

**SANGAM SKM COLLEGE – NADI**  
**LESSON NOTES – WEEK 1**  
**YEAR 11**  
**BIOLOGY**

*Strand 1: Structure And Life Process - Sub strand 1.6: Structure, Form and Function in Animals*

Learning Outcomes

- Examine and describe the structure and function of the respiratory system of humans.
- Investigate the disorders that relate to the respiratory system.

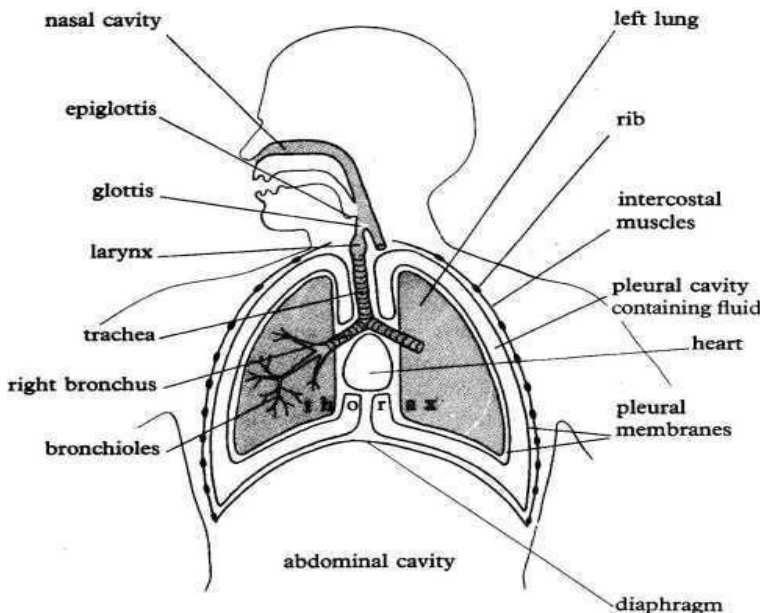
GAS EXCHANGE AND THE RESPIRATORY SYSTEM

Three processes take place in this system:

1. Breathing
2. Gaseous exchange
3. Cellular respiration

The Human Respiratory System/ Gas Exchange System

- Enables body to move oxygen into and carbon dioxide out of the body by the process of breathing.



Pathway of Air Flow

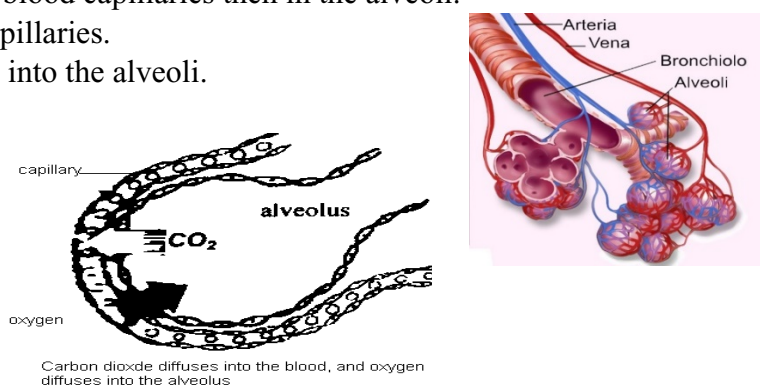
- Air flows in through the nose and the mouth.
- Small hairs in the nose trap dust and germs.
- It passes the epiglottis and down the trachea or the windpipe.
- Cilia and mucus line the trachea walls. They trap dust, bacteria, and other bits and pieces that you don't want in your cilia sweep the mucus with the pieces stuck in it back up towards your mouth and nose.
- Air passes into the two bronchi then flows into the bronchioles (small tubes that branch off the bronchi).
- From the bronchioles air enters the alveoli
- Each alveolus is covered with blood capillaries.
- The concentration of the oxygen is high in

the alveoli then in the blood capillaries.

- The concentration of carbon dioxide is high in the blood capillaries then in the alveoli.
- Oxygen diffuses from the alveoli into the blood capillaries.
- Carbon dioxide diffuses from the blood capillaries into the alveoli.

Adaptations of a Gas Exchange Surface

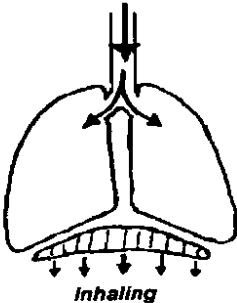
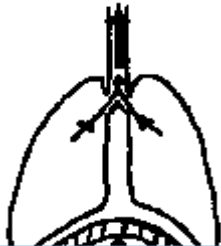
1. *GE surfaces are kept moist.*  
This dissolves the gasses, allowing them to diffuse more quickly across the alveoli and capillary walls.
2. *Have a large surface area.*  
Many alveoli sacs to maximize diffusion of gases.
3. *Walls are thin or 1 cell thick.*



To allow the diffusion to happen quickly.

