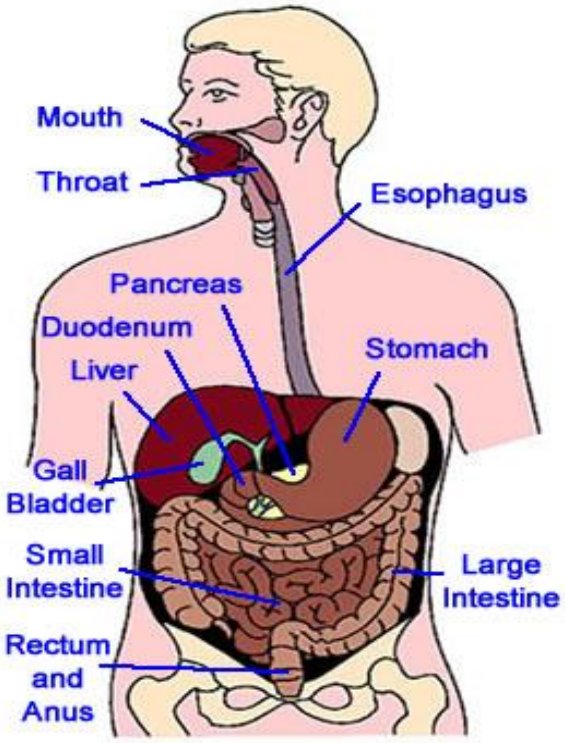
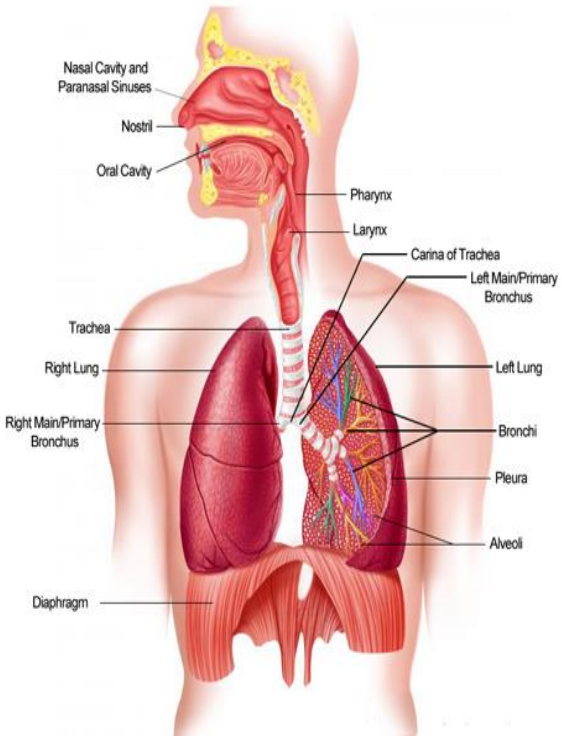
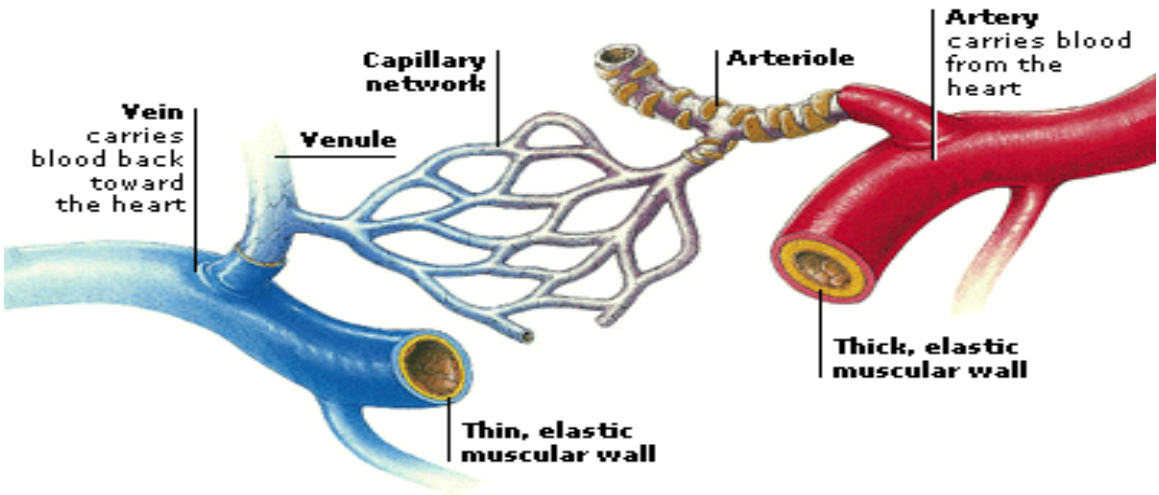
# Etege Menen Girl's boarding secondary school

# Biology handout

# Grade 9




**By; G..T.**

**2012 E.C.**

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# Unit 1
# Biology and technology

## 1.1 Renowned Ethiopian biologists

- Biology is the study of life and living organisms.
- Biologists study both the outer appearance and the internal workings of living things.
- All biological knowledge comes by the work of biologists, scientists who study living organisms.
- **Hypothesis** an idea or statement that explains observed facts and predicts new outcomes
- **Journal** a regular publication presenting articles on a particular subject
- **Peer review** evaluation of a person's work done by others in the same field
- Some of the most important renowned Ethiopia biologists are listed below;

1) **Dr Aklilu Lemma and the battle against bilharzias (schistosomiasis)**
   - Discover endod that can kill snail (secondary host of blood fluke)
2) **Dr Tewolde Berhan Gebre Egziabher, an ardent lover of nature**
   - Safeguard biodiversity and genetic resource
   - environmental protection and diversity
3) **Professor Tilahun Yilma and his vaccines**
   - Develop vaccine to get rid of cattle disease called **rinderpest**.
   - Work on HIV/AIDS vaccines using genetic engineering
4) **Professor Yalemtsehay Mekonnen:** the first female professor in AAU
   - Worked the assessment of the impact of chemical pesticide hazard on humans. And
   - The importance medicinal plants against human and animal diseases
5) **Dr Melaku worede**
   - Worked to save the genetic diversity of Ethiopia's domestic plants.
6) **Dr Gebissa Ejeta**
   - Develop Africa's first commercial hybrid new strain of sorghum, which is resistant to drought.
7) **Professor Legesse Negash**
   - Research in the conservation of indigenous plant propagation and biodiversity development in Ethiopia
8) **Professor Beyene Petros**
   - A biomedical scientist and long serving professor at Addis Ababa University
9) **Dr Zeresenay Alemseged**
   - Discovered 3.3 million-year-old human old child fossil in 2006.
10) **Dr Tsehaynesh Meselle**
   - Director General of the Ethiopian Health and Nutrition Research Institute (EHNRI)
11) **Dr Berhane Asfaw**
   - An Ethiopian scientist whose team discovered two 160 000-year-old human skulls
12) **Professor Mogessie Ashenafi**
   - Works at the University of Addis Ababa and leads international research into food microbiology.
13) **Professor Ensermu Kelbessa**
   - Is one of the leading systematic botanists who has discovered and named many new plant

## 1.2 BIOLOGICAL RESEARCH IN ETHIOPIA

Some of the institutions that play an important part in biological research in Ethiopia**;**

**1) Addis Ababa University (AAU) Biology Department**

- **Mainly involved in;**
  - Food quality and quantity improvement
  - Conservation of natural resources
  - Disease and vector control

**2) Armauer Hansen Research institute (AHRI)**

- AHRI was first set up in 1969, carried out research only into leprosy.
- However, since 1996 AHRI has widened its research into tuberculosis **(TB**), **leishmaniasis, malaria** and **HIV/AIDS**, as well as leprosy.

**3) Aklilu Lemma institute of Pathobiology (ALIPB)**

- ALIPB carries out research in five major areas;.
  - Major infectious diseases,
  - Vectors of diseases and how to control them,
  - Human parasitic diseases
  - Animal health and disease.
  - Research on Endod and other plants as source of medicine

**4) Ethiopian institute of Agricultural Research (EIAR) also known as.**
**Institute of Agricultural Research (IAR)**

- There are five main areas of research.
  - working on crop technology have improved crops like maize, teff and sorghum
  - improving the health of livestock
  - improving the fertility of the soil
  - Forestry
  - mechanizing farming

**5) The Institute of Biodiversity Conservation (IBC)**

- Biodiversity – the verities of living organisms in an area.

Mainly involved in;

- The conservation of plants, animals and micro-organisms in Ethiopia.
- Research into the management of the ecosystem such as
  - Forest and aquatic plants
  - medicinal plants
  - animal genetic resources
  - biotechnology and safety,
  - Ecosystem conservation.
- It holds one gene banks in the whole of Africa with over 300 plant species
- Preservations of gene of Ethiopian domestic plant.

# UNIT 2
## CELL BIOLOGY

## 2.1. THE MICROSCOPE

☞ Is an instrument that helps to observe very small organisms, cell and their cell components

Two major ability of microscope

❖ **Magnification**
- ➢ Increase the size of an object
- ➢ The best light microscope magnify up to 2000 times
- ➢ An electron microscope magnify up to 2 000 000 times

❖ **Resolution**
- ➢ The ability to distinguish between two separate points
- ➢ The measure of how much detail the microscope can show is called **resolving power**
- ➢ The greater the resolving power of the microscope, the more detail it can show
- ➢ The resolving power and the wave length are inversely proportional
- ➢ The higher the wave length the smaller resolving power
- ➢ The electron microscope has higher resoling power then light microscope

### Type of microscope

**1) Light microscope**

❖ Use a beam of light to form an image
❖ Relatively less magnification and resolution power
❖ Due to its low resolution power light microscope is not used to see cellular organelle such as ribosome, mitochondria, chloroplast, endoplasmic reticulum
❖ Used to study cell, tissues or individual organism
❖ Used to study living material directly through light microscope
❖ Mounting and staining is the basic techniques using the light microscope
☞ **Mounting** is a techniques of preparing an object or specimen to be seen under microscope
☞ **Staining** is a method of adding pigment chemicals to slid tissue to make cells or their parts easier to see

| Type of stain | Type of cell | Main organelles stained |
|---|---|---|
| ❖ **Haematoxyline** | ❖ Animal and plant cell | ❖ Nuclei stained blue/ purple or brown |
| ❖ **Methylene blue** | ❖ Animal cell | ❖ Nuclei stained blue |
| ❖ **Acetoceramine** | ❖ Animal and plant cell | ❖ Staining the chromosomes |
| ❖ **Iodine** | ❖ plant cell | ❖ Any material Containing starch |

☞ Total magnification of light microscope is the product of an eye piece / ocular/ and objective lens

| Total magnification= | magnification power of Eye piece × | magnification power of objective lens |
|---|---|---|

### Advantage of light microscope

❖ It help to study living things
❖ It is relatively cheap
❖ Easy to move from place to place and Do depend on electric source

**Disadvantage of light microscope**

- ❖ It has limited magnification and resolution power

**2) The Electron microscope**

- ❖ Use a beam of electron
- ❖ It has highest magnification and resolution power
- ❖ Its maximum magnification power is 2,000,000
- ❖ Resolving power of an electron microscope is 1000 times greater than the resolving power of light microscope

☞ **Advantage of electron microscope**

- ❖ It has high magnification and resolution power
- ❖ Used to see three dimensional structure of specimen e.g. .scanning electron microscope
- ❖ Transmission electron microscope used to show the detail structure of microscope

☞ **Disadvantage electron of microscope**

- ❖ Do not use to study living things
- ❖ It very expensive
- ❖ Depend on electric source
- ❖ It is not easy to move from place to place

## 2.2. THE CELL

- ❖ All living organisms are made unit called **Cell**
- ❖ **Cell** are the basic structural and functional units in all living organism
- ❖ Some organisms like bacteria and protozoa are composed of a single cell and are called **unicellular organism**
- ❖ Plant, animal, fungi composed of many cell are called **multicellular organism**
- ❖ There are seven lifer process that are common to most living things
  1. **Nutrition;** food substance need by the body
  2. **Respiration;** the process by which living organism get the energy from the food we eat
  3. **Excretion;** getting rid metabolic west product produced by cell
  4. **Growth;** increase the size and mass of an organism
  5. **Irritability;** sensitivity of an organism to changes in an organism
  6. **Movement;** the need to get near to or away from things
  7. **Reproduction;** the production of offspring to ensure the survival of a type of organism

☞ **Cell theory**

- ❖ Cell were first by discovered by English scientist called **Robert Hook**
- ❖ Matthias Schledian and Theondoer Schwann introduce the idea of **cell theory**
- ❖ Cell theory states that cell are the basic unit of life

**Type of cell**

- ☞ Prokaryotic cell
- ☞ Eukaryotic cell

**Prokaryotic cells**

- ❖ Smaller cells
- ❖ Smaller ribosomes
- ❖ Lack distinct nuclei and membrane bounded organelle
- ❖ Nuclear material not enclosed by membrane
- ❖ No membrane bounded cellular organelle
- ❖ Do not have chromosome because DNA do not have protein histone
- ❖ Have cell wall but chemically different from eukaryotic cell
- ❖ E.g. bacteria and blue green algae

**Eukaryotic cell**

- ❖ Larger cells
- ❖ Larger ribosomes
- ❖ Have true nucleus bounded by membrane
- ❖ Have many membrane bounded organelle
- ❖ Have chromosome , DNA has protein histone
- ❖ Found in all organism **except** bacteria and blue green algae

☞ **Eukaryotic cell structure and function**

- ❖ Almost all eukaryotic cell have three Major parts
  - ➢ Nucleus
  - ➢ Cell membrane
  - ➢ Cytoplasm

**1) The nucleus**

- ❖ Control all activities of cell
- ❖ Contains instruction for making a new cell Known as **chromosome or genetic material**

**2) Cell membrane**

- ❖ Forms a barrier between the cell and outside the cell
- ❖ Semi/ partially/selectively/ permeable membrane
- ❖ Control the movement of substance in and out of the cell
- ❖ Substance that cross the cell membrane are carbon dioxide, oxygen, water
- ❖ Made up of protein and lipid bilayer, it is called **lipo-protein layer**

**3) The Cytoplasm**

- ❖ Internal structure of the cell outside the nucleus
- ❖ A liquid gel in which in most of the chemical reaction for life take place
- ❖ The cell contain Specialized organelle to perform specific task

**4) Cytoplasmic organelles**

- ❖ Are membrane bounded Structure in a cell
- ❖ Examples the nucleus other organelles are found in the cytoplasm
- ❖ Specialized to perform specific task because they have specific enzymes
- ❖ Some of very important organelles are listed below;

**I. Mitochondria**

- ❖ The power house of the cell
- ❖ They carry out the reactions of respiration
- ❖ Energy is released from then food we eat for cellular activities

**II. Endoplasmic reticulum(ER)**

- ❖ Three dimensional system of tubules
- ❖ It links the nucleus with the cell membrane
- ❖ Two forms of endoplasmic reticulum

**Rough ER**

- ➢ Have ribosome on its membrane surface
- ➢ Involved in protein transport synthesized by ribosome

**Smooth E.R**

- ➢ Has no ribosome on its surface
- ➢ Concerned with lipid synthesis, carbohydrate metabolism and detoxification

**III. Ribosome**

- ➢ Found on the endoplasmic reticulum and freely in the cytoplasm
- ➢ Responsible for protein synthesis

- ➢ **Organelle found only in plant cells**

**Permanent Vacuole**

- ❖ It is fluid portion and central components of plant cell
- ❖ Filled with a fluid called **cell sap**
- ❖ Help to maintains the turgidity to plant cell

**Chloroplast**

- ❖ Found in all green part of plant cell
- ❖ Contain the green pigment called **chlorophyll**
- ❖ It is the site of photosynthesis

