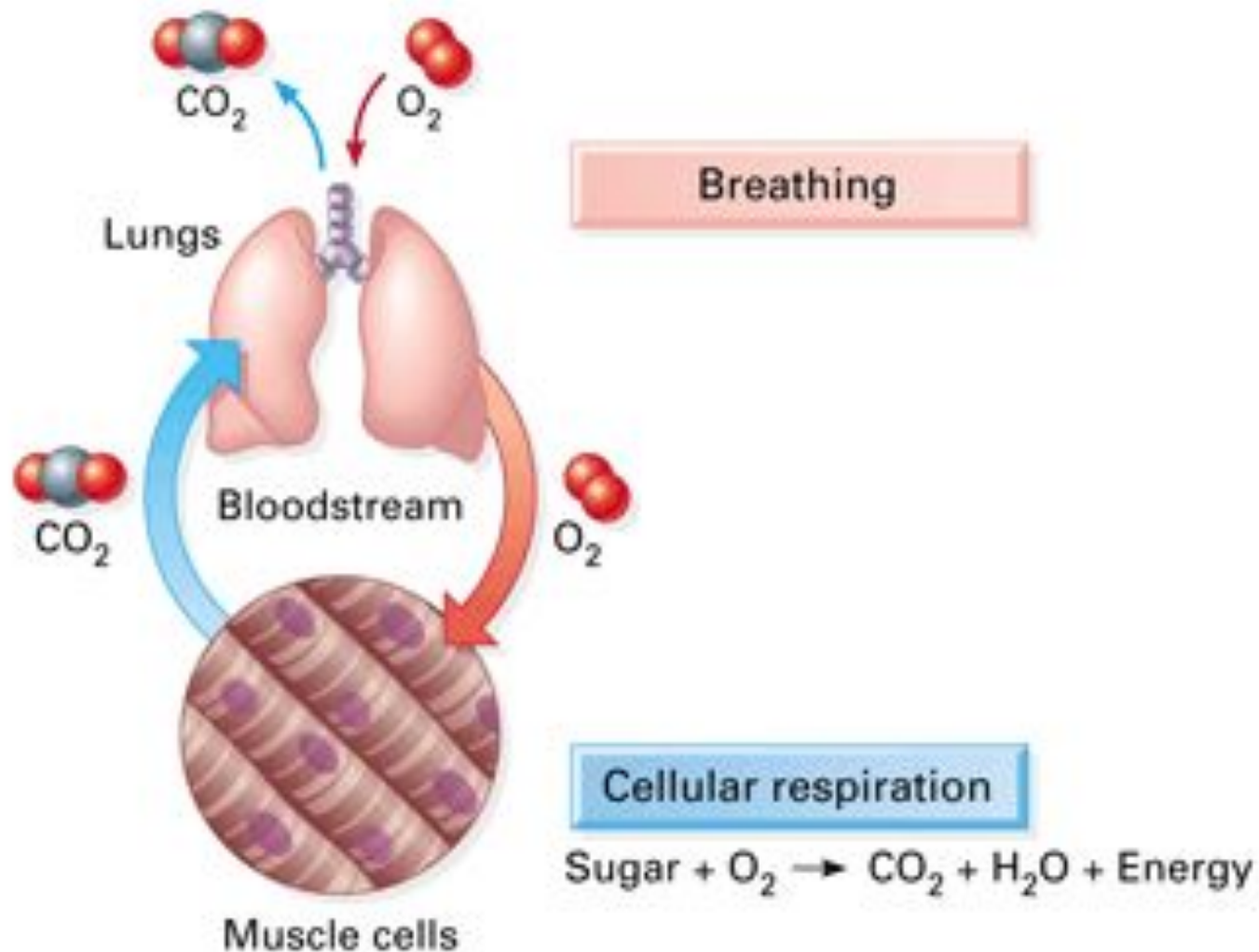
- The second phase of respiration begins with the movement of carbon dioxide from the cells to the bloodstream.
- The bloodstream carries carbon dioxide to the heart,
- which pumps the carbon dioxide-laden blood to the lungs.
- In the lungs, breathing out, or *exhalation*, removes carbon dioxide from the body, thus completing the respiration cycle.



