THE LESTER VAUGHAN

THIRD FORM

BIOLOGY

MANUAL

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Updated 2016

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Reference Books
Beckett and Gallagher, *Co-ordinated Science Biology*, second Edition – Text Book
Roberts and Mitchelmore, *Biology for CXC*
Chinnery et al, *CXC Biology*
McKean, *Introduction to BIology*

INTRODUCTION

Biology is the Science that deals with living organisms. The knowledge of Biology explains how your body works and thus is useful for everyday living. It can also be used to study medicine, environmental studies, marine biology, nursing, pharmacology, dentistry, veterinarian science, immunology, physiology, botany and teaching – just to name a few areas!

The CXC syllabus for all the Sciences begins in third form. With third form Biology, you may do Biology or Human and Social Biology or Integrated Science in fourth form. If you want to do Biology at a higher level (A level or CAPE), you must also do Chemistry at (O level or CSEC).

Biology is definitely a practical subject. You must be able to describe how various processes occur in living organisms, draw and label diagrams of structures. Biology has its own vocabulary and you must learn the meaning of these new words. In your notebook you need to have a vocabulary section. It should be full of diagrams you have to learn, definitions and descriptions.

HOW TO SUCCEED IN BIOLOGY

- ✓ **Reading** – Biology requires reading of both the notes you get from your teacher and the text book. It is the first step to learning your work.
- ✓ **Always study for tests.** This seems obvious but many students cram for tests the night or even worse, the morning of the day of the test. Studying should take place in stages and doing it right helps you succeed.

- ✓ **Use your syllabus to help you study.** The syllabus tells you exactly what you have to be able to do for each topic. Use it to test yourself.
- ✓ **Practicals** – take your practical work seriously, write them up properly and you'll never get less than an 'A'.
- ✓ **Projects and assignments** – follow the guidelines and you'll get an 'A' grade.
- ✓ **Standardized Tests** – these are end of unit tests that every third former must do. There will be one in term 1 and one in term 2.

STUDY METHODS

METHOD 1 – A TOPIC WITH NO DIAGRAMS

Read your notes (learning as you go); read your text book; test yourself.

METHOD 2 – A TOPIC WITH NEW WORDS AND DIAGRAMS

Read your notes; learn the meanings of all the new words; practise labelling your diagrams; read your text book; test yourself

METHOD 3 – STUDY CARDS

1. Write over your notes but in short points on index cards.
2. Draw your diagrams on separate index cards, labelled with letters, write what the letters represent on the back of the card (so you can test yourself).
3. Write all your new words on the back of your notebook to create a vocabulary section.

METHOD 4 – FOR LEARNING NEW WORDS

1. Use a marker to write your new words on a piece of coloured paper or card.
2. Write the definitions on another piece of coloured paper or card
3. Cut out the words and definitions, mix them up and match words with definitions.

SYLLABUS

TOPIC	
LIFE PROCESS	Definitions and Functions
CELLS	Plant and animal cell structure, , cell specialization and organization
DIFFUSION AND OSMOSIS	Definition and importance, definitions.
PHOTOSYNTHESIS	Definition, equations, importance, structure of leaf, testing a leaf for starch
NUTRIENTS	Balanced diet, food groups, nutrients, deficiency diseases, diabetes, hypertension, obesity,
TEETH AND DIGESTION	Definitions, structure and function of alimentary canal, tooth structure, function, care, herbivore and carnivore dentition
RESPIRATION	Definition, equation, structure of respiratory system
CIRCULATORY SYSTEM	Components of circulatory system, blood.

ECOLOGY	Definitions, food chains, food webs, energy relationships, decomposers, interdependency of organism, soil

LIFE PROCESSES

REVIEW

All living things carry out certain life processes. You should be able to define each process and state its importance to living organisms. An easy way to remember the life processes is the word REMINDeR. Each letter represents a life process expect for the second e which just completes the word.

Respiration

Definition: The breakdown of food to release energy

Importance: To provide the energy to carry out the life processes e.g. movement and growth.