☞ **What are the organelles found only in Animal cells**

**Lysosomes**

- ❖ Contain digestive enzymes that break down cellular waste and debris
- ❖ **Important in**
  1. Digestion of material taken into cell
  2. Digestion of unwanted material
  3. Self-digestion of cell by releasing its enzymes

**Centrioles**

- ➢ Important in cell division in animal cell

☞ **Cell specialization in human**

- ❖ **Undifferentiated cells /unspecialized cells/;** cells that have not yet assumed their final characteristics.
- ❖ **Embryonic stem cell;** Undifferentiated cells in the early embryo that have a potential to form almost other type of cell
- ❖ **Specialized cells /differentiated cell/;** adapted to carry out a particular bodily function
- ❖ Some of specialized cell in humans are;

**1) Epithelial cells;** specialized to perform

- ❖ Protection
- ❖ Diffusion of material
- ❖ Secretion
- ❖ Ciliated epithelial in respiratory used to move microbe away from your lung
- ❖ Ciliated epithelial in female reproductive help to move substance toward the uterus

**2) Reproductive cells (the egg and sperm)**

☞ **Egg**

- ❖ Contain half the number chromosomes found in normal body cells
- ❖ Egg cell have large nucleus contain genetic information from the women
- ❖ Have a protective coat to make sure only one sperm fertilized the egg

☞ **Sperm**

- ❖ Contain half the number chromosomes found in normal body cells
- ❖ Sperm have long tails they can swim towards the egg
- ❖ The middle portion of the sperm contain mitochondria which provide energy for the tail to work
- ❖ They have special as known as **acrosome;** which store digestive enzymes used for breaking down the outer layer of the egg.
- ❖ Have large nucleus contain genetic information

**3) Nerve cell (neurons)**

- ❖ Communication and control system of your body
- ❖ Control and coordination system of the body

**4) Muscle cells**

- ❖ Perform movement in your body

## 2.3. The cell and its environment

- ❖ Exchange of between the cell and its environment takes place in the following major ways
  1. **Diffusion**
  2. **Osmosis**
  3. **Active transport**

## 1. Diffusion

- ❖ Is the net movement of particle from an area of higher concentration to an area of lower concentration
- ❖ A passive movement of substance and depend on concentration gradient
- ❖ Is the random movement of gas or substance
- ❖ Diffusion occur along or toward concentration gradient

**Rate of diffusion**

**Rate of diffusion can be affected by factors like;**

- ☞ **Temperature**
  - ✓ as the temperature rises, the rate of diffusion also increase
- ☞ **Concentration gradient**; the difference in concentration between two area
  - ✓ The bigger the difference in concentration the faster the rate of diffusion

## 2. Osmosis

- ❖ Is the movement of water molecule from an area of high water concentrations to low water concentration across semi permeable membrane
- ❖ Osmosis depend on a concentration gradient of water and a partially permeable membrane
- ❖ Is the movement of water molecule from dilute solution to concentrated solution
- ❖ There are three type of solution depending upon their concentration of solute

**Isotonic solution**

- ❖ The solute concentration of the cell and its surrounding environment are the same
- ❖ There is no net movement of water into and out of the cell

**Hypotonic solution**

- ❖ The solute concentration of surrounding the cell has less solute then the cell
- ❖ The cell gain water and swell up

**Hypertonic solution**

- ❖ The solute concentration outside the cell more concentrated then inside the cell
- ❖ The cell losses water by osmosis

**Osmosis in plant and animal cell**

| Solution | Plant cell | Animal cell |
|---|---|---|
| ☞ **Isotonic** | ➢ There is no net movement of water | ➢ There is no net movement of water |
| ☞ **Hypotonic Dilute or Weak solution** | ➢ The cell gain water and swells<br>➢ The cell becomes **turgid**<br>➢ The cells do not burst. Because the cell wall exerts wall pressure against t**urgor pressure** | ➢ The cell gain water<br>➢ The cell will swell and eventually **burst /hemolysis/** |
| ☞ **Hypertonic Concentrated or strong solution** | ➢ The cell loss water by osmosis<br>➢ The vacuole shrinks and the cell become **flaccid**<br>➢ The cytoplasm pulls away from cell wall known as **plasmolysis** | ➢ The cell loss water by osmosis<br>➢ The cell becomes **shrink** and **shrivel** |

## 3. Active transport

- Allows cell to move substance from an area of low concentration to an area of high concentration
- Substance move against concentration gradient
- Important the cell can absorb ions from dilute solutions
- Use energy from cellular respiration

### ☞ The important of active transport

- Plants can absorb mineral ion needed for making protein. Mineral ions in the soil are usually found in a dilute solution then the plant cell
- Glucose is moved out of the gut and kidney tubule into blood

# UNIT 3
# HUMAN BIOLOGY AND HEALTHY

## 3.1. FOOD AND NUTRITION

☞ **The human diet** is a diet that provide all necessary class of nutrients in adequate amounts
What is food?

- ❖ Food is the source of nutrients and energy for the body.
- ❖ Three main use food in :
  - ➢ To provide energy for cells
  - ➢ Raw materials for growth, repair and replace damaged and worn out cells.
  - ➢ To provide the resources needed to fight disease and maintain a healthy body.
- ❖ There are six main classes of food needed by the body. These are;
  - ➢ Carbohydrates, } macronutrients; needed in a large amounts
  - ➢ Proteins
  - ➢ Fats
  - ➢ Minerals } **micronutrients** ; needed in a small or tiny amounts
  - ➢ Vitamins
  - ➢ Water

**1. Carbohydrates**

- ❖ .Carbohydrates are made up of **carbon, hydrogen and oxygen**.
- ❖ Used as a source of energy for the body
- ❖ liver, muscles and brain stores carbohydrate in the form of **glycogen**
- ❖ Excess carbohydrate converted to fat, which is stored in the body. .
- ❖ Glucose is the sugar made by plants in photosynthesis and it is vital in cells for energy.
- ❖ Carbohydrate-rich foods include injera, fatira. honey, Potatoes, rice and dabo
- ❖ three main types carbohydrates, depending on the complexity of the molecules:
  - ➢ simple sugars,
  - ➢ double sugars
  - ➢ complex sugars

**I. The simple sugars (monosaccharide);** one sugar unit

- ❖ It contains one oxygen and two hydrogen atoms for a single carbon atom present in the molecule. This can be written as a general formula: (**CH2O)n**
- ❖ The common examples of simple sugar are **glucose**, **fructos**e **galactose**;
- ❖ All have the same chemical formula $C_6H_{12}O_6$.but different in structure
- ❖ **Fructose**, the sugar found in fruit and honey

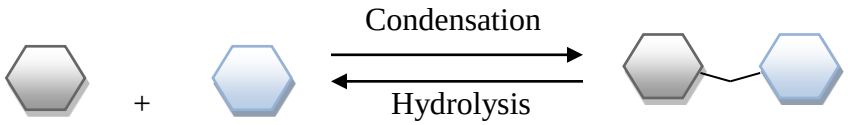
**II. The double sugars (Disaccharide);** two sugar unit

- ❖ Double sugars are made up of two simple sugars joined together by condensation reaction.
- ❖ Condensation reaction joins two simple sugars to form a double sugar, and a molecule of water ($H_2O$) is removed.
- ❖ The bond formed between two simple sugar are **glycosidic bond**

- some of the more common ones double sugars :

| Disaccharide | Source |
|---|---|
| ❖ **Sucrose** (cane sugar) ; Glucose + Fructose | ❖ Stored in plants such as sugar beet and sugar cane |
| ❖ **Lactose** (milk sugar); Glucose + Glucose | ❖ Carbohydrate found in milk |
| ❖ **Maltose**( malt sugar); Glucose+ Glucose | ❖ Found in germinating seed such as barley |

- **Glucose** is a common simple sugar found in all double sugar
- Sweet taste and ability to dissolve in water is common to simple and double sugars




**Glucose + glucose** ⟶ **Maltase**

### III. Complex sugar (polysaccharide)

- Made up of many single sugar units are joined to form a long chain.
- Do not dissolve in water and have no sweet taste
- Form very compact molecules for storing energy.
- physically and chemically very inactive, storing them does not interfere with the other functions of the cell
- Some common example of complex sugar are **starch, glycogen and cellulose**

☞ **Starch**

- Important in energy store in plants.
- The sugars produced by photosynthesis converted to starch.
- plant storage organs such as **potatoes** are rich in starch

☞ **Glycogen**

- Sometimes referred to as '**animal starch'**.
- Storage form of carbohydrate in animal
- Found mainly in muscle liver and brain tissue because;
  - They are very active and needs a readily available energy supply at all times.

☞ **Cellulose**

- Important structural material in plants.
- It is the main constituent in plant cell walls.
- Just like starch and glycogen it consists of long chains of glucose.
- Human beings cannot digest cellulose because cannot break down the linkages between glucose molecule.

# 2. Proteins

- Proteins are made up of the elements **carbon, hydrogen, oxygen and nitrogen**.
- Important in growth and repair of tissue
- Protein-rich food includes;
  - meat, fish,
  - dairy products such as cheese and milk
  - Pulses, such as white pea beans, chick peas and red kidney beans.
- Proteins are used for **body-building**;
- About 17–18% of body is made up of protein – a high percentage next to water
- The highest abundance of organic compound in the body.
- Proteins are polymers, made up of many small units called **amino acids.**
- 20 different naturally occurring amino acids and joined together form proteins
- Amino acids are joined together in a **condensation reaction** and a molecule of water is lost.
- The bond formed between two amino acids is known as a **peptide link**.
- Amino acids dissolve in water. However;

☞ **Some proteins are insoluble in water**. These proteins are found in;

- Connective tissue, tendons , matrix of bones (collagen),
- The structure of muscles,
- The silk of spiders' webs and silkworm cocoons
- Keratin that makes up hair nails horns and feathers.

☞ **Proteins soluble in water.**

- Antibodies,
- Enzymes
- Hormones,

- A rise in temperature or a change in pH destroy the 3-D structure of cellular proteins
- Lack of protein in the diet may result in diseases known as protein-energy malnutrition.
- The best known of protein-energy malnutrition are marasmus and kwashiorkor.

1) **Marasmus**, deficiency in calories
   - Protein energy malnutrition predominantly due to prolonged calorie deficit.
   - Inadequate energy intake including protein
2) **Kwashiorkor**; deficiency in protein.
   - A malnutrition disease caused by sever protein deficiency usually occur when the child is weaned ( stop breast feeding),
   - A protein deficiency with adequate energy intake

## 3. Lipids -Fats and oils

- Lipids are made up of carbon, hydrogen and oxygen. However, a considerably lower proportion of oxygen in lipid molecules.
- Lipid-rich foods include, butter, beef fat, oil, Plant seeds like groundnuts and coconuts are also rich in lipid.
- **Importance of lipids ;**
  - Storage of energy in the body
  - Structural component of cell membrane
  - Insulation layer under skin
  - Regulation of body temperature
- Lipids contain more energy per gram than carbohydrates or proteins.
- All lipids are insoluble in water, but dissolve in organic solvents. **What is the use of this?**
- Fats and oils are made up of combinations of two types of organic chemicals**, fatty acids** and **glycerol.( $C_3H_8O_3$)**
- **There are two main ways in which fatty acids vary;**
  - the length of the carbon chain can differ
  - The fatty acid may be saturated or unsaturated.

☞ **Saturated fatty acid**

- Carbon atom is joined by a single covalent bond.
- More common in animals lipids
- Solid at room temperature
- **S**aturated fat, in diet are not good for our long- term health

☞ **Unsaturated fatty acid**

- The carbon chains have one or more double bonds in them.
- more common in plant lipids
- liquid at room temperature
- Relatively healthier contain less number of cholesterol

- When a molecule of glycerol combines in a condensation reaction with three fatty acids, a lipid is formed
- Lipids include the highest profile chemicals in public health issues – **cholesterol and fat**.
- **Cholesterol** need to make;
  - The membranes of your body cells
  - Sex hormones
  - The hormones which help your body deal with stress.
- But high levels of cholesterol in blood increase risk of getting heart disease or diseased blood vessels.

## 4. Minerals;

- Group of nutrient found in a small amount and classified as micronutrients
- Important for the proper function of the body
- Lack of mineral in the diet may result in a deficiency disease

| Mineral | role in body | foods rich in mineral | Deficiency disease |
|---|---|---|---|
| **Calcium** | ➢ Making bones and teeth<br>➢ Blood clotting | ➢ Dairy products, fish, bread vegetables | ➢ Rickets |
| **Phosphorus** | ➢ Making teeth and bones; part of many chemicals, e.g. DNA,ATP | ➢ Most foods | ➢ Improper formation of teeth and bones; failure of metabolism |
| **Sodium** | ➢ For proper fluids balance, nerve transmission and muscular contraction | ➢ Common salt, most foods | ➢ Dehydration, shock Muscular cramps |
| **Chlorine** | ➢ For proper fluids balance, stomach acid | ➢ Common salt, most foods | ➢ Muscular cramps |
| **Magnesium** | ➢ Making bones, nerve transmission, muscular contraction and immune system health | ➢ Green vegetables | ➢ Skeletal problems, cell chemistry affected, defects in metabolism |
| **Iodine** | ➢ Synthesis of thyroxin | ➢ Table salt, onion | ➢ Goiter |
| **Iron** | ➢ hemoglobin synthesis; helps carry oxygen and result in energy production | ➢ Red meat, liver, eggs, green leafy vegetables, e.g. spinach | ➢<br>➢ Anemia |

## 5. Vitamins

☞ Vitamins are important in regulation and maintenance of health body

- ❖ Lack of vitamin in the diet cause **deficiency disease**
- ❖ Vitamins are classified into two groups
  - ➢ **Fat soluble vitamins;** vitamin A,D,E,K
  - ➢ **Water soluble vitamin** C and B group

| Vitamins | Role in the body | Food rich in the body | Deficiency disease |
|---|---|---|---|
| **Vitamin A** *Retinol* | ➢ To make cell of retina | ➢ Carrots, vegetable. Fish | ➢ Night blindness<br>➢ Dry skin |
| **Vitamin $B_1$** *Thymine* | ➢ Used in cellular respiration | ➢ Meat and cereal | ➢ Beri-beri |
| **Vitamin C Ascorbic acid** | ➢ Helps to heal wound for healthy gum | ➢ Lemons, orange, vegetable | ➢ Scurvy (bleeding of gum) |
| **Vitamin D** *Calciferol* | ➢ Helps calcium and phosphate to be used for making of bone | ➢ Fish, liver oil, also made in the skin in sun light | ➢ Rickets ,poor teeth |
| **Vitamin E** *Tocopherol* | ➢ Affect muscle and reproductive system in animals | ➢ Vegetable, Cereals, meat | ➢ Infertility in rat |
| **Vitamin K** ***phyloquinone*** | ➢ For the formation of blood clotting | ➢ Liver, cheese, milk, vegetables | ➢ Failure of blood to clot |

## 6. Water

- The most abundance substance in the body. It constitutes between 60 and 70% of the body.
- Some of the biological role of water
  - A medium of chemical reactions– it is a vital solvent.
  - Water is involved in the transport of substances around the body food, hormones, waste products such as urea
  - Water is involved in temperature regulation as lose heat from the body through sweating
  - Water is involved in the removal of waste materials such as urea
  - Water is a reactant in many important reactions in the body for example, hydrolysis reactions.
  - Water is needed for the osmotic stability of the body

## 7. Fiber (Roughage )

- Fiber Important part of a healthy balanced diet
- Roughage or fiber cannot be broken down, digest or absorb in the human gut
- It can **help;**
  - **to prevent heart disease**, diabetes, weight gain , some cancer and improve healthy diet
  - Fiber also important in lowering cholesterol, blood pressure, glucose level and inflammation
  - Provides bulk for the intestinal muscles to work on.
- Low in roughage a diet results in the movements of food through the gut are sluggish and the food moves through the gut relatively slowly. This can result in constipation

### Food test

| Food | Reagent used | Positive result |
|---|---|---|
| **Carbohydrates**<br>❖ Starch<br>❖ Reduced sugar. E.g. glucose | ❖ Iodine solution<br>❖ Benedicts solution | ❖ Blue black color<br>❖ Orange red precipitates |
| **Proteins**<br>❖ **Biuret test** | ❖ Biuret reagent | ❖ Purple color |
| **Lipids**<br>❖ Filter paper test or oil spot test<br>❖ Emulsion test | ❖ Piece of paper<br>❖ Ethanol solution | ❖ Translucent spot<br>❖ Milky suspension |
| **Vitamin C** E.g**.** orange or lemon juice<br>❖ DCPIP solution | ❖ DCPIP (dichlorophenol indo phenol) reagent | ❖ Colorless |

- **Balanced diet** taking food from all major food groups in order to maintain a healthy body
- **Malnutrition** diet is lacking in important elements needed for a healthy body
- **Under nutrition** too little food is eaten. **Over nutrition** too much food is eaten

☞ **Body/mass index or BMI**. This compares weight to height in a simple formula:
- BMI = weight /(height)2
- Most people have a BMI in the range 20–30. Have health weight
- But, if a BMI of below 18.5, or above 35, then may have some real health problems.