### Breathing

- Taking air in and out of the lungs.

Inhaling	Exhaling
<ul style="list-style-type: none"> <li>• Taking air into the lungs.</li> <li>➤ Diaphragm muscle contracts, flattening beneath the lungs.</li> <li>➤ Volume of the chest cavity increases, lowering the air pressure.</li> <li>➤ Air rushes in from outside to equalize the pressure.</li> </ul> 	<ul style="list-style-type: none"> <li>• Taking air out of the lungs.</li> <li>➤ Diaphragm relaxes pushing up against the lungs.</li> <li>➤ Reduces the volume of the chest, increasing the air pressure.</li> <li>➤ Air rushes out to equalize the pressure.</li> </ul> 
<ul style="list-style-type: none"> <li>• Not all of the inhaled oxygen can diffuse into the blood from the lungs, nor can all of the carbon dioxide diffuse out. These gases diffuse until the blood and alveoli-air concentrations are the same. Thus exhaled air contains some oxygen and the blood always contains some carbons dioxide.</li> </ul>	

### Making Sounds

To make sound you must force exhaled air through the vocal cords at the top of the trachea. The moving air vibrates the cords, like strings played on a guitar.

## **RESPIRATION AND HOMEOSTASIS**

- Without oxygen cells cannot perform the respiration reaction to release energy
- The nervous system and the hormones adjust the rate of contraction of the heart and the diaphragm to keep the blood concentration of oxygen and carbon dioxide stable.

### **Gas Exchange in Other Vertebrates**

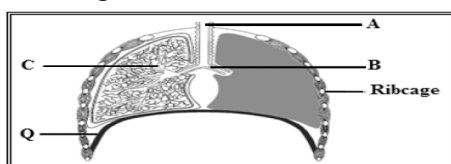
1. Fish- gills
2. Amphibians- e.g. toads
  - Tadpoles- gills
  - Adult- lungs, skin

### **Malfuncions of Respiration**

- |                               |              |                |
|-------------------------------|--------------|----------------|
| ○ Asthma                      | ○ Bronchitis | ○ Tuberculosis |
| ○ Lung cancer                 | ○ Emphysema  | ○ Laryngitis   |
| Whooping Cough<br>(Pertussis) | ○ Hay fever  | ○ Pneumonia    |
|                               | ○ Influenza  | ○ Covid-19     |
- ❖ *Research on theses malfuncions and make short notes.*

### **Exercise**

The diagram shows the hum



A lung

- Label the parts A, B and C.
- Give one function of the ribcage.
-

If the chest cavity is punctured during a road accident, suggest how the wound would affect the

functioning of the lungs.

iv. Describe the role of Q when breathing in

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**LESSON NOTES – WEEK 2**  
**YEAR 11**  
**BIOLOGY**

<b>Strand 1</b>	Structure And Life Process
Sub strand 1.6	Structure, Form and Function in Animals
Content Learning Outcome	B.11.1.6.1 Explore and study the different organ systems and account for their functional adaptive features.

**EXCRETION AND THE URINARY SYSTEM**

Serves two functions:      1. Excretion                              2. Osmoregulation

- ❖ *Excretion* – getting rid of metabolic waste products such as carbon dioxide and nitrogenous wastes (ammonia, urea, uric acid).
- ❖ *Osmoregulation*– regulation of the balance of water and solutes in the body.

Human excretory system consists of:

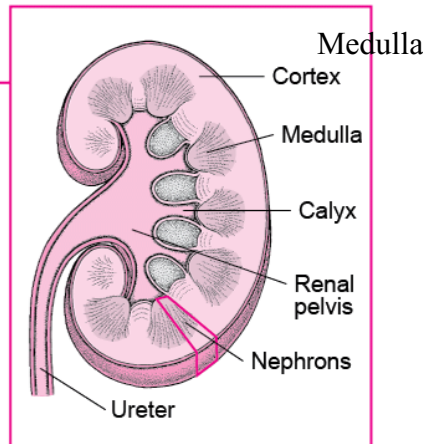
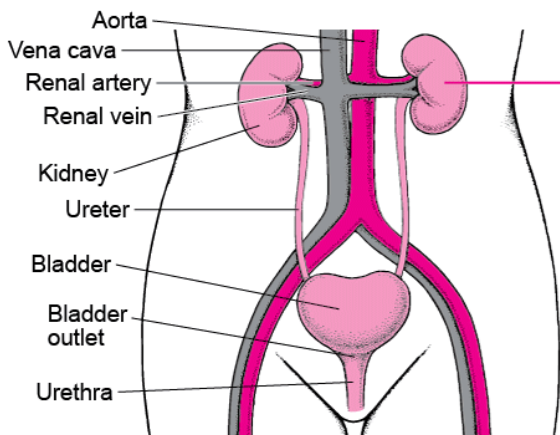
- A pair of kidneys
  - Located in the back of abdomen
  - 2 kidneys present, one on either side of the backbone
  - Bean-shaped
  - Notch on the inner concave side called '**Hilum**'
- A pair of ureters
  - Slender tubes arising from Hilum of Kidney
  - Opens into urinary bladder
- Urinary bladder
  - Pear shaped
  - Muscular reservoir of urine
  - Opens into Urethra
- Urethra
  - Longer in males than in females

**Structure of Kidney**

Average weight of approx. 120- 170 grams.

Important structures in a kidney are as follows:

- Hilum
  - Ureter, blood vessels & nerves enter the kidney here
- Renal pelvis
  - Receives urine from kidney nephrons
- Calyx
  - Small hollow tubes to collect urine
- Renal capsule
  - Fibrous & transparent thin layer
  - protects inner soft tissues
  - Provides shape to the kidneys
- Zones of kidney:
  - Cortex
    - Smooth outer zone, reddish in color
    - is the protective portion
  - Medulla
    - Striated inner zone, reddish-brown in color
    - Contains nephrons



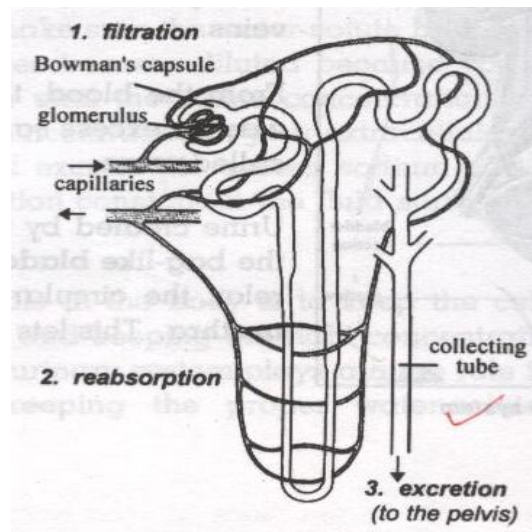
**\*\*When the bladder is full, you relax the circular sphincter muscle between the bladder and urethra which lets the urine flows out.**

## Micturition

Micturition is the release of urine from urinary bladder through urethra. It is also termed as 'Urination'. This occurs involuntarily in children up to 4-5 years; thereafter regulated voluntarily.

## Nephron

- Are tiny filtering units found in the medulla section of the kidney
- Each nephron acts as a microfilter
- Each nephron consists of 2 parts:
  1. Glomerulus
    - Network of very thin-walled blood capillaries
  2. Renal tubule
    - Contains the Bowman's capsule - Double-walled epithelial cup-shaped structure that encloses Glomerulus
- Blood is brought to the kidney in the **renal artery**. The kidneys filter the blood and then reabsorb useful materials such as **glucose**. After it has been purified, the blood returns to the circulation through the **renal vein**.



## **Excretion involves three processes:**

### **i.) Filtration**

### **ii.) Reabsorption**

### **iii.) Excretion**

#### *i.) Filtration*

- Occurs in the glomerulus (knot of capillaries) surrounded by *Bowman's capsule*.
- Small molecules such as glucose, water, urea and salts diffuse into the *Bowman's capsule* (larger molecules such as blood proteins and blood cells cannot pass through).
- Filtration occurs through simple diffusion.

#### *ii.) Reabsorption*

- Occurs in the nephron tubules or loop of henle.
- The tube is surrounded by blood capillaries which reabsorb all of the glucose, most of the water, and any other solutes needed by the body.
- The amount of water absorbed depends upon the amount of wastes in the body & the amount of excess water in the body.
- Is an example of an active transport which requires energy i.e. absorption takes place against the concentration gradient.

#### *iii.) Excretion*

- Left over urine solution of nitrogenous wastes (urea), water and salts are excreted.
- From nephron, urine drips into the collecting tubules, collected in the pelvis and flows into the bladder.