# Cellular Respiration vs. Breathing

- ***Cellular Respiration*** is the process by which living cells break down foods and release the stored chemical potential energy.
- ***Breathing*** is the means by which respiratory gases are exchanged between the entire organism and its environment.
- Breathing is simply a mechanical process. Breathing causes air containing a high concentration of oxygen to enter the lungs and cause air containing a high concentration of carbon dioxide to leave the lungs.

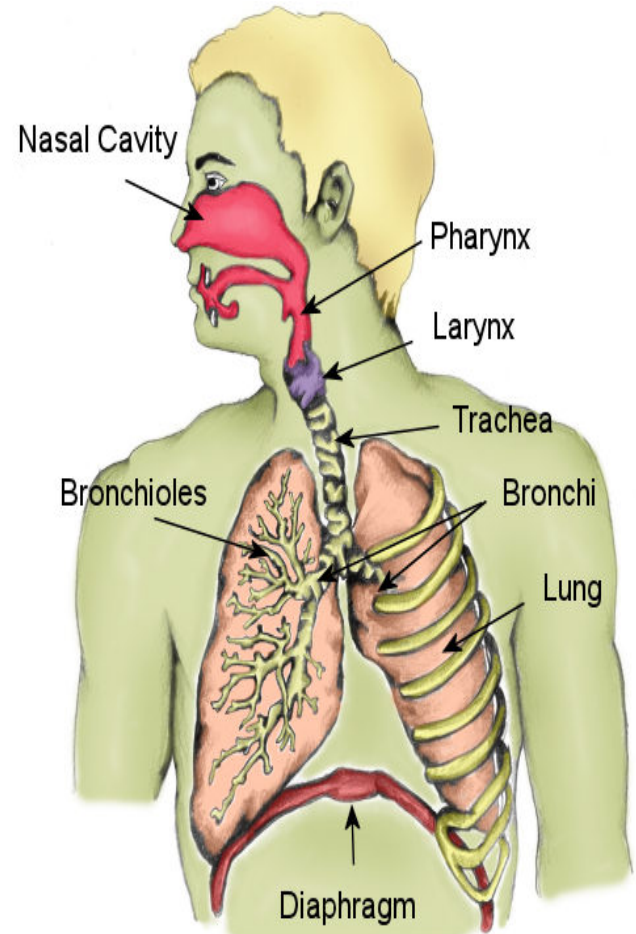
# Cellular Respiration vs. Breathing





# The Human Respiratory or Gas Exchange System

- Nose to the lungs
- The *upper respiratory tract* consists of (1) the *nose* or nasal passages and (2) the *pharynx*, or throat.
- The *lower respiratory tract* includes (3) the *larynx*, or voice box; (4) the *trachea*, or windpipe, which splits into two main branches called *bronchi*; tiny branches of the **bronchi** called *bronchioles*; and (5) the *lungs*, a pair of saclike, spongy organs.