☞ **Exercises**

1. When some juice was added to DCPIP .The solution changed into colorless .This shows that the solution contains;
   A. Glucose B. Vitamin C C. Protein D. Lipids
2. The growth and maintainace of organism depends on?
   A. Glucose B. Water C. Protein D. Lipids
3. Which of the following the major role of carbohydrate in human diet is:
   A. form cell membrane C. Catalyze cellular reaction
   B. Supply energy to the body D. provide building blocks for protein
4. in equal weight of the following substance are oxidized, the large amount of energy is release by? A. protein B. fat C. Starch D. Sugars
5. Which of the following organic tissue is most abundant in animal tissue?
   A. Protein B. Lipids C. carbohydrates D. minerals

## 3.2 DIGESTIVE SYSTEM

☞ Digestive system is the system in which food substances are broken down into small soluble molecules.
- **Digestion is** the process in which **large, complex and insoluble** food particles are broken down into **smaller, simpler and soluble** form that can be used by the body.

**Two stage of Digestion**

☞ **Physical [mechanical] digestion**
- Food is mechanical broken down by teeth and muscular activity of the gut.
- Involves cutting, grinding, chewing food in the mouth.
- Important to increase surface area of the food to act upon.

☞ **Chemical digestion**
- **It** involves the breaking down of food by hydrolysis reaction
- Change large insoluble food into smaller and soluble form
- chemical breakdown is controlled by enzymes

## ENZYMES

- **Enzyme** are biological catalyst that speed the rate of chemical reaction
- **Properties of enzyme include**
  - **E**nzyme are protein
  - Enzyme are biological catalyst
  - Not affected by the reaction they speed up
  - Enzyme can be re--used
  - Enzymes are very specific. E.g. **amylase** breaks down starch, **lipase** breaks down fats, **catalase** breaks down hydrogen peroxide but **pepsin** breaks down proteins
- **Enzyme can be divided into two**
  - **Intracellular enzyme** are enzyme that work inside side the cell
    E.g. Respiratory enzyme
  - **Extracellular Enzyme** are enzyme that work outside the cell
    E.g. Digestive enzyme

- **Process that occurs in digestive system**
  - **Ingestion** the taking of food into the mouth
  - **Digestion** breaking down of food into smaller, simpler and simpler forms
  - **Absorption** taking in and used of digested food into the blood stream.
  - **Assimilation** the use of digested food by the body
  - **Egestion** the removal of undigested food from the body.

### 1. Digestion in the mouth

- Both physical and chemical digestion starts in the mouth
- Physical digestion carried out by grinding and chewing action of teeth and rolling of tongue
- Chemical digestion carried out by action of enzymes called **salivary amylase /ptyline/**
- Salivary amylase /ptyline/ digest starch to maltase

- **Mastication or chewing** is the process by which food is crushed and grind by teeth
  - The first step of digestion which increase surface area of the food for enzyme action

**TEETH**

- Teeth are needed for a variety of different jobs – gripping food, tearing food and chewing food,
- **Type of teeth**
  - **Incisors** } used for biting
  - **Canines** }
  - **Premolar** } used for chewing and crushing food
  - **molar** }
- **Cross section of the teeth**
  - **Enamel** the top surface the teeth, the hardest structure of the body
  - **Dentine** living layer underneath tooth enamel, dentine contains many fine channels filled with cytoplasm, which supplied with oxygen and nutrients by the blood vessels in the pulp cavity
  - **pulp cavity c**enter of the tooth which contains nerves and blood vessels
  - **Cement** fibrous layer that holds teeth in jaw bone

- **The longitudinal section of teeth**
  - **Crown;** the upper part of tooth
  - **Root;** embedded in jaw bone
  - **Neck;** narrow region between root and crown

☞ **Periodontal disease** bacterial infection of the gum
  - **Dental plaque** a mass bacteria combined with food and saliva, form a thin biofilm which the bacteria grow with in the mouth

- **Symptoms** include **tender gums (bleeding gums** ) when you clean your teeth
- **Ways to avoid tooth decay include:**
  - Regular brushing of teeth and gums twice a day. This removes the plaque from the teeth, preventing the build-up of a sticky, acidic film over the enamel.
  - Avoiding sweet, sugary foods
  - Have regular dental check-ups.

☞ **Moving the food along the esophagus**
- The saliva coated chunk of chewed food is called **bolus**
- Swallowing is a reflex action.
- During Swallowing epiglottis closes over the trachea, preventing food going down into lungs. swallowing and breathing cannot occur at the same time
- Muscular contractions of the gut moves swallowed food down esophagus /gullet/
- **Peristalsis** is a wave like muscular contraction that moves the food along the gut.
- Waves of alternate contraction and relaxation of the circular and longitudinal muscles move food from one end of the gut to the other

## 2. Digestion in the stomach

- **The** stomach wall contain gastric gland which secrete gastric juice

☞ **Gastric juice contain**
- **Hydrochloric acid /HCL/**
  - Provide correct PH for pepsin
  - Kill micro-organism which are swallowed with food
- **Pepsin** a protease enzyme that convert protein into peptones
- **Renin** used to solidify milk protein

☞ **Function of stomach**
- Digestion of protein
- Formation of chime
- Temporary storage 0f food

## 3. Digestion in Small intestine

- It is a place where most digested food take place
- **Has three parts**
  - **D**uodenum
  - Jejunum
  - Ileum

### I. Duodenum

- The upper part of small intestine
- Do not secret its own enzyme
- Digestion facilitated by the secretion of **liver** and **pancreases.**

- **The liver**
  - Liver secret **bile** stored in gall bladder
  - **Bile used?**
  - Neutralize the acidity chime
  - Emulsifies fat into tiny droplets
- **Pancreases**
  - Secrete pancreatic juice which is passed in to duodenum through pancreatic duct
  - Contains three enzyme
    - ✓ **Lipase**; hydrolysis fat into fatty acid and glycerol
    - ✓ **Trypsine**; Protease enzyme break down peptones into peptide
    - ✓ Pancreatic **amylase**; Carbohydrase enzyme break down starch into maltase

II**. Jejunum**; the middle part of small intestine

III, **Ileum**

- The lower part of small intestine
- All digestive process are completed and soluble food are absorbed into the blood strem
- Intestinal wall secret intestinal juice , which contain;
  - **Erepsine**; convert peptides into amino acid
  - **Lipase**; converts fat into fatty acid and glycerol
  - **Maltase;** converts maltose into glucose
  - **Lactase;** converts lactose into glucose and galactose
  - **Sucrose**; converts sucrose into glucose and fructose

**Absorption and assimilation**

- **Absorption** is the process by which the end product of digestion pass from the wall of small intestine and enter into blood stream
- Some of the factors that make the absorption of the digested food very efficient in small intestine is;
  - It has **many finger-like projections** called **villi**, to increase the surface area for diffusion, and each individual villus have smaller projections called **microvilli**.
  - Have a **rich blood supply** that carries away the digested food molecules.
  - **Short diffusion distances**.
- The glucose molecules and amino acids go directly into the blood.
- The fatty acids and glycerol move initially into the **lacteals**, which are part of the lymph system.
- **hepatic portal vein** blood vessel that takes digested food molecules to the liver
- **Assimilation** taking in and use of digested food by the body

**Issues of digestive health**

☞ **Constipation**

- If the faeces remain in your large intestine for too long, too much water is removed from them.
- Become compacted, hard and difficult to remove from body.
- The most common causes;

- Lack of fiber in the diet
- Not drinking enough water.
- Pass faeces can cause hemorrhoids (piles) or a tear in the anus.

❖ Constipation can be treated relatively easily.
- Eating more fiber drinking plenty (so the faeces remain soft)
- Taking laxatives (chemicals which stimulate the gut to contract and force out the faecal material)..

☞ **Diarrhoea**
- ❖ Diarrhea the faeces that are produced very loose and watery.
- ❖ Diarrhea can be fatal as it causes dehydration of the tissues.
- ❖ Can be treated very simply by giving the sufferer frequent drinks of water with rehydration salts.
- ❖ These replace the fluids that are being lost and keep the body tissues hydrated until the immune system overcomes the infection.

☞ **Exercise**

1. Which of the following digestive processes is affected if the gall bladder is surgically removed?
   A. Digestion of lipid C. Digestion of protein
   B. Digestion of protein D. Digestion of vitamins
2. The two human teeth types that are used for biting are;
   A. Canines and premolars C. premolars and molar
   B. Molar and incisors D. Canines and incisor
   C.

## 3.3. RESPIRATORY SYSTEMS

☞ The human respiratory system are a serious organ responsible for taking in oxygen and expelling carbon dioxide

❖ The human respiratory system consists the following structures

**1) The nasal passages**
- ❖ Have a large surface area,
- ❖ A good blood supply, used warms the air
- ❖ Lots of hairs. used to trap dust particles some bacteria
- ❖ Lining secretes mucus., used to moist the air
- ❖ So breathing through nose is good because the air we breathe in is **warm, clean** and **moist** before it gets into the delicate tissue of the lungs.

**2) Pharynx;** found behind the nasal cavity and mouth
- ❖ is a common passage of air and food

**3) Larynx;** voice box, where sound is produced

**4) Epiglottis;** Prevents the entrance of the food into the trachea during swallowing of food

**5) Trachea; wind pipe**
- ❖ Contain C shaped ring of cartilage keep open all the times

- ❖ The opening of trachea is called glottis
- ❖ Divided into two bronchi

6) **Bronchi (singular bronchus)** leading to each lung **,** Connects trachea to bronchioles
7) **Bronchioles;** are small tube branching from each brunching the lung
8) **Alveoli;** air sac
   - ❖ Is the site of gas exchange between blood capillaries and the lung
   - ❖ alveoli provide an ideal site for the most effective possible diffusion of gases into and out of the blood
   - ❖ oxygen moves into the blood where as carbon dioxide moves out of the blood
   - ❖ The mechanism of gas exchange in the alveoli depends on;
     - ➢ large surface area
     - ➢ moist surfaces
     - ➢ short diffusion distances
     - ➢ rich blood supply

☞ **The lung**
- ❖ The major breathing organ of animals
- ❖ Surround by a membrane called plural membrane
- ❖ Protected by ribs, sternum, vertebral column, diaphragm and intercostal muscles

☞ **The mechanism of breathing**
- ❖ The movement of air in and out of the body is known as ventilation of the lungs
- ❖ Breathing involves two process inhalation and exhalation

☞ **Comparisons of Inhalation and Exhalation**

| **Inhalation /inspiration/** | **Exhalation/expiration/** |
|---|---|
| ❖ Air enters into lungs | ❖ air pushed out of lungs |
| ❖ Diaphragm muscles contract become flatten | ❖ diaphragm muscles relax , becomes dome-shape |
| ❖ External intercostal muscles contract, | ❖ Internal intercostal muscles contract, |
| ❖ Ribcage moves upward and out ward | ❖ Ribcage moves down and inward |
| ❖ Volume of thorax increase | ❖ Volume of thorax decrease |
| ❖ Pressure of thorax decrease | ❖ Pressure of thorax decrease |

☞ **Composition of inhaled and exhaled air**

| | **Inhaled air** | **Exhaled air** |
|---|---|---|
| **Nitrogen** | About80% About | About 80% About |
| **Oxygen** | 21% | 16% |
| **Carbon dioxide** | 0.04% | 4% |
| **Water vapor** | Less | High |
| **Heat** | Less | High |

☞ **Demonstrating the presence of carbon dioxide (CO2) in exhaled air**
- ❖ To demonstrate the presence of carbon dioxide (CO2) in exhaled air. Use;

- Lime water (Ca(OH)2) as an indicator of the presence of carbon dioxide.
- The clear liquid turns cloudy when carbon dioxide is bubbled through it,

☞ **Demonstrating the presence of water vapor in exhaled air**

- To demonstrate the presence of carbon dioxide (CO2) in exhaled air. Use;
  - Blue **cobalt chloride paper** turns pink in the presence of water,
  - White **anhydrous copper (II) sulphate** turns blue.
  - Breath out on a **glass surface or mirror** results in a droplet of water or moisture

☞ **Demonstrating the presence of heat in the air breathe** out

- Temperature of the air breathe out is higher than the temperature of breathe in
- Breathing on the back of the hand result in warm feeling

**What affects breathing rate?**

- The average resting breathing rate for an adult human being is around 12–14 breaths per minute.
- **Tidal volume** of air breathing normally at rest, you take about 500 cm3 of air in and out each time you breathe – this is only about 15% of your possible maximum. This is known as your
- **The vital capacity** of are the absolute maximum amount of air take into or breathe out of lungs.
- What factors affect breathing rate?
  - **The main factors affect breathing rate are**

**1. Exercise 2.Anxiety 3. Drugs 4. Environmental factors 5.Altitude 6.Weight 7.Smoking**

☞ **Group assignment discuss in one two five educational group on the main factor which affect breathing rate**

## 3.4. CELLULAR RESPIRATION

- **Cellular respiration** is a process in which energy is released from the breaking down of organic substance in the body
- Cellular respiration is a serious biochemical reaction **release energy from food**
- All cells need energy to carry out the reaction of life, and respiration provide this energy
- Respiration release energy from the food we eat so that the cell of the body can use it
- The energy that is used by the cells is stored in the form of molecule called **ATP**
  - **ATP**; stands for **adenosine tri phosphate**
  - **Adenosine** molecule attached to **three phosphate**
  - **ATP** is immediate source of energy for the cell
  - **ATP** energy currency of a cell
  - **T**he direct energy source for each cell
  - During respiration **ATP is made from** ADP (adenosine diphosphate) and phosphate (Pi) **ADP + P** $\xrightarrow{\text{energy produced}}$ **ATP + $H_2O$**

- When **energy is needed** for any chemical reaction in the cell, the third phosphate is broken by a hydrolysis reaction **ATP + $H_2O$** $\xrightarrow{\text{energy required}}$ **ADP +P**

☞ **Importance of ATP to the body**

- To carry out basic function of life known as **metabolism (** anabolism + catabolism**)**
  - **Anabolism**; build up large molecule from smaller one to make new cell material
  - **Catabolism**; break large molecule into smaller one
- For muscle contraction
- To regulate core body temperature in Homoiotherms
- Provide energy for active transport material across cell boundaries.