## Exercise

1. Fill in the table below with the substance that are filtered out into the nephron?

	Filtered out of blood	Reabsorbed by blood	Excreted

Substances			
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2. What other organ system apart from the urinary system has a major role in excretion.
3. Define the term osmoregulation and explain why it is so important.

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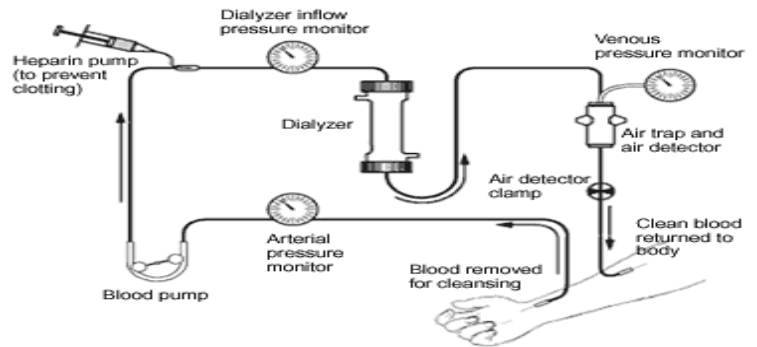
**EXCRETION cont'd**

**Diabetes and Kidney Failure**

- ❖ Blood in the kidney reabsorbs all the glucose from the filtrate. But in a diabetic person, it is forced to excrete glucose because of high glucose level in the blood.
- ❖ This leads to kidney failure.
- ❖ A dialysis machine is used by people with kidney failure, which acts as their kidney.

**Advantage:** allows the person to live for a longer time.

**Disadvantage:** it is so expensive, inconvenient, works by machine so problem would arise in case there is a power cut.

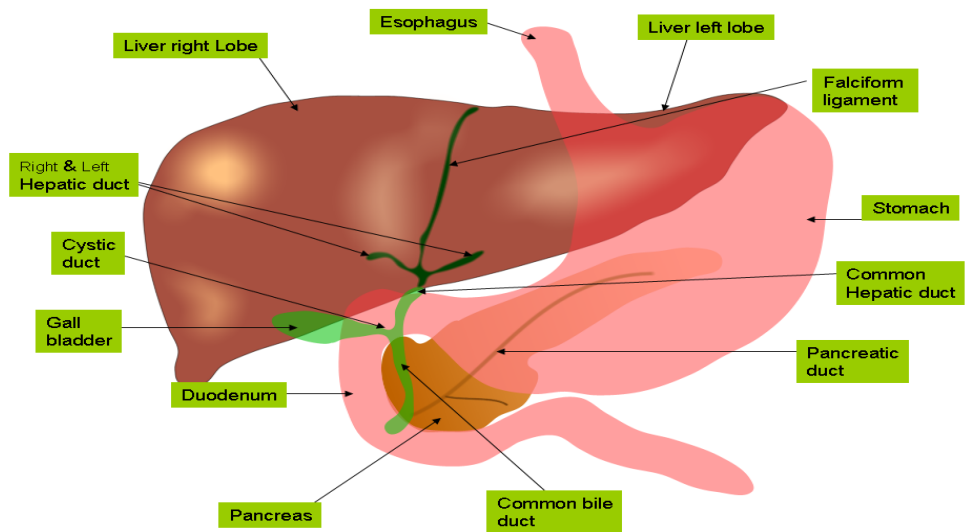


**Liver and Homeostasis**

Liver is the largest organ which has many roles to maintain homeostasis.