Excretion

Definition: The removal of metabolic waste products

Importance: Metabolic waste products are produced by chemical reactions. They are dangerous if allowed to accumulate in the body. Examples of metabolic waste products are carbon dioxide (from respiration) and urea (from excess proteins).

Movement

Definition: The whole or partial displacement of an organism.

Importance: Movement is important in growth, in fact most movement in plants is growth movement. Most plants are unable to move from place to place but animals can. Movement is also important for reproduction, protection from unfavourable conditions and predators and feeding.

Irritability

Definition: The ability to sense and respond to changes in the internal and external environment.

Importance: Irritability is important for reproduction (e.g. animals on heat); to maintain internal environments (e.g. when an organism becomes overheated); for protection from predators and unfavourable conditions; for feeding.

Nutrition

Definition: The making or use of food.

Importance: Food is used for energy, growth, development and repair.

Types of Nutrition

There are two types of nutrition:

(i) autotrophic nutrition where the organism makes its own food e.g. photosynthesis carried out by plants.

(ii) heterotrophic nutrition where the organism feeds on other organisms e.g. holozoic nutrition carried out by animals.

Development and Growth

Definition: To increase in size and complexity of an organism.

Importance: To reach maturity, in order to carry out all of the life processes e.g. reproduction cannot occur unless an organism has reached a certain level of maturity.

Reproduction

Definition: The ability to produce new organisms.

Importance: To carry on the species.

Types of Reproduction

Asexual reproduction: one individual is involved and there is no exchange of gametes
e.g. a potato budding into a new plant, a banana sucker. The offspring is identical to the original. A gamete is a sex cell.

Sexual reproduction: two individuals are involved there is an exchange of gametes.
Hermaphrodites are organisms with both male and female sex organs e.g. an earthworm but they still need two to reproduce.

Some plants can reproduce both asexually and sexually. Some animals can too but most complex animals reproduce sexually.

Assignment 1

Read pages 6 and 7 in your text book. Answer questions 1 – 4 on page 7 in your notebook.
Read pages 8 and 9 in your text book.

Assignment 2

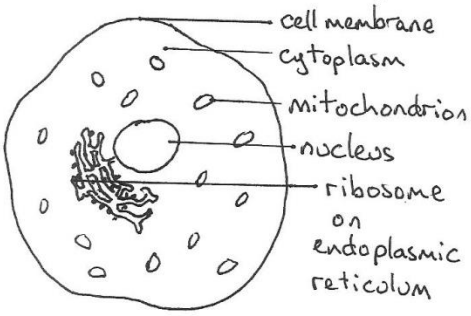
Read your notes on life processes. Answer the following question in your notebook.
'A moving motorcycle uses fuel for energy, gives off exhaust, has gauges to show low fuel, oil and other things. What features do motorcycles share with living organisms. Explain why motorcycles cannot be considered to be living.

CELL STRUCTURE AND SPECIALIZATION

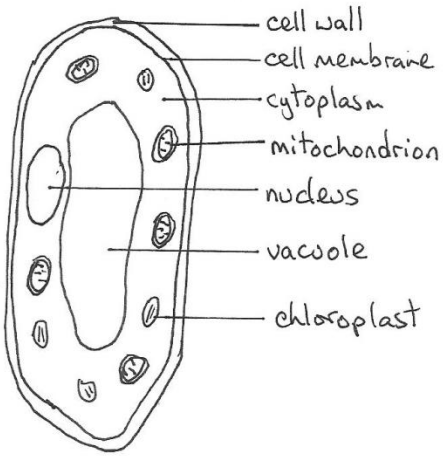
INTRODUCTION

Cells are the basic units of protozoa and multi-cellular organisms. Bacteria, protists, fungi, animals and plants are all made up of cells.

CELL STRUCTURE



Animal Cell



Plant Cell

FUNCTIONS OF CELL STRUCTURES

Cell membrane – surrounds cell, controls what enters and leaves the cell
Cytoplasm – gel-like substance that fills the cell and contains cell organelles
Cell wall – made of cellulose, it surrounds plant cells and gives them their shapes

Cell Organelles – these are membrane-enclosed structures with specific functions. The following are cell organelles.