# Upper Respiratory Tract

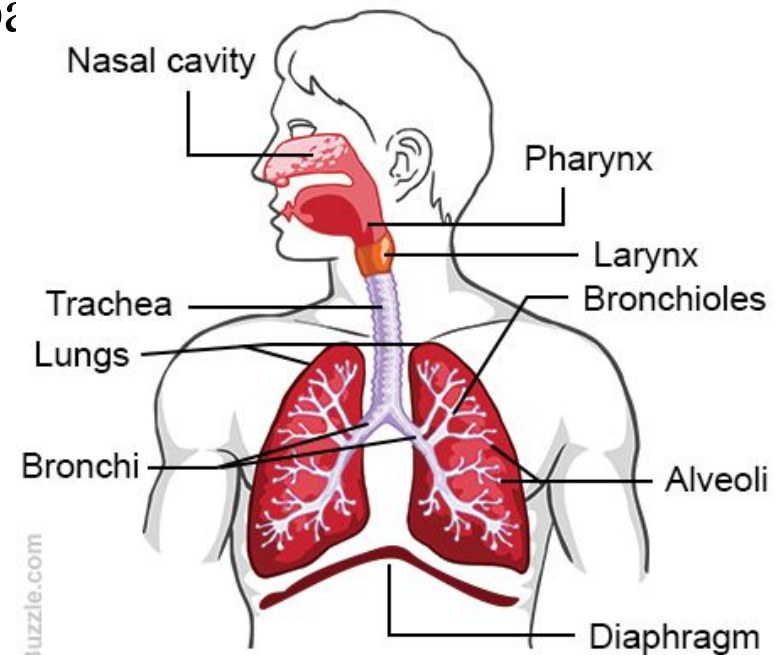
## 1. *Nasal Passages*

The uppermost portion of the human respiratory system, the nose is a hollow air passage that functions in breathing and in the sense of smell.

The nasal cavity moistens and warms incoming air, while small hairs and mucus filter out harmful pathogens and microorganisms.

## 2. *Pharynx*

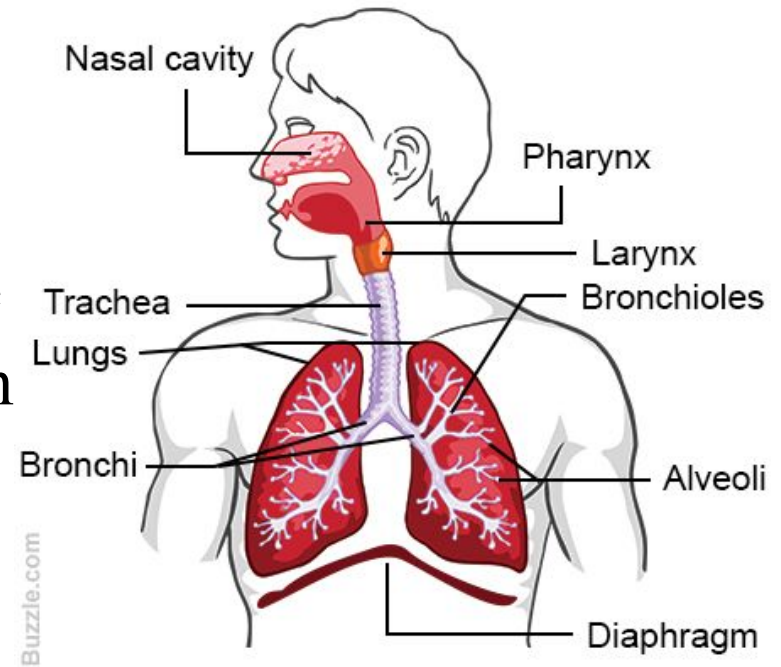
Air leaves the nasal passages and flows to the pharynx, a short, funnel-shaped tube about 13 cm (5 in) long that transports air to the larynx.



# Lower Respiratory Tract

## 3. *Larynx*

Air moves from the pharynx to the larynx, a structure about 5 cm (2 in) long located approximately in the middle of the neck.



## 4. *Trachea, Bronchi, and Bronchioles*

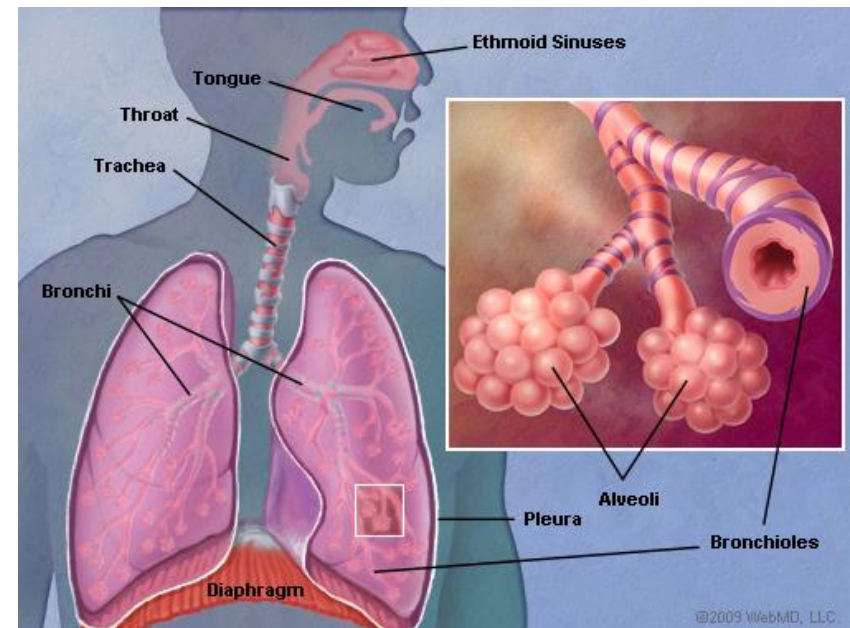
Air passes from the larynx into the trachea, a tube about 12 to 15 cm (about 5 to 6 in) long located just below the larynx. The trachea branches into two tubes, the *left and right bronchi*, which deliver air to the left and right lungs, respectively. Within the lungs, the bronchi branch into smaller tubes called *bronchioles*.