**Roles of the Liver**

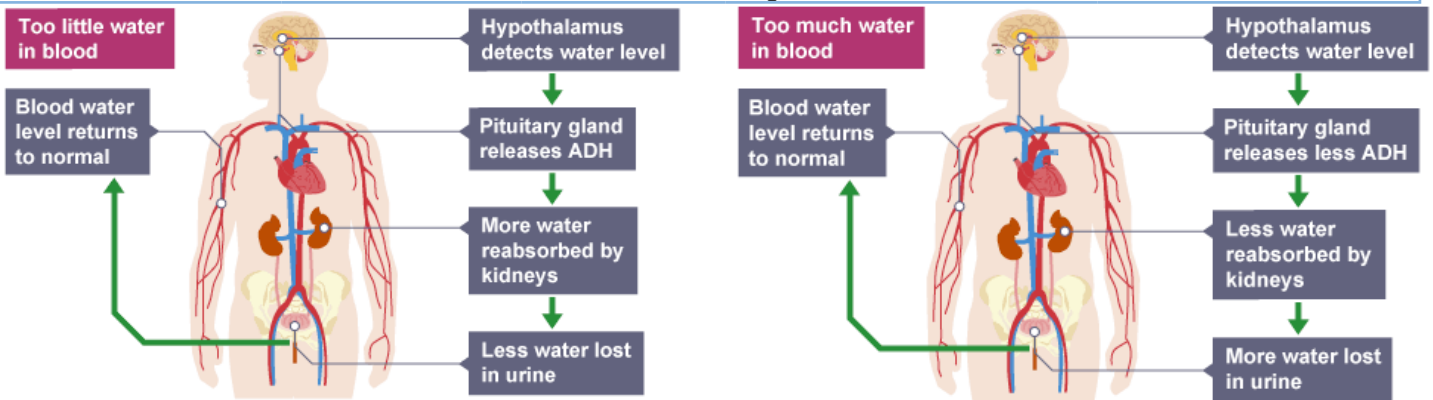
- i.) Poison removal.
- ii.) Regulation of the blood sugar level.
- iii.) Breaking down excess amino acids (deamination).
- iv.) Vitamin and mineral storage.
- v.) Making bile.
- vi.) Making some hormones
- vii.) Breakdown of old red blood cells.
- viii.) Heating the blood.



## ADH

The water content of the blood is controlled by a hormone called ADH (anti-diuretic hormone). Different amounts of ADH are released into the bloodstream according to the concentration of the *blood plasma*.

Plasma	Problem	ADH release	Effect of ADH	Effect on urine
High concentration	Too little water	Increases	More water reabsorbed by nephrons	More concentrated
Low concentration	Too much water	Decreases	Less water reabsorbed by nephrons	More dilute



## Malfunctions and disorders of the excretory system

### 1. Kidney stones (nephrolithiasis or Renal calculi)

- A small, hard deposit that forms in the kidney from minerals in urine and is often painful when passed.
- Common symptom is severe pain, usually in the side of the abdomen, often associated with nausea.
- Treatment includes pain relievers and drinking lots of water to help pass the stone.
- Medical procedures may be needed to remove or break up larger stones.

### 2. Nephritis

- Is inflammation of the kidneys and may involve the glomeruli, tubules, or intestinal tissues surrounding the glomeruli and tubules.
- Caused by infection, and toxins or autoimmune disorders that affect the major organs.
- One of the first focuses of therapy is to control high blood pressure. Blood pressure may be very hard to control when your kidneys are malfunctioning.

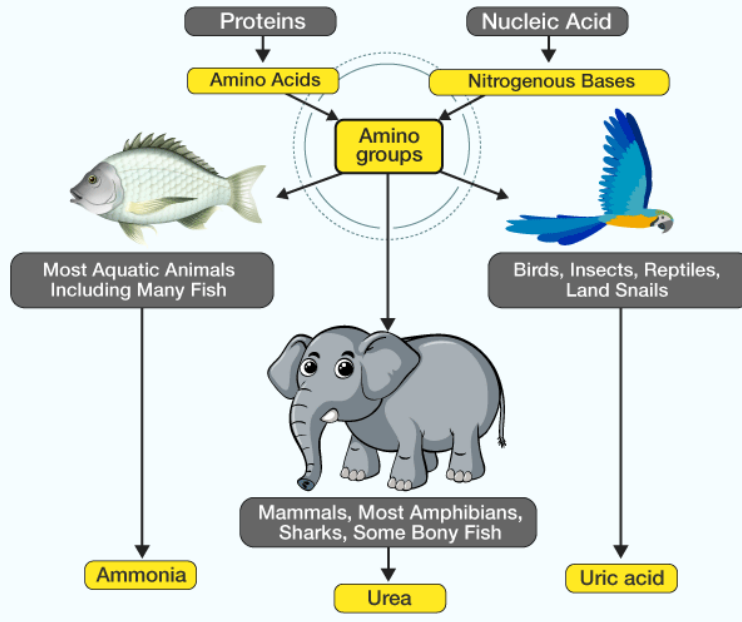
### 3. Uremia

- Urine in blood.
- Cause: Urea & wastes accumulate in the body.
- Symptoms: Nausea, vomiting, weight loss, shortness of breath, irregular heartbeat.

### 4. Kidney failures

- Cause: Kidney stops functioning which results in wastes accumulation.
- Symptoms: Shortness of breath, chest pain, headache, weakness etc.
- Acute Kidney failures can be corrected by Kidney transplant.





**Exercise**

1. The \_\_\_\_\_ is a tuft of capillaries that forms the filtrate.
2. What structure in the kidney is responsible for urine formation?
3. Define the process of deamination. Explain its importance in the body.