- Nucleus – control centre of the cell, it is responsible for the production of proteins and cell division
- Mitochondria – respiration occurs in them.
- Chloroplast – contains chlorophyll, photosynthesis occurs in it
- Vacuole – a fluid filled structure, the fluid is called cell sap, it contains sugars and other substances and it helps maintain the firmness of the cell.
- Endoplasmic reticulum – responsible for making large molecules in a cell
- Ribosome – production of proteins

Table showing the Comparison of Plant and Animal Cells

FEATURE	PLANT CELL	ANIMAL CELL
Cell wall	Present	Absent
Chloroplast	Present	Absent
Vacuole	Present	Absent or small and temporary
Cytoplasm	Thin layer under cell wall	Fills cell
Starch granules	Present	Absent
Glycogen	Absent	Present
mitochondria	present	Present
Nucleus	Present	Present
ribosomes	present	present

ASSIGNMENTS

Read page 30 and 31 in your text book. Answer questions 1 – 5 on page 31.

Make models of an unspecialized animal and plant cell. Your model should be on a piece of construction paper which your teacher will provide you with. You must use a different material for each cell organelle. Some appropriate materials include rice, dried peas, sand, string and pasta. You may also use markers, crayons and glitter. You may work by yourself or in groups of no more than 4. You will be marked on the following: all organelles are represented, presentation and creativity.

CELL ORGANIZATION

Specialized Cells

Cell specialization helps efficiency and divides labour in organisms.

Examples of specialized Animal Cells

(i) Ciliated epithelial cell – lines respiratory tract, helps trap dust particles
(ii) Red blood cells – carry oxygen in blood
(iii) Phagocytes – kills pathogens (disease causing organisms

Examples of Specialized Plant Cells

(i) Palisade cell – photosynthesis
(ii) Xylem cell – transports water and minerals
(iii) Phloem cell – Transports sugars and other foods

Tissue – identical cells that work together to perform a specific function.

Examples: Animal tissues – muscle, nerve
Plant tissues – palisade layer, xylem vessel

Organs – different tissues that work together to perform a specific function

Examples: Animal organs – heart, lung, kidney
Plant organs – leaf, root, stem

Organ System – a number of organs which are coordinated to perform specific functions

Examples: Animal organ systems – digestive system, transport system
Plant organ systems – leaves on a tree, root system

Organism – complex organisms are made up of a number of organ systems e.g. human or a mango tree

Look on the internet for images of different types of cells, tissues and organs.

ASSIGNMENT

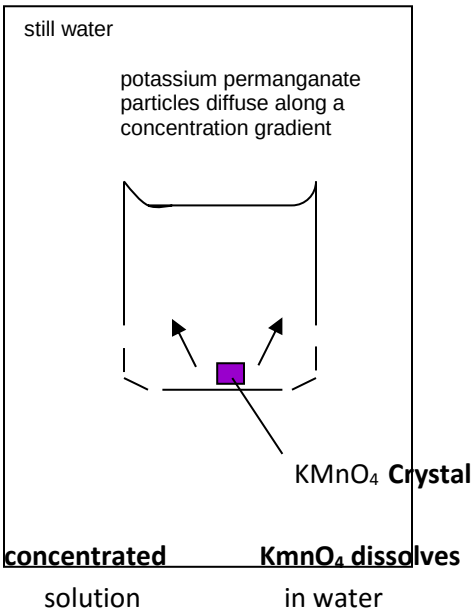
Read pages 32 – 33. Answer questions 1 – 5.

DIFFUSION/OSMOSIS

Particles always move along a concentration gradient from a high concentration to a low concentration. Atoms, molecules and ions which are always moving thus tend to spread themselves evenly over a given area.

DIFFUSION

Definition Diffusion is the movement of particles from an area of high concentration to an area of low concentration.