# Lower Respiratory Tract

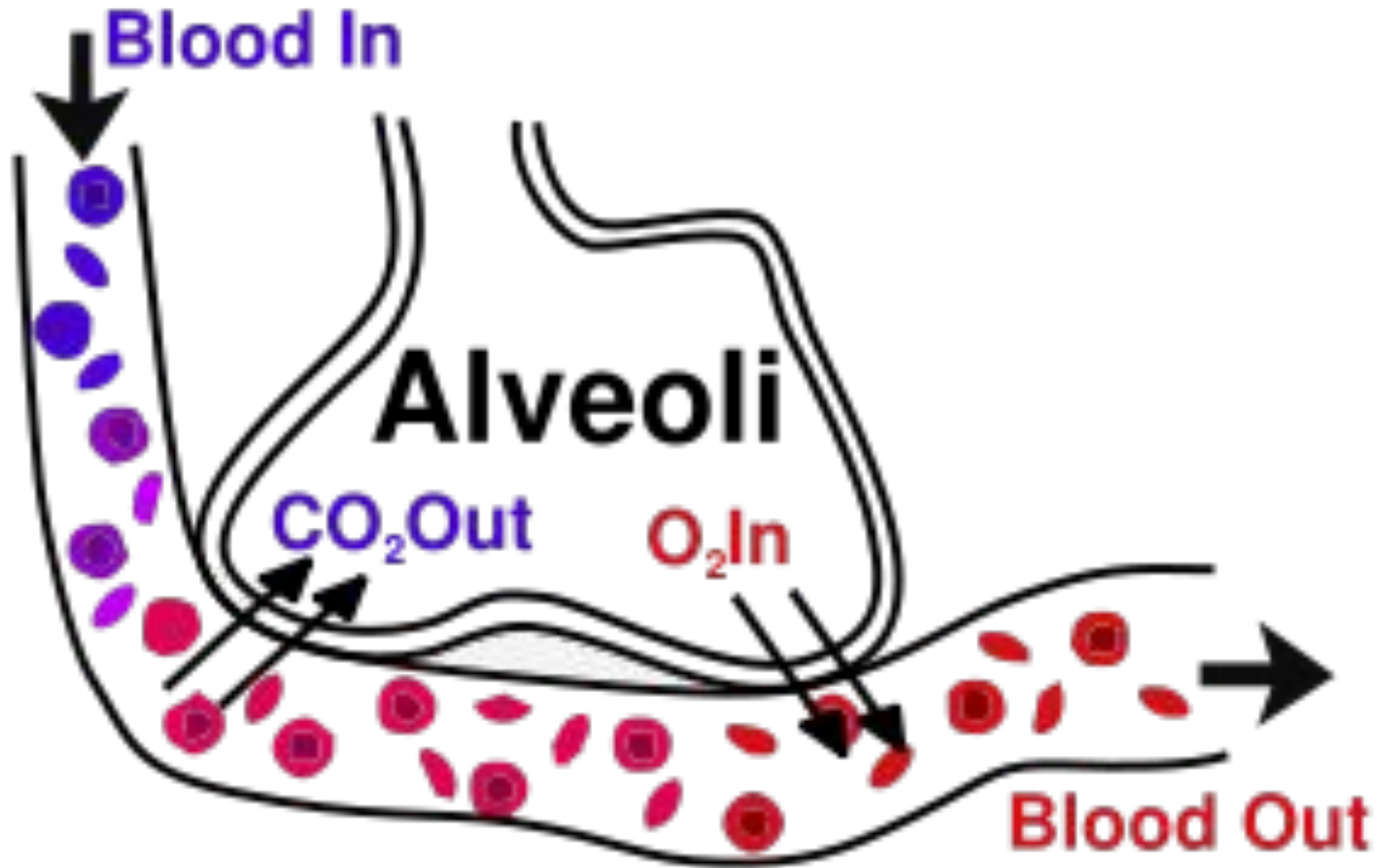
## 5. *Lungs*

The two branches of the trachea, called *bronchi*, subdivide within the lobes into smaller and smaller air vessels. They terminate in *alveoli*, tiny air sacs surrounded by capillaries.

When the alveoli inflate with inhaled air, oxygen diffuses into the blood in the capillaries to be pumped by the heart to the tissues of the body, and carbon dioxide diffuses out of the blood into the lungs, where it is exhaled.

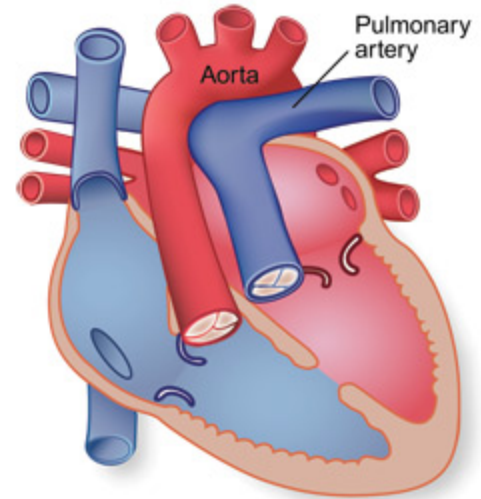


# Gas Exchange in Lungs



# Gas Exchange in Lungs

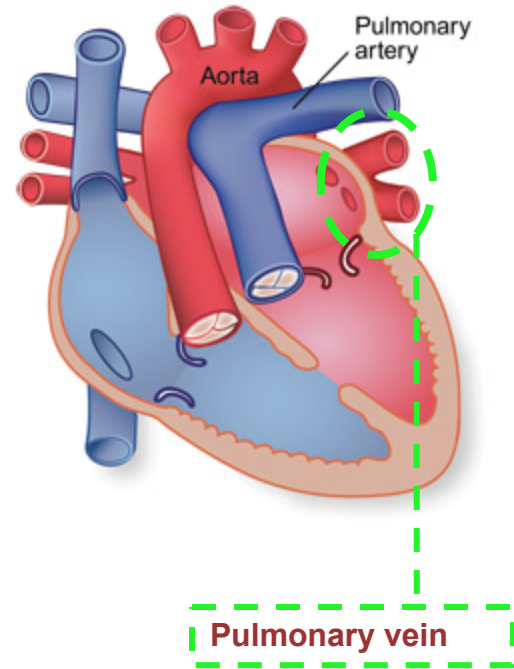
- **Deoxygenated blood poor in oxygen and rich in carbon dioxide** is pumped by the heart into the capillary surrounding the airspace of an alveolus.
- Fresh air contains only 0.034% carbon dioxide, which is a lower concentration than that in the blood.
- Since inside of the alveolus has lower concentration of carbon dioxide, it diffuses into the airspace and is exhaled out.





# Gas Exchange in Lungs

- Fresh inhaled air in the airspace contains about 21% oxygen. This is a very high concentration compared to what is in the blood.
- Therefore, oxygen molecules diffuse from the airspace into the blood stream through the thin lining of the alveolus.
- The now *bright red, oxygen-rich blood* moves through the capillary into the pulmonary vein and back to the heart.
- At the same time that oxygen diffusion is occurring, carbon dioxide is diffusing from the blood into the air space of the alveolus.