**Type of respiration**

- Based on the requirement of oxygen, respiration can be classified;

**I. Aerobic respiration**

- Production of energy **using oxygen**
- Relatively **high amount of energy** is produced than anaerobic respiration
- Takes place in the **mitochondria** of a cell
  - An organelle found in almost any cells
  - Have a folded inner membrane to provides a large surface area for the enzyme involved in aerobic respiration
  - Muscle cell, liver cell and cones and rods of eye have a lot of mitochondria because they use a lot energy
- **Carbon dioxide** and **water** are produce as waste product
- Glucose + oxygen $\longrightarrow$ carbon dioxide + water + ATP
  $C_6H_{12}O_6 + O_2 \longrightarrow CO_2 + H_2O$ +38ATP

**II. Anaerobic respiration**

- **Do not** utilize **oxygen**
- **Less amount of energy** is produced. Only 2ATP from one glucose is produced
- It mostly produced in the **cytoplasm** of a cell

**1. Anaerobic respiration in animal cell ( Lactate fermentation)**

- During heavy exercise the **muscle cell** respire anaerobic ally
- Produce a waste product called **lactic acid**
- The body cannot get rid of lactic acid
- The **accumulation of lactic acid** during exercise cause **muscular ache**
- The amount of oxygen needed to breakdown lactic acid **oxygen dept**
- Anaerobic respiration in **muscle cell**
  - **Glucose $\longrightarrow$ Lactic acid +2ATP**
- After exercise, the lactic acid is completely oxidize(broke down) by oxygen into carbon dioxide and water in the **liver**

**Oxygen dept repayment**

- **Lactic acid + oxygen $\longrightarrow$ carbon dioxide + Water**

2. **Anaerobic respiration in yeast cell (Alcoholic fermentation)**
   - ❖ When yeast have plenty of oxygen
   - ❖ Respire aerobically and produce carbon dioxide and water
   - ❖ **Carbon dioxide produce in aerobic** respiration of yeast cell makes the dough to rise which also gives it tangy flavor so that used for **making bread and injera**
   - ❖ Yeast can also respire anaerobically
   - ❖ Yeast cell break down sugar into **ethanol** and **carbon dioxide**
   - ❖ **Glucose ⟶ Ethanol + carbon dioxide +2ATP**
   - ❖ Anaerobic respiration in yeast result in making alcoholic drinks

☞ **Exercise**

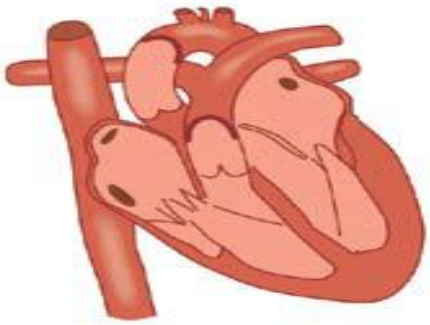
1. Which of the following is **not** the product of aerobic respiration?
   A, oxygen B. Water C. carbon dioxide D. ATP
2. The reaction **lactic acid + oxygen →carbon dioxide +water**
   A. Aerobic respiration B. Oxygen dept repayment C. lactate fermentation
3. Which of the following is the product of both aerobic and anaerobic respiration of yeast?
   A. Ethanol B. Carbon dioxide C. Lactic acid D. Water
4. Lactic acid completely oxidize into carbon dioxide and water in the
   A. Muscle cell B. Liver cell C. Pancreases D. Kidney
5. The fermentation of glucose by yeast produces
   A. $CO_2$,$H_2O$ and 2ATP . C. lactic acid ,2ATP
   B. Ethanol, $CO_2$ and 2ATP D. $CO_2$, $H_2O$ and 36ATP
6. Cellular respiration is a series of biochemical reaction that:-
   A. Make sugar from sun light C. Release energy from sunlight
   B. Make energy from sunlight D. Release energy from food
7. Yeast is used in baking bread because. They produce:-
   A. Ethanol B. Oxygen C. CO2 D. Lactate
8. What molecule is essential for aerobic respiration to take place?
   A. $N_2$ B. $O_2$ C. $CO_2$ D. Ethanol

## 3.5. CIRICULATORY SYSTEM

☞ Circulatory system is a system in which oxygen, digested food and other nutrients transport to all part of body.

- ❖ All organism do not have specialized circulatory system. Small, single celled organism relies on simple diffusion to exchange material between the environment and their cells.

☞ **CIRCULATION** is the movement of blood and other fluid through blood vessels to all parts of the body.



- ❖ The human transport system is the blood circulatory system
- ❖ It has three elements
  1. Heart ( pump)
  2. Blood vessels ( pipe)
  3. Blood ( medium)

**1.HUMAN HEART**

- ❖ Made up of **cardiac tissue**
- ❖ It is a muscular blood pumping organ

- Surrounded by a double membrane called **pericardium**
- Human heart has four chamber
  - ✓ Two atria ( auricles) upper chamber
  - ✓ Two ventricles lower chamber
- **The right auricle** receive **deoxygenated blood** from all part of the body through vena cava
- **The left auricle** receive oxygenated blood from lung through pulmonary vein
- **T**he **right ventricle** pump deoxygenated blood to lung whereas **left ventricle** pump oxygenated blood to all part of the body
- **Left ventricle** is the thickest chamber of the heart because it pumps blood longer distance
- The left side of the heart separate from the right side by **septum**
- **T**he muscle of the heart supplied oxygenated blood by **coronary artery**

☞ **Valves** the structure of the heart prevent the back flow of blood

**Tricuspid valve**

- the valve between right atrium and right ventricle
- prevent the back flow of blood from right ventricle to right atrium

**Bicuspid (mitral) valves**

- The valve between left atrium and left ventricle
- Prevent the back flow of blood from left ventricle and left auricle

**Simi-lunar valve**

- Found at the opening of pulmonary artery and aorta
- Prevent the back flow of blood into ventricle

- The contraction of the heart chamber is stimulated specialized tissue called **pacemaker**
- An instrument used to listen the heart beat is **stethoscope**
- An average heart rate of human being is **72 times** per minute**.**

☞ **Systolic blood pressure**

- Pressure formed by the **contraction heart chamber**
- Forced blood out of the heart into arteries
- Blood pressure at highest reading

☞ **Diastolic blood pressure**

- Pressure exerted by the **relaxation of the heart chamber**
- Blood pressure at lowest reading
- Fills the chamber of the heart with blood

- The normal blood pressure of human being is **120mmHg/80 mmHg**
- The **nominator** is systolic and **denominator** is diastolic Pressure
- Highest reading (120) systolic and Lowest reading (80) diastolic

.

## 2. BLOOD VESSELS

☞ **Blood vessel** are the pathways through which transportation of material takes place
There are three main type of blood vessels

- ❖ Arteries
- ❖ Veins
- ❖ Capillaries

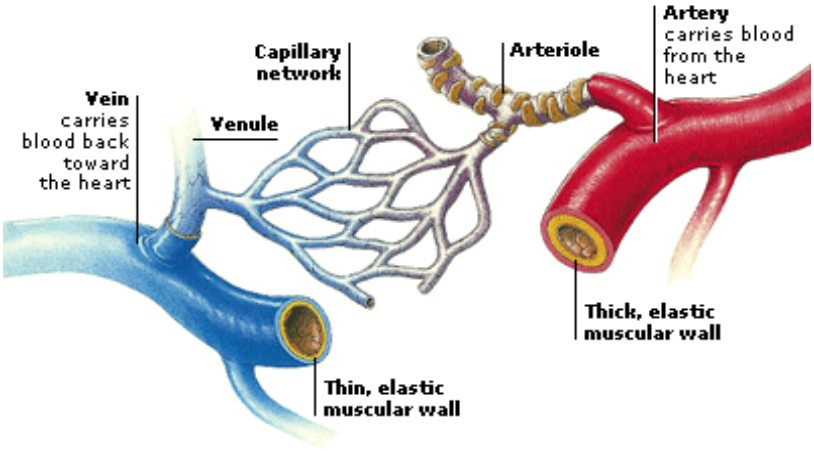
☞ **ARTRIES**

- ❖ Carry blood away from the heart
- ❖ Thick and elastic wall
- ❖ Thick muscle layer
- ❖ Have elastic fiber
- ❖ Small /narrow/ lumen
- ❖ Blood flow rapid
- ❖ High pressure and pulsate
- ❖ No valves
- ❖ Mostly deep seated
- ❖ Blood oxygenated except
  - ➢ **Pulmonary artery** carry deoxygenated blood to lung
  - ➢ **Umbilical artery** carry deoxygenated from fetus to placenta
- ❖ Largest artery **aorta** smallest **arterioles**

| ARTERIES | SUPPLY OXYGEN TO; |
|---|---|
| Carotid artery | Head |
| Coronary artery | Heart muscle |
| Renal artery | Kidney |
| Hepatic artery | Liver |

☞ **VAINS**

- ❖ Carry blood back to the heart
- ❖ Thin wall
- ❖ Thin muscle layer
- ❖ No elastic fiber
- ❖ Big /wider/ lumen
- ❖ Blood flow slowly
- ❖ Low pressure and pulsate
- ❖ Have valves
- ❖ Mostly superficial
- ❖ Carry deoxygenated blood except
  - ➢ **Pulmonary vein** return oxygenated back from lung to heart
  - ➢ **Umbilical vein** carries oxygenated blood placenta to fetus
- ❖ Largest vein vena cava smallest venules




☞ **CAPILLARIES**

- ❖ Narrow thin walled blood vessels
- ❖ Connects arteries and with veins
- ❖ Take blood to the tissue and cell
- ❖ Site of exchange of substance within the body

- ❖ Wall one cell thick
- ❖ Blood flow slowly
- ❖ Mix oxygenated and deoxygenated blood
- ❖ No valve

## 3. THE BIOOD

☞ **BLOOD** is a fluid tissue that carries nutrient, respiratory gases, metabolic wastes and other substance

☞ **Blood contains**

**1)** Plasma

**2)** Blood cells

- ➢ Red blood cells
- ➢ White blood cells
- ➢ platelets

☞ **PLASMA**

- ❖ **A** pale yellow liquid portion of the blood
- ❖ 90% of the plasma is water
- ❖ 10% consists dissolved and suspended substance
- ❖ Caries **nutrients , carbon dioxide, hormones, enzymes and nitrogenous waste**
- ❖ Contain plasma protein such as fibrinogen, prothrombin and Thrombin

☞ **RED BLOOD CELLS (ERYTHROCYTES)**

- ❖ **Biconcave disk** shaped non nucleated cell
- ❖ Live 100-120 days in your body
- ❖ Worn out red blood cell destroyed and removed by **liver** and **spleen**
- ❖ Thin surface membrane for ease of diffusion
- ❖ Used to transport oxygen and carbon dioxide back into the lung
- ❖ Formed in the **bone marrow**
- ❖ Contain a red pigment called **hemoglobin**
- ❖ Hemoglobin contain iron, the lack of iron in diet cause **anemia**
- ❖ Hemoglobin is a complex protein which carries oxygen

**Hemoglobin +oxygen** ⇌ **oxy-hemoglobin**

**High oxygen concentration** →

← **Low oxygen concentration**

☞ **Adaptation of RBC to carry oxygen**

- ❖ Contain hemoglobin
- ❖ Does not have nucleus to carry more room for hemoglobin.
- ❖ Have biconcave disk shape increase surface area for diffusion of oxygen
- ❖ Thin surface membrane for ease of diffusion

- **WHITE BLOOD CELL (LEUCOCYTES)**
  - Collarless, irregular shaped and nucleated
  - Produced in **bone marrow**, **lymph nodes** and **spleen**
  - Fewer white blood cell then red blood cell
  - Much bigger then red blood cell
  - **Used to defense the body against disease**
  - White blood cell can be classified
    - **Phagocytes** a group of white blood cell that engulf and ingest infection microbes
    - **Lymphocytes** group which help to produce antibodies

- **PLATLATES (THROMBOCYTES)**
  - Collarless and non-nucleated
  - **Important in blood to clot at the site of a wound**
    - Prevents the body from bleeding to death from a simple cut
    - Also protect the body from the entry of pathogen through open wound
    - Protect the new skin as it grows

## Human blood group

**ABO** blood group system

- **Four major blood group in humans'** Blood group **A** Blood group **AB** Blood group **B** Blood group **O**
- **Antigens** are special protein which are found on the red blood cell
  - Antigen allow cells to recognize each other
  - Blood group **determine by** the type of **antigen** on the red blood cell
  - **"A"** blood contain "**A"** antigen **"B"** blood contain **"B "** Antigen
  - **"AB"** blood contain **"A'** and **"B"** antigen "**O"** blood **do not contain antigen**

- **Antibody** are protein which are produces the body to fight foreign antigen and found in the plasma of the blood
  - Two type of antibodies against antigen. These are **anti-A** and **anti B** antibodies
  - **Agglutination** is incompatibility of antigen and antibody in blood group
  - Blood groups that mix without agglutination are called **compatibility**

**Transfusion of blood group**

| Blood group | antigen | Antibody | Can be transferred (donate) into | Can received blood from |
|---|---|---|---|---|
| **A** | A | Anti-B | A and AB | A and O |
| **B** | B | Anti-A | B and AB | B and O |
| **AB** | A and B | NONE | AB only | A, B,AB,O |
| **O** | NONE | Anti A and B | A,B,AB,O | O only |

**AB universal recipient** **O Universal donor**

- There is another antigen found on the surface of RBC called **Rh antigen**
- A person who do have this antigen is called $Rh^+$ (Rh positive)
- A person who do not have this antigenic called $Rh^-$ ( Rh negative)

☞ Rh system in relation to marriage

| **Mother** | **Father** | |
|---|---|---|
| $Rh^+$ | $Rh^+$ | → No problem |
| $Rh^-$ | $Rh^-$ | → No problem |
| $Rh^-$ | $Rh^+$ | → **May be a risk** Why? |
| $Rh^+$ | $Rh^-$ | → No problem |

## A DOUBLE CIRCULATION

Double circulation is the two transport system of the body these are;

1. **Pulmonary circulation**
   - The pathway of blood between heart to lung
   - Important to exchange oxygen and carbon dioxide
   - **Right ventricle → pulmonary artery → lung → pulmonary vein left auricle**

2. **Systematic circulation**
   - The pathway of blood form heart to all part of the body
   - Supply oxygen rich blood to all part of the body
   - Systematic circulation can be divided into:
     - **Hepatic circulation** the pathway of blood between heart to liver
     - **Renal circulation** the pathway of blood between heart to kidney
     - **Coronary circulation** the pathway of blood between heart to heart muscle
     - **Hepatic portal circulation** carries digestive nutrient from the digestive system to the heart through the liver.

## COMMON PROBLEM OF CIRCULATORY SYSTEM

☞ **ANEMIA**
- Is caused few red blood cell or if the level of hemoglobin is less by
- Most commonly caused by the lack of iron in the diets
- Treated by eating iron rich diets such as liver, meat, egg, green leaf vegetable
- Girls are more likely to be anemic then boys because they lost iron in their menstrual bleeding

☞ **HYPERTENSION**
- High blood pressure above**140/90 mmHg**
- Caused by various reason such as
  - Age. Over weightiness
  - High consumption of salt

- Drug addiction
- Diabetics etc.