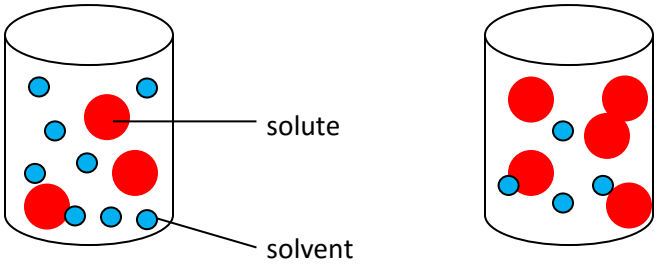
Importance in Living Organisms

1. Food diffuses from inside the intestines into (blood capillaries (sugars and amino acids).
2. Gases for respiration diffuse across cell membranes into mitochondria.
3. Oxygen diffuses from the lungs into capillaries and red blood cells.
4. Carbon dioxide diffuses from the blood capillaries into the lungs.

OSMOSIS

Definition Osmosis is the movement of water molecules from a dilute solutions to a concentrated solution, through a semi-permeable membrane.

Remember: solvent (water) + solute → solution

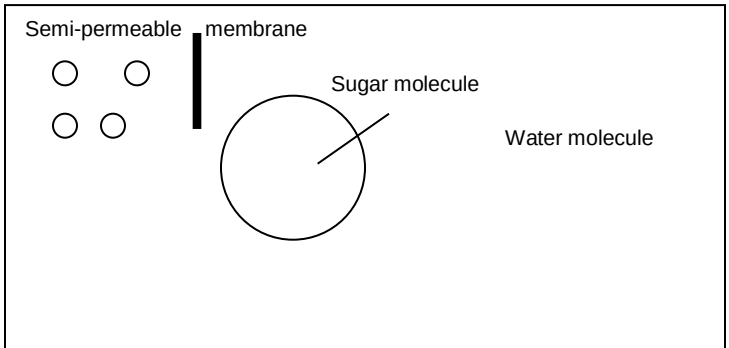


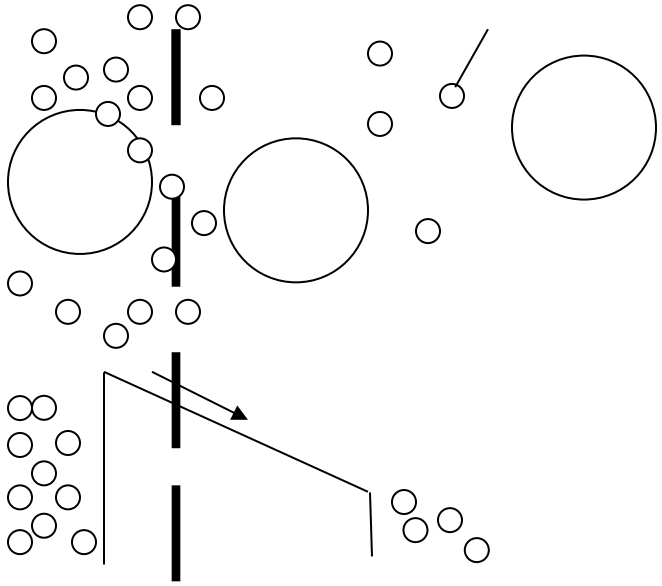
Dilute solutions have a lot of water and little solute

Concentrated solutions have a little water and a lot of solute

From the diagram above we can say that there are more water molecules in a dilute solution than a concentrated solution hence water ***is*** moving from a high concentration to a low concentration across a concentration gradient.

The **concentration gradient** is the difference in concentration of molecules i.e. high and low. The bigger the difference the faster the movement of the molecules. See the diagram below.





Importance in Living Organisms
Water moves across cell membranes by osmosis. In plants osmosis is an important mechanism by which water moves up the plant – from cell to cell.

Osmosis in Animal Cells
An animal cell in concentrated solutions will shrink because there is more water inside the cell than outside i.e. water will leave the cell.
An animal cell in a dilute solution will swell and eventually burst as it takes in water.

Osmosis in Plant Cells
A plant becomes plasmolysed in a concentrated solution i.e. it becomes **flaccid**. If a cells of a plant become flaccid, the plant loses its firmness and begins to
wilt.