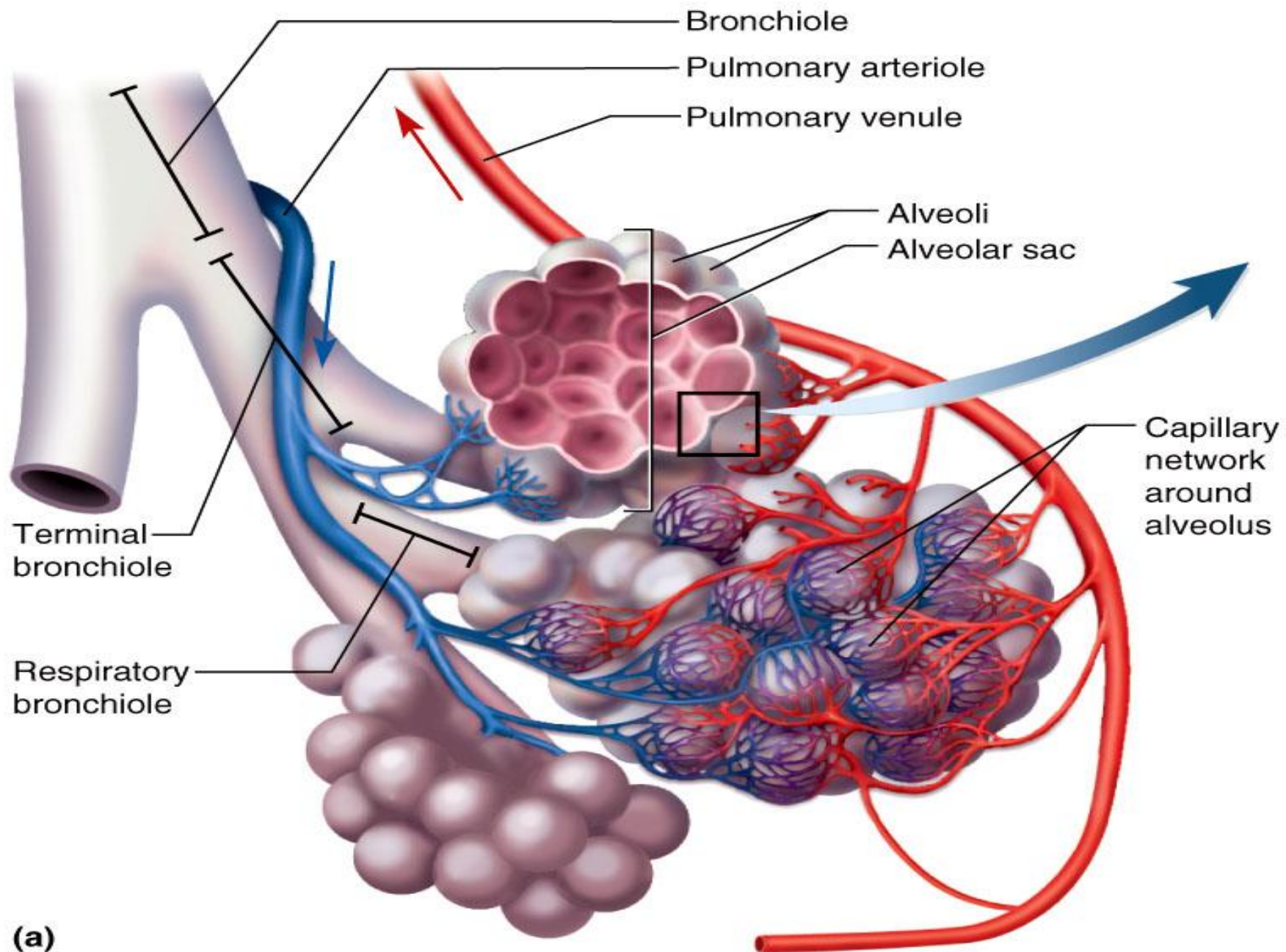
# Gas Exchange in Lungs

- If you hold your breath you can stop the diffusion;

***Table: Effect of gas exchange on the air we breathe***

	Percent Oxygen	Percent Carbon dioxide	Percent Water
Inhaled air	21	0.034	1
Exhaled air	16	4	6