❖ Can be reduce and controlled by;

- Eating less fat and salt
- Regular exercise
- Avoid use of drug etc

**Exercise- Circulation**

1. The transfer of oxygen to the body's cell takes place in the;
   A. Arteries B. Arterioles Venules. D,. Capillaries
2. Which of the following is correct about human blood cells?
   A. RBC's fewer then WBC's
   B. Mature RBC"S do not possess nuclei
   C. WBC's contain hemoglobin
   D. RBC's defend the body against disease
3. Which of the following marriages is not good because it is dangerous for the offspring?
   A. RH- women and RH+ man
   B. RH+ women and RH-woman
   C. RH- women and RH- man
   D. RH+ women and RH+ man
4. If one inject of a blue die into left ventricle in which of the following parts of the body will the die appear next?
   A. Pulmonary artery B. Right auricle C. Right auricle D. Left auricle
5. From which blood group can blood be transferred regardless of the recipient group?
   A. A B. B C. AB D. O
6. A biochemical compound that reedy combines with oxygen and distributes the later throughout human body?
   A. Hemoglobin B. Acetylcholine C. Water D. Urea
7. Blood pressure is the pressure exerted by the blood on the wall of;
   A. Veins B. Capillaries C. Arteries D, Auricles
8. Suppose a person lost a lot of blood due to accident. If his/ her blood group is "O" for successful blood transfusion the donor blood's should be;
   A. 'B' B. 'A' C. 'O' D.'AB'
9. Which of the following types of blood **do not** have antigens in red blood cells?
   A. ''B'' B. ''A'' C." AB" D. "O"
10. The chamber of the heart which pumps blood to all part of the body;
    A. Left auricle B. left ventricle C. right auricle D. right ventricle
11. Which of the following arteries the failure of blood flow can result in an immediate loss of consciousness?
    A. Renal artery B. Carotid artery C. Coronary artery D. hepatic artery
12. Suppose a nurse inject a drug in the vein of left arm of sick women. Which of the following part of the heart of women receives the drug last?
    A. Left auricle B. Left ventricle C. Right auricle D. Right ventricle
13. Which of the following blood transfusion is **not compatible?**
    A. O into A B. B into AB C. AB into A D. O into

# UNIT 4
# MICRO-ORGANISM AND DISEASE

## 1.4. MICRO-ORGANISM

- Are organisms too small to be seen with the naked eye
- Micro- organisms can be seen with the aid of microscope
- Micro-organism have useful and harmful aspects
- **Useful aspect of micro-organism**
  - Decay and recycling of nutrients
  - Used in the making of food, Such as injera, ergo and eyib
  - Produce alcoholic drinks such as beer, wine and tej
  - Important in genetic engineering
- **Harmful aspect of micro-organism**
  - Cause disease in plant ,animals and humans
  - Food poisoning bacteria cause spoilage of food
- Micro-organism includes bacteria's, viruses. Molds. Yeast

**BACTERIA**

- Bacteria are a single called organisms
- Smaller than the smallest animal and plant cells
- Are unicellular and prokaryotic organisms
- Bacterial cell have many **similarities to animal and plant cell**. They are made up of **cell wall, cell membrane, cytoplasm** and **genetic material**
- **Some bacteria** have **flagella**(for movement)and **capsule** (for protection)
- Bacteria are classified based on shape into **rod shaped(bacilli), round (cocci), comma (vibro) and spiral**
- Bacteria can also be classified into **gram positive** and **gram negative** based on **gram stain**
- **Gram stain** is a differential stain used to classify bacteria into two
- Different bacteria have different **cell walls** which take up the stain differently

☞ **Stages of gram stain**

1) **Cristal violet/**purple color/; primary stain
2) Iodine solution; as a mordant /to form iodine-- violet complex/
3) Decolorized by **ethanol**
4) **Safranin** /red color/; counter stain or secondary stain

- **Gram positive**
  - Keep the color of primary stain /crystal violet/ not decolorized
  - Stain **purple**
- **Gram negative**
  - Primary stain decolorized by ethanol
  - Take the color of secondary stain safranin
  - **Stain red/ pink/**

## Viruses

- Smaller then bacteria
- Neither prokaryotic nor eukaryotic cell.
- Viruses are a particle, made up of a **protein coat( capsoid)** and **genetic material**
- The genetic material is either **DNA or RNA**
- They are **obligate parasite**
- Viruses are considered to be living and non-living things. **How?**
- **Do not carry out any of the function** of normal living organism **except reproduction**
- Viruses only **reproduce inside living cell**
- Viruses cause some common human disease such as AIDS, Influenza, rabbis

## Fungi

1. **Yeast;**
   - Is a single called fungi
   - At anaerobic condition yeast carry out alcoholic fermentation
   - Yeast have heterotrophic mode of nutrition
   - Yeast reproduce **asexually** by **budding**
2. **Moulds**
   - Made up of filament called hyphae
   - A mass of hyphae together forms mycelium
   - Reproduce **asexually** by **spore formation**

- **Germ theory diseases** states that germ are the cause of disease
- **The theory of spontaneous generation** states that living things arise from nonliving things
- **Louis Pasteur** disproves the theory of spontaneous generation. **How?**
- **Louis Pasteur** indicates that, infectious disease caused by pathogenic micro-organism. He also introduces **pasteurization** technique.
- **Robert Koch** discovered the first disease causing micro-organism called **bacillus anthracites** which cause **anthrax**

## Controlling micro-organism

The major methods of controlling microorganisms include;

- Sterilization
- Disinfectants
- Pasteurization

1) **Sterilization**;
   - is the process of complete removal of micro-organism
   - some of the methods that are used as sterilization;

**A. autoclave sterilization**

- Used to sterilize;
  - Equipment which are not damage by heat
  - **Bacterial spores** which do not die at low temperature
- Killing micro-organisms by boiling them in water at **$120^0$C** under high pressure for **15-45 minutes**.

**B. Ultra high temperature (UHT)**

- It is a way of **treating food** to kill all the micro-organism found in it.
- It is a techniques of heating the food at a temperature of **$135^0$c to$150^0$c for 2-6** second
- **Used in food processing industries** to prevent contamination of food

**C. Dry heat sterilization**

- Used to sterilize **scientific equipment**
- Requires higher temperature for longer period of time
- Use the temperature of **$170^0$C** for one hour and**$160^0$C** for two hour

**2) Pasteurization**

- Involves **boiling** or **heating** of milk, bear, other food staff
- It include heating followed by **rapid cooling**
- The temperature used
  - **$62.9^0$C for 30 seconds**
  - **$71.6^0$C for at least 15 seconds**

**3) Disinfectants**

- **Chemicals that** are used to kill micro-organisms on **inanimate object**
- Disinfectants have the following characteristics
  - Fast acting
  - Effective against all type of micro-organism
  - Disinfect material without damaging or discoloring it
- Dilute bleach and calcium hypochlorite used as disinfectant on drinking water
- **Antiseptics**
  - **Chemicals (**Disinfectants) that can be applied to a **living tissue** such as skin
  - Help to protect the entrance of germs if the skin is cut or damage

**Culturing (Growing) Microbes**

- **Importance of growing micro-organism**
  - To know how to kill them
  - To develop vaccine
  - To identify useful and harmful aspect
- **Precondition** for growing micro-organism;
  - **Isolating** the type of micro-organism to be studied
  - Developing suitable **nutrients medium**
  - Suitable **environmental condition**

- **Nutrient medium**; nutrients required for the growth of micro-organisms
  - It can be solid or liquid
  - **Agar**
    - ✓ As **solid nutrient** medium which is extracted from red algae
    - ✓ Micro-organism are cultured in a **petridish**
  - **Broth**
    - ✓ A liquid nutrient medium
    - ✓ Micro-organism are cultured in **test tube**
- **Culture media;** is a collection of nutrients and microbial cells grow on medium
- **Inoculation;** a technique of transferring microbes into a nutrient medium
  - **Inoculating loop / needle**/; an instrument that is used to transfer micro-organism
  - Culture microbes should transfer in a **zigzag streaks** because to avoid competition

## Immune system

- **Immune system** the system in the body which protects against disease causing micro-organisms and foreign proteins ( antigen)
- **Immunity** the ability of the body to resist disease

**Type of immunity**

**i. Innate immunity**

- Natural ability of the body to fight disease producing micro-organism
- Immunity present at the time of birth against certain diseases
- Nonspecific antibodies against disease germs
- Inborn and is due to the presence of naturally occurring antibodies since birth
- It obtain without the stimulation any foreign bodies

**ii. Acquired immunity**

- Immunity developing during the life time of individual after birth
- Acquired immunity either active or passive

**Active immunity**

1. **Natural active immunity**
   - Immunity resulting from having had a disease previously
   - The infection stimulates the body to form its own specific antibodies against germs
2. **Artificial active immunity**
   - Immunity acquire artificially by receiving **vaccine**

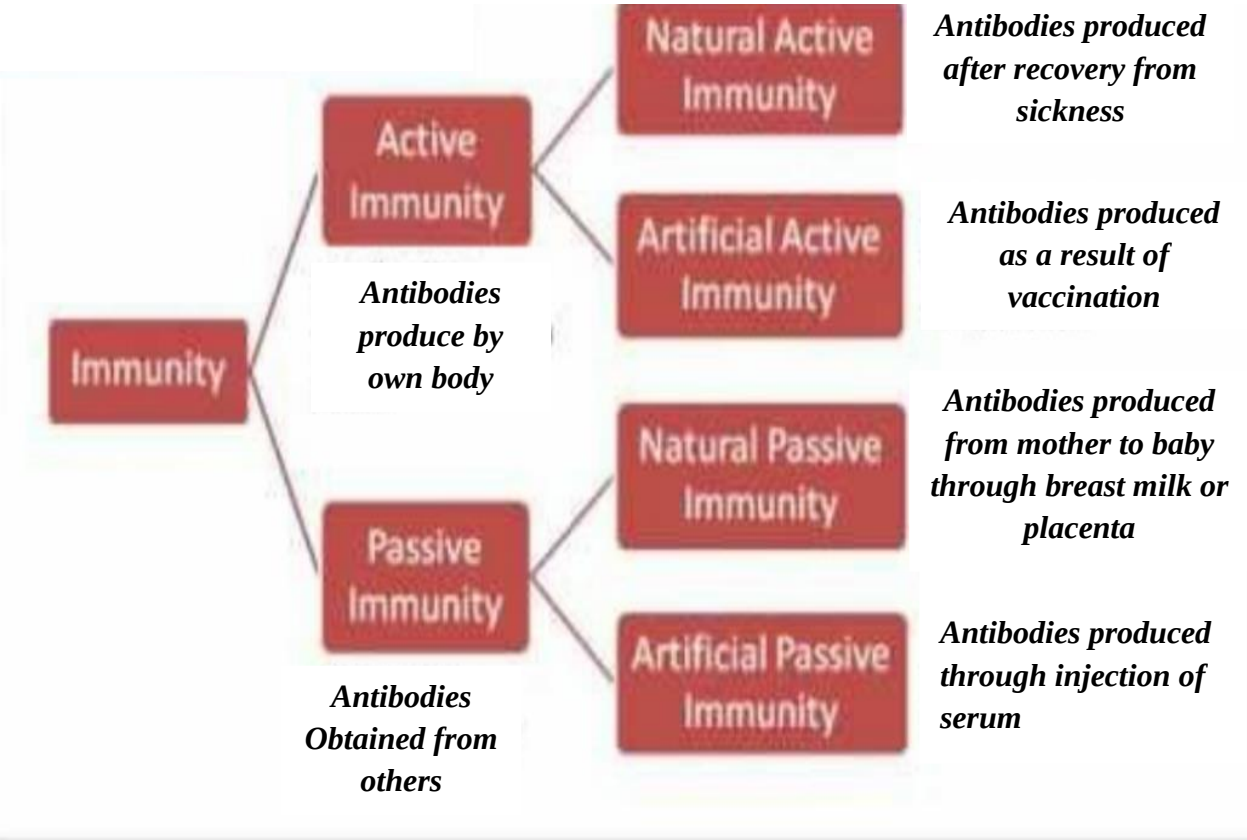
- **Vaccination /Immunization/**the use of dead or weakened pathogens to produce immunity to dangerous disease
  - **Vaccine** stimulated the body to form its own antibodies without having a disease
  - A child receive vaccines for **polio, tetanus, tuberculosis, hepatitis, measles, mumps, diphetria**

**Passive immunity**

**Review question P.136-137**

1) **Natural passive immunity**
   - Immunity passed **from mother to child**
   - Antibodies from the mother pass into fetus across placenta
   - Many antibodies are passed to the baby through breast milk
2) **Artificial passive immunity**
   - Introducing artificially **antibodies** into the body give immediate immunity

❖ **Antibodies** are drugs/ chemicals/which kill bacteria inside our body but do not harm human cell.
- Antibiotics have no effect on disease caused by viruses
- **Penicillin** is the first antibiotic produce by Alexandor Flemming




## 2.4. DISEASES

❖ Disease is a disorder state of an organ or organism
❖ Some of the most common human disease in Ethiopia

1) **Tape worm**
   - ❖ Tape worm live in the intestine of host
   - ❖ Have **head or scolex** which help to attach to the wall of intestine
   - ❖ Scolex have **suckers and hooks** used to attach the intestinal wall

- ❖ They have segmented body called **proglottids**
- ❖ The two most common tape worms that infect human are; **beef tape worm** (***Taenia saginata*** )and **pork tape worm** (***Taenia solume*** )
- ❖ Beef tape worm **cattle** intermediate host and pork tape worm **pig** intermediate host

☞ **Transmissions**
- ❖ Eating raw or undercooked meat

☞ **Symptoms**
- ❖ Vitamin B12 deficiency
- ❖ Weight loss

☞ **Control and prevention**
- ❖ Use proper latrine
- ❖ Meat inspection
- ❖ Meat should be cooked well

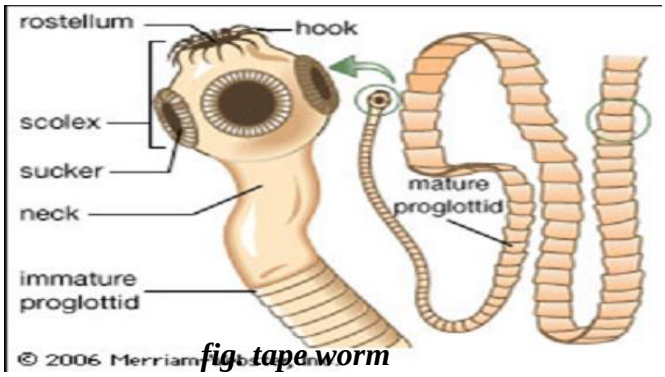


***fig. tape worm***

☞ **Special adaptation of tape worm to service inhuman gut**
- ❖ Scolex has hooks and suckers helps the parasite attached to small intestine
- ❖ Flattened body absorbed digested nutrient over a large surface area
- ❖ Thick cuticle to prevent from intestinal enzymes

**2) Tuberculosis(TB)**

☞ **Cause**
- ❖ The bacteria called mycobacterium tuberculosis

☞ **Symptoms**
- ❖ Loss of weight
- ❖ Persistent cough
- ❖ Night sweat
- ❖ Loss of appetite
- ❖ Fever and chest pain
- ❖ Blood in sputum

**TB** usually affect lung (pulmonary TB) but it can also affect kidneys, lymph nodes, joints and bones

☞ **Transmission**
- ❖ Through air droplet cough , sneeze
- ❖ Infected milk

☞ **Prevention**
- ❖ Pasteurize milk
- ❖ Vaccination
- ❖ Avoid droplet infection
- ❖ antibiotics

3) **Malaria**
- ❖ Vector born disease ( **vector** an organism that transmit disease causing microorganisms from one host to another )
- ❖ Affect the **liver** and **red blood cells. How?**

☞ **Cause;** parasite called **plasmodium**

- **Symptoms**
  - High fever, chills and sweats
- **Transmission**
  - by **the bite of female anopheles mosquito**
- **Preventions**
  - Avoid contact with mosquito using mosquito **repellents**, fixing **screen on windows**, using **net over beds**
  - Remove mosquito breeding place
  - **Biological control** ( introducing an organism such as fish into the water that feeds on larva)
  - **Chemical control** sprayed on to the water in order to kill mosquito larva and egg

**4) Gastroenteritis/acute watery diarrhea AWD/**

- If someone suffering from AWD , the lining of the stomach, small intestine, become inflamed and painful
- Water cannot be reabsorbed by the inflamed lining the large intestine, resulting in liquid diarrhea

- **Caused**
  - **Viruses** rotavirus**es**
  - **Bacteria** salmonella and Escherichia coli
  - **Protozoa** giardia and amoeba
- **Transmission**
  - Eating contaminated food and watery
- **Symptoms**
  - Violet abdominal cramps and pain
  - Feeling nauseous, vomiting often both
  - Watery diarrhea which does not usually have blood in it
  - Slight fever
  - General muscle ache and head ache
- **Control and prevention**
  - Wash hands after using toilet, and before preparing and eating food
  - Make sure that the water you drink and use to wash salad food and fruit is clean and safe
  - Avoid raw and undercooked meat, egg, fish etc
  - Avoid contact with someone has AWD