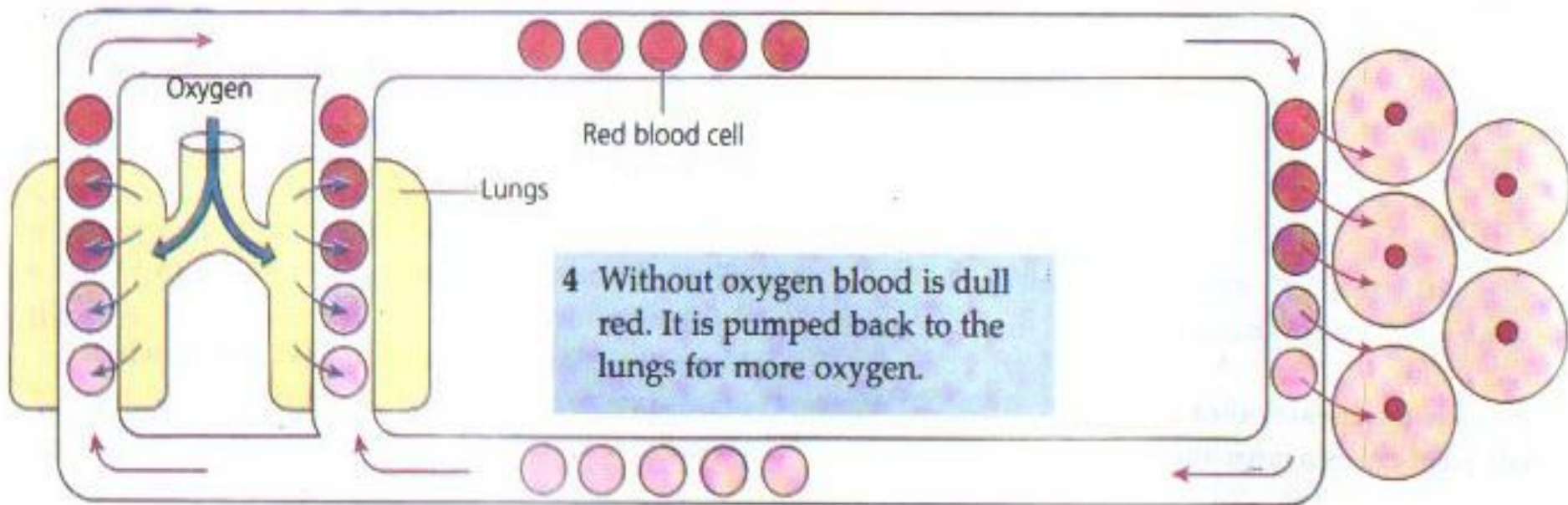
# How tissue gets oxygen and release carbon dioxide