**5) Cholera**

- **Caused**
  - Bacterial infection called ***vibrio cholera***
- **Transmission**
  - Contaminated food and water with faces

- **Symptoms**
  - Mild to severe diarrhea
  - Vomiting and dehydration
  - A pale an water y diarrhea
  - Loss of salt and dehydration
  - Sever muscular cramp
- **Control and prevention**
  - Replace the fluids and salt to prevent dehydration
  - Antibiotics are used to treat disease
  - Everyone has supply of clean, uncontaminated water
  - The sewage is disposed effectively
  - Avoid consuming uncooked food and water

**6) Typhoid**

- **Cause**
  - bacterial infection ***salmonella typhi***
- **Transmission**
  - Contaminated food and water by faces
- **Symptoms**
  - A very high fever 39-40$^0$C
  - A painful abdomen
  - Sore throat and headache
  - Constipation or diarrhea
  - An enlarged spleen and liver
  - Untreated thyroid, becomes delirious, weak, exhausted and may die
- **Control and prevention**
  - Used antibiotics
  - Need plenty of fluids to replace the one lost
  - High calorie meals to help mineral and energy they have lost
  - Carful hand washing after toilet

## Sexually transmitted disease (STD's)

- **STD'S** are transmitted through sexual contact
- They are also known as venereal disease
- The commonly known STD'S are gonorrhea, cancroids, syphilis, HIV/AIDS

**7) Gonorrhea**

- **Caused**
  - Bacteria called ***Neisseria gonorrhea***
- **Transmission**

- ❖ Spread through unprotected sex
- ❖ Mother to child during birth

☞ **Symptoms**

- ❖ **In men the symptoms of gonorrhea are**
  - ➢ Burning sensation during urination
  - ➢ Yellowish or white discharge from penis
- ❖ **In women mostly asymptomatic,** but sometimes it may show
  - ➢ Discharge from vagina
  - ➢ Burning sensation while urination
  - ➢ Untreated gonorrhea in pregnant women ,may result in **blindness** of her baby

☞ **Control and prevention**

- ❖ Respect ABC rule

  A; abstain B; be faithful C; use condom
- ❖ Visit clinics or hospitals

8) **Syphilis**

☞ **Cause**

- ❖ A bacterial infection called ***Treponema palladium***

☞ **Transmission**

- ❖ unprotected sexual intercourse
- ❖ congenital syphilis transmitted from mother to child

☞ **Symptoms** three major stage of symptoms

- ❖ **Primary stage** (the first six weak)
  - ➢ Painless sore at the site of infection
  - ➢ Swollen gland
- ❖ **Secondary stage** ( occur sex wreaks after primary infection)
  - ➢ Tiredness Hoarseness
  - ➢ Fever Loss of appetite
  - ➢ Sore throat Patch hair loss
  - ➢ Headaches Swollen gland
- ❖ **Third stage** (late syphilis)
  - ➢ It appears after years may cause severe irreversible problems
  - ➢ Involves illness of the **skin , bones, central nerve systems**
  - ➢ Transmitted from pregnant women to her baby and may cause death and deformity

☞ **Control and prevention**

- ❖ Respect ABC rules
- ❖ Visit clinic and hospitals
- ❖ Blood test for pregnant women
- ❖ If you are infected, avoid sexual contact

**9) Chancroids**

- **Cause**
  - A bacteria called ***Hemophilus ducrey***
- **Transmission**
  - Unprotected sexual intercourse
- **Symptoms**
  - **First stage**
    - Ulceration on genitals, particularly on penis
    - Bleeding of ulcer and bursting of pus
  - **Second stage**
    - Swollen glands which are filled with pus
    - Permanent loss of penis
- **Control and prevention**
  - Taking effective dose of antibiotics
  - Respect ABC rule
  - good genital hygiene , male circumcision

**10) HIV/A IDS**

- Acquired Immune Deficiency Syndrome (AIDS) is the medical term for a combination of illnesses that result when the immune system is weakened or destroyed
- **Caused** by Human Immunodeficiency Virus (HIV), a virus that attacks the immune system, making the sufferer susceptible to other diseases.
- **Transmission**
  - Sexual intercourse with infected person.
  - From infected mother to her baby in the womb, during birth breastfeeds.
  - Through Infected blood transfusion
- **Fight against HIV/AIDS**
  - Education on HIV/AIDS (transmission and prevention)
  - Avoid stigma and discrimination
  - Encourage people to take voluntary HIV-test

## The lymph system and Immune system

- Immune system is based in **lymph system** which spreads throughout the body.
- The lymph vessels carrying a fluid called **lymph**
- **Lymph defend the body against disease** by producing lymphocytes
  - **Lymphocytes** produce antibodies against invading pathogens.
  - The lymph glands filter out bacteria and other microbes from the lymph to be ingested by the phagocytes.
- Enlarged lymph glands are a sign that the body is fighting off an invading pathogen.
- The main sites of the enlarged lymph glands
  - **Axillary lymph nodes (in armpit)**
  - **Cervical lymph nodes (neck)**
  - **Mesenteric lymph nodes (gut)**
  - **Inguinal lymph nodes (in groin)**

☞ **How does HIV attack the immune system?**

- ❖ There are two main types of white blood cells in the immune system.
  - ➢ **T-cells** bind to foreign antigen and destroy it.
  - ➢ **B-cells** make antibodies which bind to the antigen and destroy it.
    - ✓ Make memory cells which 'remember' how to make the right antibodies if the same foreign antigen turns up again
- ❖ HIV **attacks the T-cells** of the immune system

**Summery**

| No | Disease | Caused by | Root of transmission |
|---|---|---|---|
| **1** | **Tape worm** | Parasitic flat worm | Eating raw or under cooked meat |
| **2** | **Tuberculosis** | Bacteria, *Mycobacterium tuberculosis* | Air droplet /aerosol/ |
| **3** | **Malaria** | Protozoa, **plasmodium** | Bite of anopheles mosquito |
| **4** | **Cholera** | Bacteria, ***Vibro cholera*** | Contaminated food and water |
| **5** | **Typhoid** | Bacteria, ***Salmonella typhi*** | Contaminated food and water |
| **6** | **AWD** | Bacteria, Virus, Protozoa | Contaminated food and water |
| **7** | **Gonorrhea** | Bacteria, ***Neissaria gonorrhea*** | Unprotected sexual intercourse |
| **8** | **Syphilis** | Bacteria, ***Treponema palladium*** | Unprotected sexual intercourse |
| **9** | **Chancroid** | Bacteria, ***Hemophilus ducrey*** | Unprotected sexual intercourse |
| **10** | **AIDS** | Virus, Human Immune Virus | Unprotected sexual intercourse |

# UNIT 5
# CLASSIFICATION

## 5.1. PRINCIPLES OF CLASSIFICATION

☞ **The importance of classifying organism**

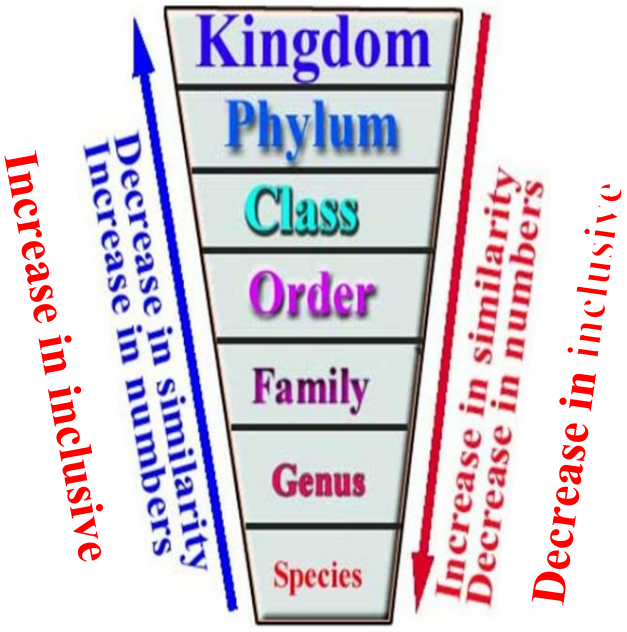
- ❖ To simplify the study
- ❖ Try to understand how life originated
- ❖ To bring order out of chaos or confusion

☞ **The classification system**

- ❖ **Species** a group of organism that can breed successfully with one another to produce fertile offspring
- ❖ **Classification** is the system of groping organism based on similarity and difference
- ❖ **Taxonomy a** branch of biology which is concerned with classification of organism
- ❖ **Dichotomous key/ identification key**/the a type of key used to classify living organism based on making a choice between two alternatives
- ❖ **Groups of living things into categories** is called **taxa**
- ❖ The main taxonomic categories are;

\\\\

- ➢ **Largest**; kingdom **Smallest**; species
- ➢ Kingdom divided into phylum , phylum divide into class
- ➢ Similar phylum group into kingdom, similar class group into phylum
- ➢ Species contain one type of organism, which have all their main feature in common



☞ **Naming of living things**

- ❖ **Linnaeus** was the first biologist who introduce **binomial system** of classification
- ❖ **Binomial system** of naming organism has two names
- ❖ The **first** name **genus** while the **second** name **species** both name derived from latin
- ❖ The genus name starts in capital latter and the species name in small latter
- ❖ The scientific name should be underlined or printed in italics
- ❖ Examples
  - ➢ human beings ; ***Homo sapiens*** ***Homo,*** genus name ***sapiens,*** species name
  - ➢ Dog; ***Canis familiaris*** ***Canis,*** genus name and ***familiaris*** species name
  - ➢ House flies; ***Musca domestica***
  - ➢ Domestic cat; ***Felies domestica***

**Review Question p.177**

## 5.2. THE FIVE KINGDOM

**In modern classification, there are five kingdoms namely;**

| | Kingdoms | General characteristics |
|---|---|---|
| **1** | **Monera** | Unicellular prokaryotic organism E.g. **Bacteria** |
| **2** | **Protista** | Unicellular eukaryotic organism E.g., algae and protozoa |
| **3** | **Fungi** | Unicellular or multicellular organisms E.g. yeast and mucor |
| **4** | **Animalia** | Eukaryotic without chlorophyll E.g. man |
| **5** | **Plantae** | Eukaryotic chlorophyll containing organism. E.g. angiosperm |

### I. Kingdom monera

- ❖ Are unicellular prokaryotic, that do not have membrane bonded nucleus
- ❖ Include all bacteria and blue green algae
- ❖ Bacteria act as pathogens
  - ➢ *Mycobacterium tuberculosis* which cause tuberculosis
  - ➢ *Haemophilus ducrey* that cause chancroid

### II. Kingdom protista /protoctista/

- ❖ Unicellular and eukaryotic ,that do have a nucleus
- ❖ They live as a parasite and free living
- ❖ Some protista cause a serious disease
  - ➢ *Plasmodium falciparium* which cause malaria
  - ➢ *Entamoeba histolyca*, which cause amoebic dysentery
  - ➢ Trypanosoma, a blood parasite that cause sleeping sickness
  - ➢ Dianoflagelates , which cause bioluminescence

### III. Kingdom fungi

- ❖ Eukaryotic, unicellular and heterotrophic organism
- ❖ Have cell wall made up of chitin but lack chlorophyll
- ❖ Mood of nutrition

- **Saprophytic fungi** feed on dead materials. They act as decomposer which have a role in recycling of nutrients .E.g. **Rhizophus, Mucor, penicillium**
- **Mutualism fungi**; live in close association with other organism and both benefit. E.g --**Lichens** an association of fungi and green algae
  --**Mycorrhiza**l an association of a fungus a root of plant
- **Parasitic fungi;** Feeding on living organism. ***Candida albicans*** cause trush**,** ***Tinea pedis*** cause athlete's foot

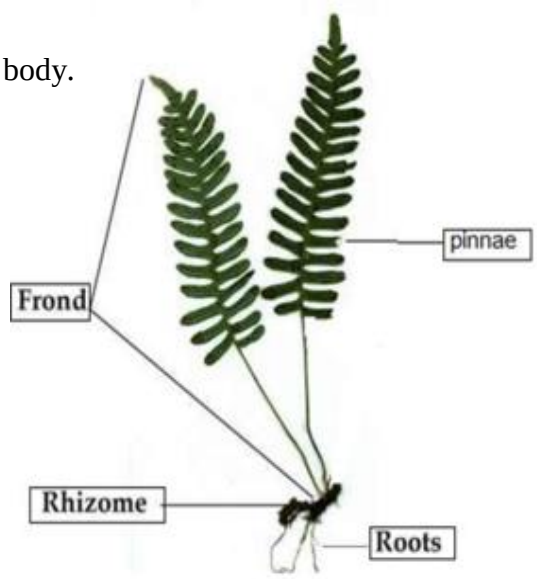
## IV. Kingdom Plantae

The main characteristics of plant

- Have eukaryotic cell
- Multicellular organism
- Contain chlorophyll and carry out photosynthesis
- Predominantly land dwelling
- Have cuticle to prevent water loss
- Four important **division** ;
  - **Bryophytes,**
  - **pteridophyta,**
  - **Gymnosperm,**
  - **Angiosperm**

☞ **Division bryophytes (mosses and liverworts)**

- They are the simplest land plant
- They have no true root, stem and leaf, they have thallus body.
- They are non-vascular ( no xylem and phloem)
- Have a simple leaves
- Have a simple root like structure called **rhizoid** which is used for absorption of nutrient
- Commonly found in rainforest and high altitude




☞ **Division pteridophyta (Ferns)**

- Have well develop root, stem and leaf
- Have horizontally growing stem called **rhizomes**
- The fern leaf is called **fronds**
- Reproduce by **spores** found in **sori,** at the back of leaf
- **Have vascular tissue (**xylem and phloem**)**

☞ **Spermatophyte (Seed bearing plant)**

- Have well develop root stem and leaf
- Have well develop vascular tissues
- Male gametes contained in a pollen grains and the female gamete found in the embryo sac
- The product of fertilization in sexual reproduction is seed
- Spermatophyte divided into two division
  - **Division gymnosperm** and **Division angiosperm**

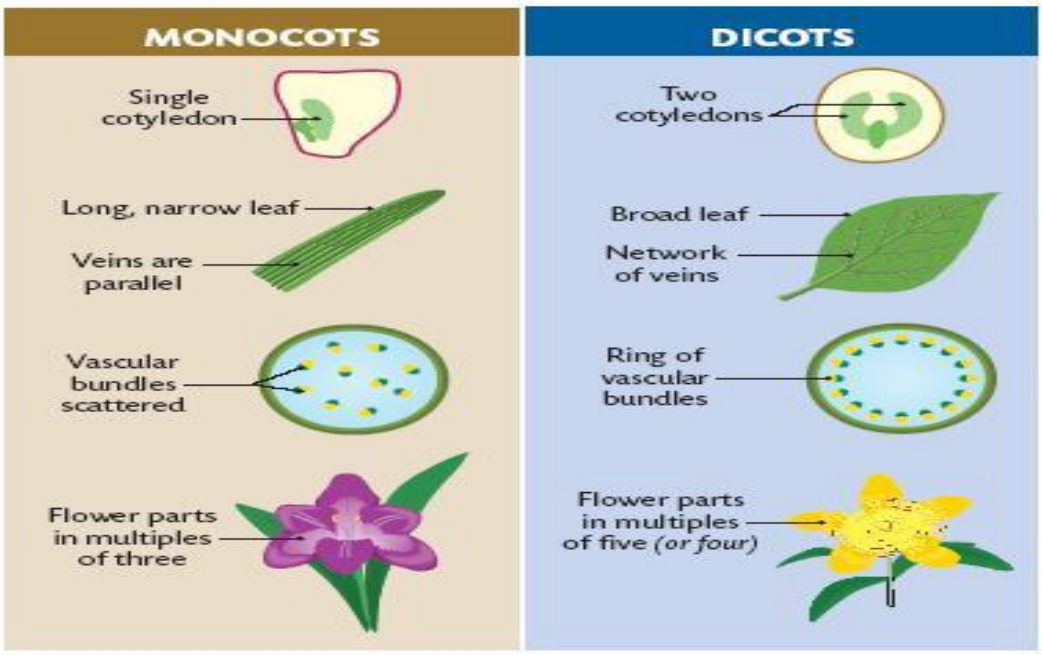
**Division Gymnospermae (conifer, Non flowering plant)**

- Seed are not enclosed in a fruit
- Have small needle shaped leaves with a weak waxy cuticle in order to
  - To reduce water loss, minimizes damage by excess heat or cold
- They are evergreen
- Reproductive organ male and female **cones**
- Do not have flower and fruits
- E.g. pinus , yabesha tid,

**Division Angiosperm (flowering plant)**

- Reproductive organ flower
- Seed enclosed in fruit
- Well develop xylem and phloem tissue
- Angiosperm divided into two sub class based on the number of cotyledon in their seed
  A. Monocotyledon (monocot)
  B. Dicotyledons ( dicots)

| Monocots | Dicots |
|---|---|
| The embryo has single seed leaf | The embryo has two seed leaf |
| Parallel venation of leaves | Net (reticulate) venation of leaves |
| Leaves are generally long and thin | Leaves are often relatively broad |
| Vascular bundle are scattered | Ring of vascular bundle |
| Generally do not reach great size ( absence of cambium) | Same dicot reach great size( have vascular cambium0 |
| Often wind pollinated | Often insect pollinated |
| E.g. maize, grass, Orichids | E.g. pea rose, bean, mango, jacaranda |



## V. Kingdom Animalia

- Multicellular ,eukaryotic, ,heterotrophic organism
- Feed on other organism
- Exhibit locomotion, move their body from one place to another
- The cell do not have cell wall
- The major phylum in animal kingdom

| Animal phylum | Representative examples |
|---|---|
| **Porifera** (sponges) | Sponges |
| **Coelenterate** (cnidarian) | Sea anemones, hydra, jellyfish, Coral |
| **Platy helminthes**(flat worm) | Planeria ,tape worm, liver flukes, |
| **Nematodes**(round worm) | Ascaris, |
| **Annelids** segmented worm) | **Earthworm, leech** |
| **Mollusca** Soft bodied animal) | **Octopus, squid, Slugs, Snail** |
| **Echinodermata** (spiny skinned animal) | Starfish (Asteris),sea cucumber, sea urchin |
| **Arthropod**(joint footed animal) | Insects, arachnidan, crustacean, diplopods , Chilopods |
| **Chordate** | Pisces, amphibians, reptiles, aves, mammals |

1. **Phylum Porifera** (sponges)
   - No tissue organization
   - Single body cavity
   - Numerous pores in body wall
   - They are hallow filter feeders
   - Adult are sessile; permanently attached to the surface of sea
   - Co-ordination supported by **calcareous spicules**




***fig. sponges***

2. **Phylum Coelenterates (Cnidarians)**
   - Have two body layer
   - Have only one opening mouth
   - Radial symmetry
   - Mouth supported by tentacle used for
     - Capturing prey
     - Have stinging cell for poisoning or immobilizing prey



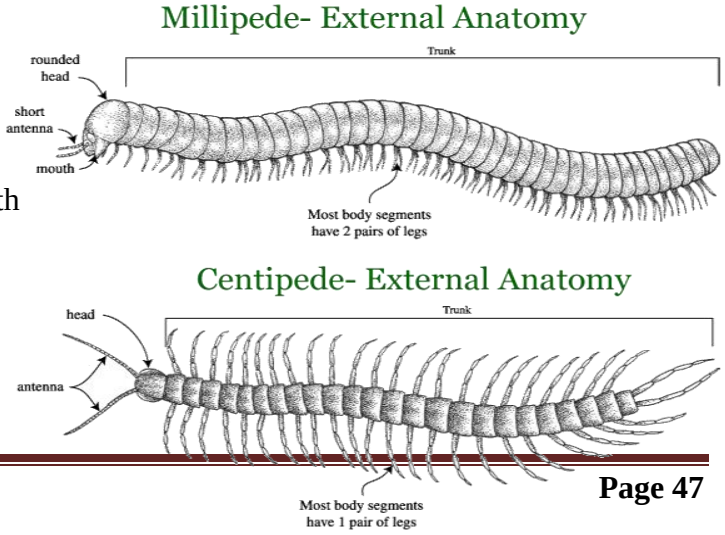

***fig. hydra*** ***fig. jelly fish***

3. **Phylum Platyhelminths - flat worm**
   - ❖ Have no body cavity
   - ❖ Have flat body shape
   - ❖ Are bilateral shape
   - ❖ Bilateral symmetry
   - ❖ They are hermaphrodites
   - ❖ Have mouth but no anus



***fig. Planarian***

4. **Phylum Nematodes - Round worm**
   - ❖ Have narrow, thread like body
   - ❖ Bilateral symmetry
   - ❖ Body not segmented
   - ❖ No circulatory system
   - ❖ Complete digestive system with mouth and anus
5. **Phylum Annelid- Segmented worm**
   - ❖ Have closed blood circulatory system
   - ❖ They are hermaphrodite
   - ❖ Bristle like structure called **chaetae,** help them to move
   - ❖ Most are free living
6. **Phylum mollusca -Soft bodied animal**
   - ❖ Have soft body
   - ❖ Body not segmented
   - ❖ Most have shell
   - ❖ Body divided into head, foot and Visceral mass, Breath through gills
7. **Phylum Echinodermata- spiny skinned animal**
   - ❖ Have exoskeleton Have many tubular feet
   - ❖ Body covered with spin Are radial symmetry
8. **Phylum arthropods – joint footed animal**
   - ❖ Have jointed appendage
   - ❖ Have an exoskeleton made of chitin, which is used;
     - ➢ Prevent water loss
     - ➢ Limits their growth
   - ❖ Have segmented body
   - ❖ Have well develop nerve system
   - ❖ Complete gut from mouth to anus
   - ❖ The **most varied animal** on the earth
   - ❖ Divided into a number of five class;
     1) **Class insect**
     2) **Class crustacean**
     3) **Class chilopodes - centipedes**
     4) **Class Diplopod- millipedes**



**5) Class Arachnidan**

| **Class Insects** | **Class Crustaceans** | **Class Chilopoda /Centipedes/** | **Class Diplopods /Millipedes.** | **Class /Arachnidan/** |
|---|---|---|---|---|
| ➢ Tree body parts<br>➢ Head, thorax, abdomen<br>➢ 3 pair of jointed Legs<br>➢ 1 or2 pair of wing<br>➢ have a pair of antenna<br>➢ one pair of Compound eye<br>➢ E.g **flies, beetles** | ➢ body two parts **Cephalothoraxes (**fused head & thorax)**,** Abdomen<br>➢ body covered by **Carapace**<br>➢ four pair jointed leg<br>➢ two pair of antenna and simple eye<br>➢ E.g**. lobsters, wood lice, water flies** | ➢ flat body<br>➢ bright colored body<br>➢ few segment<br>➢ 1 pair of limb per segment<br>➢ Carnivores<br>➢ poisoning claws<br>➢ For paralyzing prey | ➢ cylindrical body<br>➢ dull colored body<br>➢ have more segment<br>➢ 2 pair of limb per segment<br>➢ Herbivores<br>➢ have claws for biting and chewing prey | ➢ two body parts **Cephalothoraxes** Abdomen<br>➢ **with no antenna**<br>➢ 4 pair of legs<br>➢ have simple eyes<br>➢ E.g**. Spider, tikes, scorpions, mites** |

**9. Phylum chordate**

- ❖ Have notochords
- ❖ Have hallow nerve cord
- ❖ Have gill slits later replaced by lungs and gills

**Vertebrates**

- ➢ **I**nvertebrates make up 99.9% of animals
- ➢ Have endoskeleton made of bone and cartilage
- ➢ Have closed blood circulatory system
- ➢ Have well developed nerve system
- ➢ Two pair of limb and kidney as execratory organ

❖ Phylum chordate **divided into 5 classes**

| **Bony fish** | **Cartilaginous fish** |
|---|---|
| Have bony skeleton | Have cartilaginous skeleton |
| Have round shaped scales | Have scale but not round |
| Opercula covering the gills | No opercula but have gill slits |
| Have homocerical Tail( even size fin) | Have heterocerical Tail (different size) |
| Usually smaller size | Usually larger size |
| **E.g. Tilapia, Nile perch, catfish, cod,** | **E.g. Sharks, skates, rays** |

**1. Class Pisces-the fish**

- ❖ Are aquatic
- ❖ **Ectothermic**
  - ➢ variable body temperature
  - ➢ need environment to regulate their body temperature
- ❖ Have gill

- Have fins
- Lay unfertilized egg
- Divided into two sub class
  - **Teleosts** - bony fish
  - **Elasmobranches**- cartilaginous fish

**2. Class Amphibian**

- Live on land and water
- Have moist skin (respiratory surface)
- Lay unfertilized egg in water
- Larva (**tadpole**) live in water
- The adult live both on land and water
- Are **Ectothermic**
- E.g. frogs, toads, newts, salamander

| FROG | TOADS |
|---|---|
| Has smooth skin | Has rough skin |
| Has a moist skin | Has a dry skin |
| Has more webbed feet | Has less webbed feet |
| Has bright colored body | Has a dull colored body |
| More streamlined body | Less streamlined body |
| Has extra-long hind legs | Has hind legs that are not extra long |

**3. Class Reptiles**

- Have dry skin with scales
- Gas exchange take place in the lung
- Developed internal fertilization
- Lay egg in land in a leather shell
- Gill slits only seen in embryonic stage
- Have no external ears
- Are ectothermic E.g. snake, Crocodiles, Lizard

**4. Class Aves- Birds**

- Have **feathers**
- Fore limbs are adapted as wing
- Lay fertilized egg covered with shell
- Have beaks
- Have light skeleton , which make easier to fly
- **Are endothermic**-constant body temperature

**5. Class mammals**

- ❖ Feed their young with milk
- ❖ Have diaphragm
- ❖ Have 4 chamber heart
- ❖ Body covered with hair
- ❖ Have sweat gland
- ❖ Have well developed brain
- ❖ Are endothermic
- ❖ E.g. **rats, monkeys, dogs, human**

| **Sub division of class mammals** | | |
|---|---|---|
| **Egg laying mammals** | **Marsupials** | **Placental mammals** |
| ➢ Lay egg<br>➢ E.g. duck billed mammals | ➢ Produce immature young<br>➢ which are nourished milk in poach<br>➢ **kangaroo, koalbeer , opssum** | ➢ Higher mammals<br>➢ Produce fully developed young<br>➢ Nourished milk from mammary gland<br>➢ **Cats, caw, man** |

**EXERCISE**

1. In the scientific name *Canis familiaris* the word canis stands for?
   A. Genus name B. species name C. family name D. kingdom
2. Fish, Amphibian, reptiles, birds and mammals are grouped in the:
   A. phylum B. Order C. family D. class
3. Which of the following is the segmented warms?
   A. leech B. hook warm C. Ascaris D. tape warm
4. Dorsal nerve tube is a feature of;
   A. Echinodermata B. Mollusks C. Arthropod D. Chordate
5. Which of the following group of animals has varied animal on earth?
   A Arthropods B. Chordate C. Mollusks D. Echinodermata
6. Which major groups of plant kingdom is best characterize by having vascular tissue and reproduce by spores?
   A. Ferns B, Conifer C. Mosses D. Angiosperms

# UNIT 6
# ENVIRONMENT

- **Environment;** an organism's home and its surrounding
- **Ecology ;** deal with the study of environment
  - It concerned with the interrelation ship of organism with each other and with its environment
  - **It deal** biological organization above organism includes population, community ecosystem, biomes and biosphere
  - Ecology do not deal with individual organism

## 6.1 ECOSYSTEMS

- A life supporting environment
- All animals and plants that live in an area along with that thing that affect them
- Composed of biotic (living) and abiotic ( non-living) components

☞ **Abiotic components**

- Nonliving component of the environment
- Includes amount of **sun light**, amount of **rainfall**, **temperature**, type of **soil** and **rocks,** level of oxygen, **water. Wind**

☞ **Biotic component**

- The living organisms within an ecosystem which affect the ability of an organism to survive there
- Includes **disease** and **parasites, predator** numbers**, food** availability**, competition**
- **Competition;** animal compete for food, water, , territory, mate
  - Plant compete with each other for light, water and nutrient

## 6.2. FOOD RELATIONSHIP

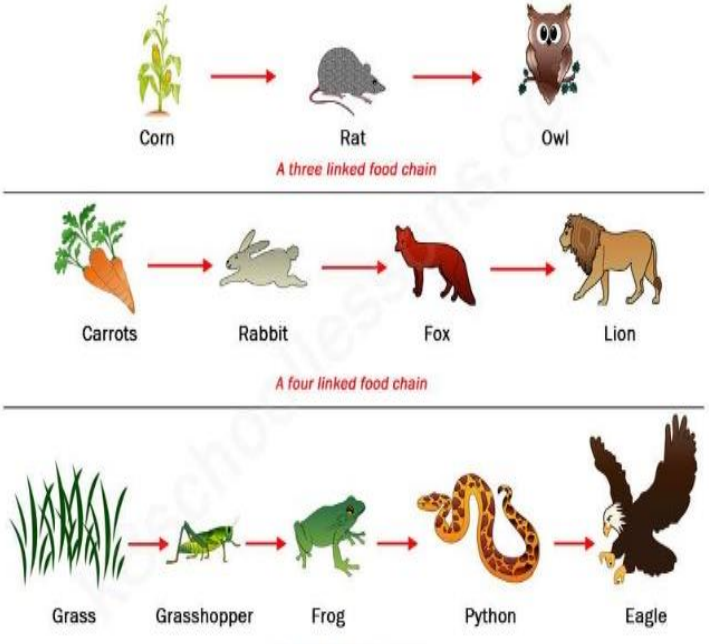
- Based on the mode of nutrition organism divided into two

1. **Autotrophs**
   - Organisms that can make their own food
   - Autotrophs can be divided into;
     - **Photo autotrophs (light feeders)**; a group of organisms that use sun light as primary source of energy to synthesis their own food **E**.g. Green plants because of making carbohydrate they are known as **producers**
     - **Chemo autotrophs;** a group of organisms that release energy from simple chemical reaction. E.g. nitrifying bacteria, green sulfur bacteria
2. **Heterotrophs**
   - Organism that cannot synthesis their own food. they are called **consumer**
   - Feed on other organism
   - Can be divided as herbivores, carnivores, omnivores and decomposer
     - **Herbivores**; animal that feed on vegetation. E.g. caw, giraffe

- **Carnivores;** animal that feed on animal flesh. E.g. Lion , cat
- **Omnivores**; animal that feed on b plant and animal flesh. E.g. human ,rat
- **Decomposers**; organism that break down dead bodies. E.g. bacteria, fungi

☞ **Food chains**

- Is a simple and direct feeding relation ship
- Involves the transfer of energy and nutrient from one organism to another
- Energy flow from producer to consumer. **Producers** ⟶ **Consumers**
  - **Producers;** first trophic level. **Green plant**
  - **Primary consumer;** second trophic level. **Herbivores and omnivores**
  - **Secondary consumer;** third trophic level. **Carnivores and omnivores**
  - **Tertiary consumer;** forth trophic level. **Carnivores**
- Omnivores can occupy primary and secondary consumer
- Decomposers are found at the end of food chain
- Grass ⟶ Caw ⟶ human
  - **Grass**; first trophic level and producer
  - **Caw**; second trophic level and primary consumer
  - **Human;** third trophic level and secondary consumer
- **Aquatic food chain** start microscopic photosynthetic organism known as **phytoplankton**
- **phytoplankton ⟶ zooplankton ⟶ fish ⟶ human**