## How Red blood Cells carry oxygen :

1 The red cells pick up oxygen as blood is pumped through the lungs.

2 The oxygen and haemoglobin join to form oxyhaemoglobin. This is bright red.

3 As the blood passes around the body, the oxyhaemoglobin breaks down and releases oxygen to the body cells.



# Excretory System

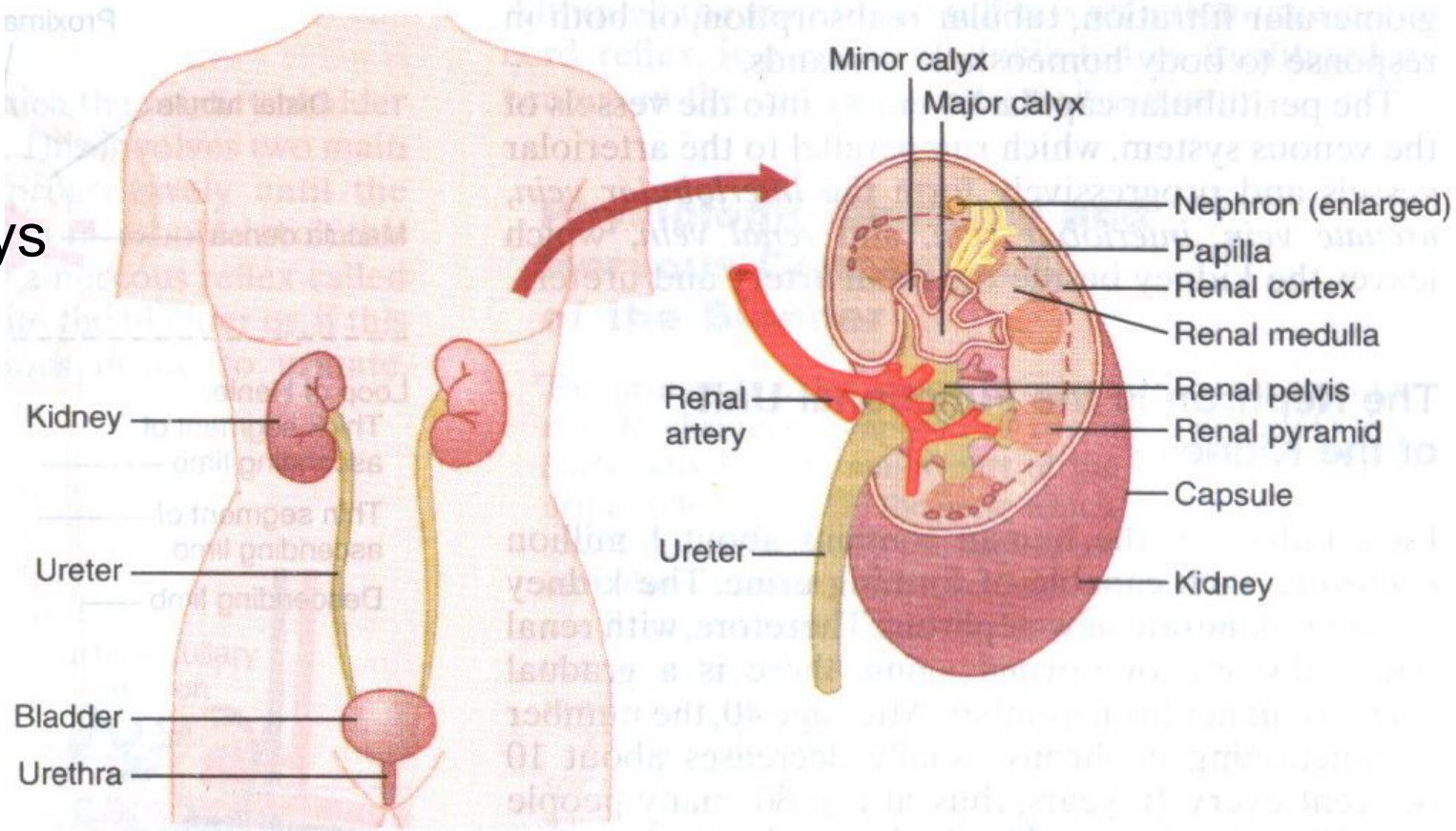
- Kidneys are the **excretory organ** of our body. These are the **major component of urinary system**.
- Urinary system includes
  - (i) **Kidneys**...formation of urine
  - (ii) **Ureters**...transport of urine from kidneys to urinary bladder
  - (iii) **Urinary bladder**...reservoir of urine
  - (iv) **urethra**...passage of urine from urinary bladder to outside



# Kidney Structure

Each kidney contains about one million **Nephrones** which are the structural & functional unit of kidneys.

**Figure –**  
General  
organization  
of the kidneys  
and the  
urinary  
system



# Functions of kidneys

- Excretion of excess unnecessary substances & metabolic waste products
- Osmoregulation
- Regulation of
  - (i) water & electrolyte balances
  - (ii) acid-base balances
  - (iii) blood pressure
  - (iv) red cell production

*Osmoregulation is the process by which cells and simple organisms maintain fluid and electrolyte balance with their surroundings.*

# How kidneys clean blood

- Kidneys clean blood by filtering it. They filter all our blood 300 times a day. The filtering is done by over a million tubes packed into each kidney. These tubes are called **nephrons**.
- Some people's kidneys are not very good at filtering blood. Kidney machines help by filtering blood for them.

Thanks!