*Fig, food chains*

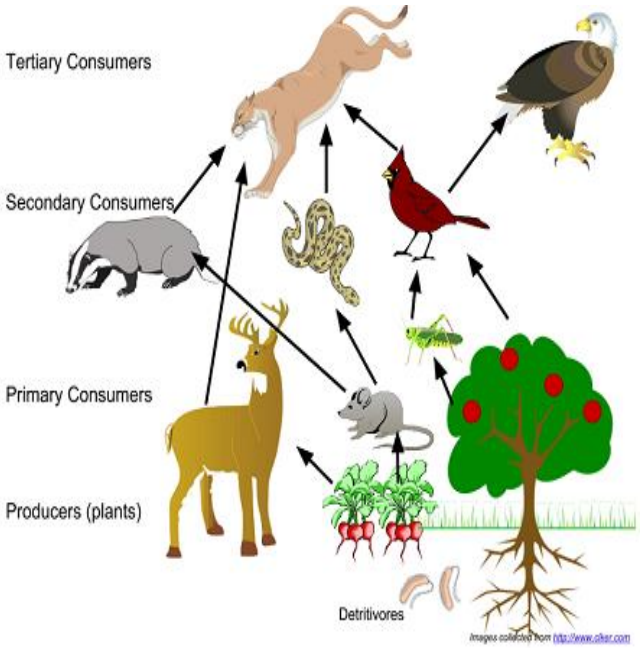



*fig. food web*

☞ **Food web**

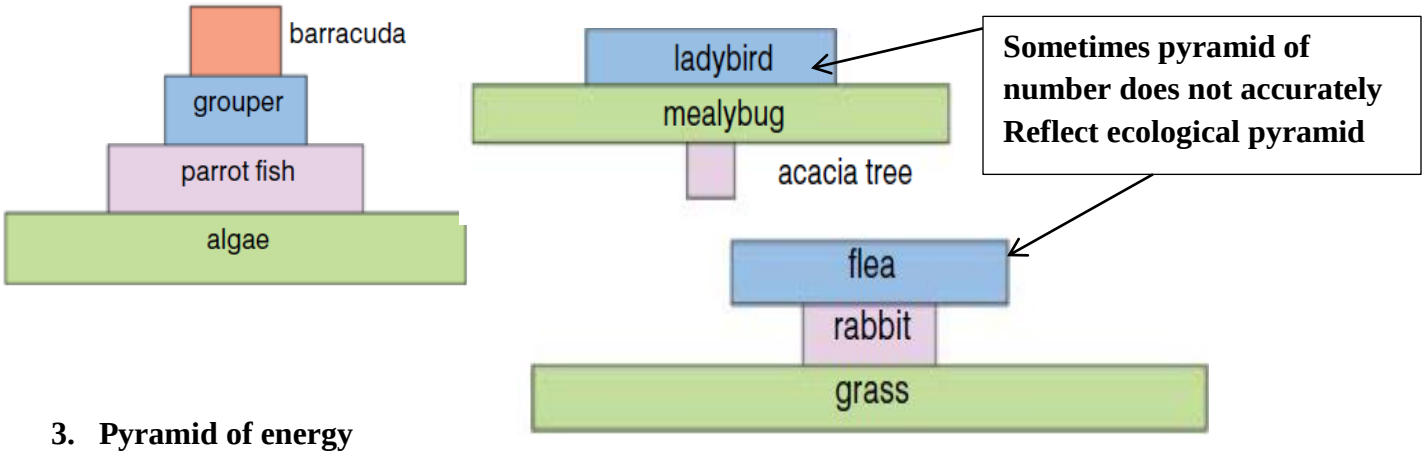
- Is a complex feeding interrelation between organism that consists many food chain
- The actual feeding relationships in a community
- **How many food chains can you construct in this food chain?**

**Ecological pyramid**

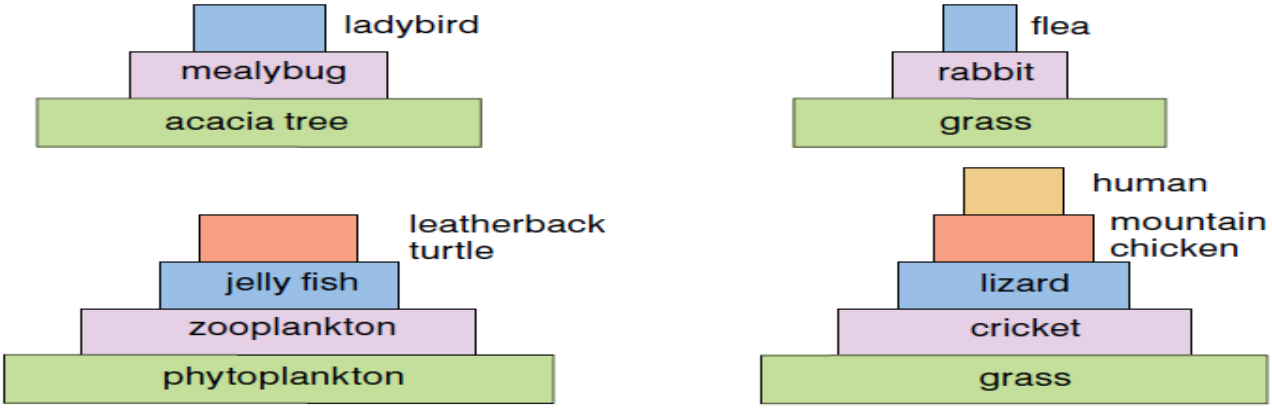
- Is a geographical representation designed to show the bio-productivity At each trophic level in a given ecosystem
- Three type of ecological pyramid

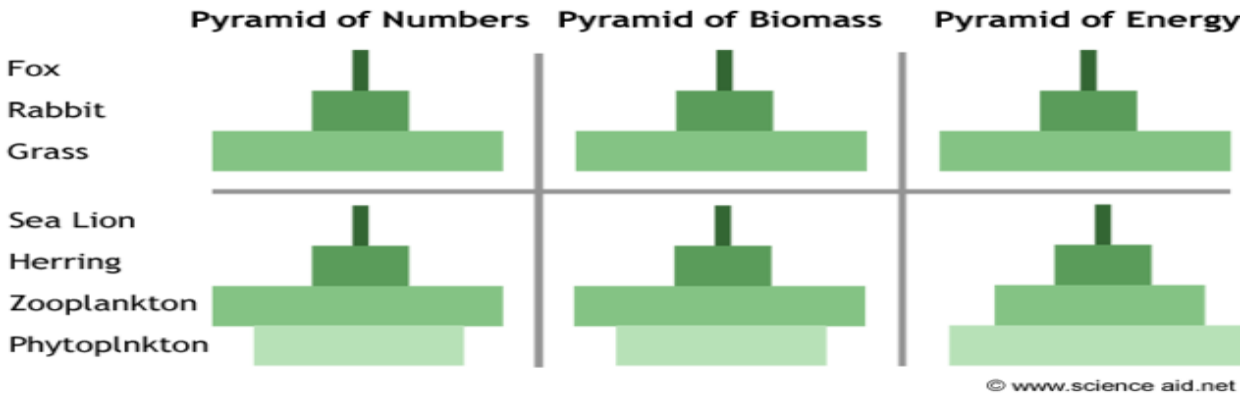
1. **Pyramid of biomass**
   - **Biomass;** the total amount of organic matter
   - Pyramid based on the dry mass of tissue of organism at each trophic level
   - The total amount of biomass decrease as we go from producer to consumer
   - At each trophic level biomass is lost by;
     - **Heat from respiration**
     - **Urine, faces and to provide energy**
   - **Limitation**
     - Gives equal value to tissue which differ in
     - Chemical Composition and energy value

2. **Pyramid of number**
   - Pyramid made based on the number of organism in each trophic level.
   - In most ecosystem the number organism decrease from producer to consumer



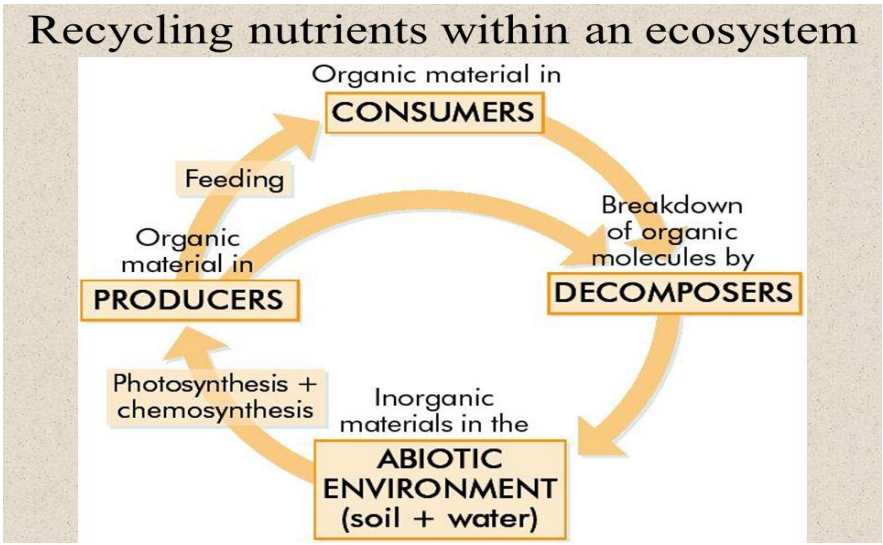

3. **Pyramid of energy**
   - Pyramid drown based on the amount energy produce at each trophic level
   - It gives the most accurate representation ecological pyramid






## 6.3. RECYCLING IN NATURE

- **Nutrient**( carbon, nitrogen, sulfur, and water) recycled in an ecosystem between organism and environment

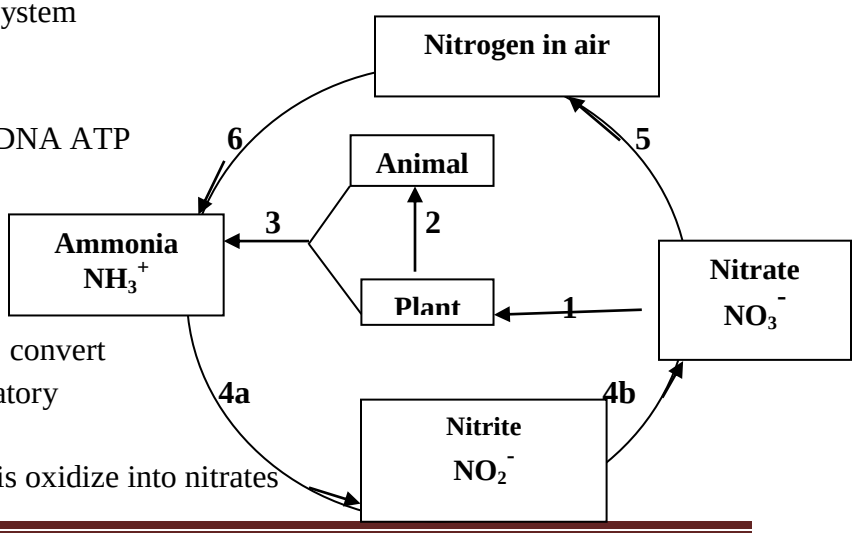



- **Decomposers ( bacteria and fungi**)play a huge role in recycling
- **Energy** never recycling in an ecosystem

**The nitrogen cycle**

N2 Is the part of protein, amino acid, DNA ATP

1. **Plant** absorb nitrate from the soil and make amino acid and protein
2. **Animal** obtains nitrogen by feeding of plant
3. **Putrefying /Ammonifying/ bacteria;** convert protein in dead bodies and their execratory product into ammonia
4. **Nitrifying bacteria ;** ammonium ion is oxidize into nitrates



in two process 4a. Nitrosomonas 4b. Nitrobacter

5. **Denitrifying bacteria;** convert nitrates in soil into elemental nitrogen, reduce the amount of nitrogen in the soil
6. **Nitrogen fixing bacteria;** convert elemental nitrogen into ammonium ion
   **Legumes (Pea, bean)**; in the root nodules of many legumes plant have symbiotically nitrogen fixing bacteria called rhizobium, which have the ability to fix nitrogen in the soil.

**Carbon cycle**

- **Important process in carbon cycle**
  a) **photosynthesis;** remove the amount carbon dioxide from the cycle
  b) **respiration;**
  c) **combustions;** } increase the amount of carbon dioxide in the atmosphere
  d) **decomposition;**

  - **Ozone;** layer of the atmospheres that protect the earth from harmful ultraviolet light from the sun
- **Global warming;** is the rising of temperature on earth's surface as a result of accumulation of **greenhouse gas** like **carbon dioxide** and **methane**
  - **Carbon dioxide $CO_2$** ; Increase as a result of human activity such as
    - **Combustio**n Burning of fissile fuel, **Deforestation**, **Respiration**
  - **Methane; It is** increased in the atmosphere as a result of
    - Growth of rice in swampy condition
    - Digestive activity of cattle produce methane

review question **P.217**

## 6.4. ADAPTATIONS

- **Adaptation**s; features of organism develop which make it possible for them to survive in a particular habitat

**1) Animal in cold climate**

- **Reduce surface area to volume** ratio, larger size like seal, whales and polar beer in order to prevent heat lost.
- **Small extremities** like ear to reduce heat loss. E.g. polar beer
- Thick layer of fat under skin **(blubber)** to store more internal heat
- Have t**hick fur coat** on the outside will insulate an animal

**2) Animal in dry climate**

- The biggest challenge of animal live in desert
  - Coping with the lack of water
  - The rise of core body temperature
- Large surface area to volume ratio (small size) to loss more heat
- Obtains water from the food they eat
- Lot of sweat produced in order to coal the body

- ❖ Active in early evening and late evening
- ❖ Big ear like **fennec fox** to loss heat faster
- ❖ Thin fur coat in order to loss heat

**3) Plant adaptation in desert**

- ❖ Deep growing root system to absorb water
- ❖ Thick and fleshy stem, root to store more water
- ❖ **Sunken and few stomata** to reduce the amount of water loss
- ❖ **Thick waxy cuticle** to reduce the amount of water loss
- ❖ **Leaves are reduce** to reduce transpiration
- ❖ **Have curled leaves**; these reduce the surface area of the leaf and trap moist air around the leaf.

☞ **Camouflage**; is the ability of an animal to blend its color into the surrounding environment to avoid detection.

- ➢ Important both to predator(the prey does not see them coming) and to prey ( they cannot be seen)
- ➢ Arctic fox change the grey and browns of their summer coat into pure white in winter

**Unit exercise**

**Choose the best answer**

**End unit questions p.225 and P. 222**

1. All non living things in an ecosystem are called?
   A. Abiotic component B. Biotic components C. Population D. ecosystem
2. A certain plants requires moistures, $CO_2$, light, and minerals. This shows that living organism depend on;
   A. biotic factor B. Abiotic factor
   C. symbiotic relationship D. carnivore and herbivore relationship
3. Which is a biotic factor operating in an ecosystem?
   A. A climate in a given region C. the amount of nitrogen gas in the air
   B. A carnivore that consume other animal D. the rate of flow of water in the river
4. A cactus is adapted to service in a desert condition. Which of the following is true?
   A. Flower only open during the heat of the day
   B. The leaves are spin to prevent water loss
   C. the leaves are spin to prevent eating by animals
   D. the swollen stem stores water
5. Organism that obtain nutrients by breaking down dead and decay plants and animals are called;
   A. Omnivores B. Decomposers C. producers D. scavengers
6. The total amount of living tissue within a given trophic level is called?
   A. Organic mass B. Energy mass C. Trophic mass D. Biomass
7. The relationship between two species where one benefits while the other unaffected is called;
   A. Mutualism B. parasitism C. Commensalism D. Predation