A plant cell becomes **turgid** in dilute solutions. The cell wall prevents the plant cell from bursting. Some plants rely on the turgidity of their cells to keep them upright.

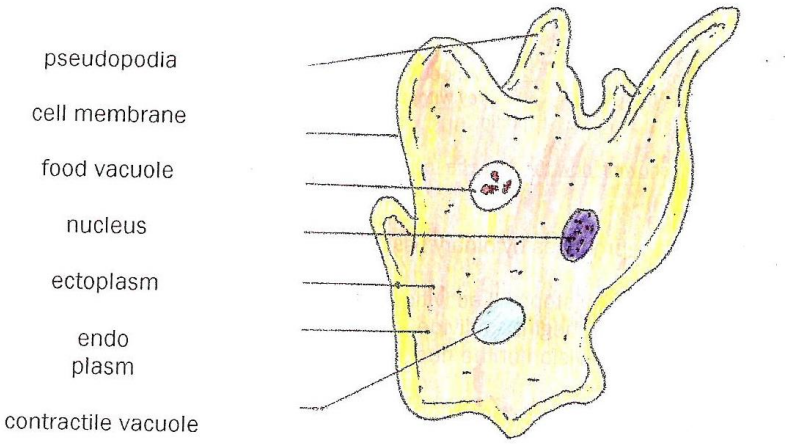
TEST YOURSELF

1. What do the following terms mean?
   a semi-permeable membrane, osmosis, diffusion, diffusion gradient, turgid, flaccid?
2. Which of these is an example of (a) diffusion, (b) osmosis or (c) neither? Explain your answer in both
   - (i) Water moves from a dilute solution in the soil into the cells in a plant's roots.
   - (ii) Saliva flows out of the salivary glands into your mouth.
   - (iii) A spot of blue ink dropped into a glass of still water quickly colours all the water blue.
   - (iv) Carbon dioxide goes into a plant's leaves when it is photosynthesising.

Answer questions 1 – 4 on page 35 of your text book.

OSMOREGULATION IN AN AMOEBA

The *Amoeba* is an example of an animal-like protist. They are made up of a single cell and they grow to about 0.25 mm in length. They live in fresh water e.g. in ponds and ditches. These species are harmless. One species however, *Entamoeba histolytica* lives in the alimentary canal of humans. If they invade the wall of the intestine or the rectum, they cause amoebic dysentery. The symptoms include pain, vomiting and diarrhoea.



The Amoeba

The *Amoeba* carries out all of its life processes in a single cell. It can grow to the size of a pinhead. They live in fresh water ponds and ditches.

OSMOREGULATION

Osmoregulation is the control of the amount of water in an organism. *Amoebae* are constantly absorbing water by osmosis because they are surrounded by fresh water. In order to prevent themselves from bursting open, this water is sent to a contractile vacuole. When the contractile vacuole is full, it moves to the cell membrane and releases the water to the outside by bursting.

PHOTOSYNTHESIS AND LEAF STRUCTURE

Definition: Photosynthesis is the process by which green plants convert inorganic substances into organic substances using light energy.

The balanced equation for photosynthesis is as follows.

$$6\,CO_2 + 6\,H_2O \xrightarrow[\text{Chlorophyll}]{\text{light}} C_6H_{12}O_6 + 6O_2$$

Word equation

$$\text{Carbon dioxide + water} \xrightarrow{\text{light}} \text{glucose + oxygen}$$

- The raw materials are carbon dioxide and water.
- The produces are glucose and oxygen.
- The conditions necessary for photosynthesis are light which provides the energy and chlorophyll which absorbs the light.

How are leaves adapted for photosynthesis?
(See internal view of leaf on page 9)

1. They have chlorophyll to absorb sunlight.
2. They are thin so that gases can move through them more easily.
3. They have many veins to keep them supplied with water and to transport foods made in the leaf to other parts of the plant.
4. They have stomata to allow carbon dioxide in.
5. They are broad to absorb a maximum amount of sunlight.
6. The air spaces in the spongy mesophyll allow for more rapid distribution of gases by diffusion.

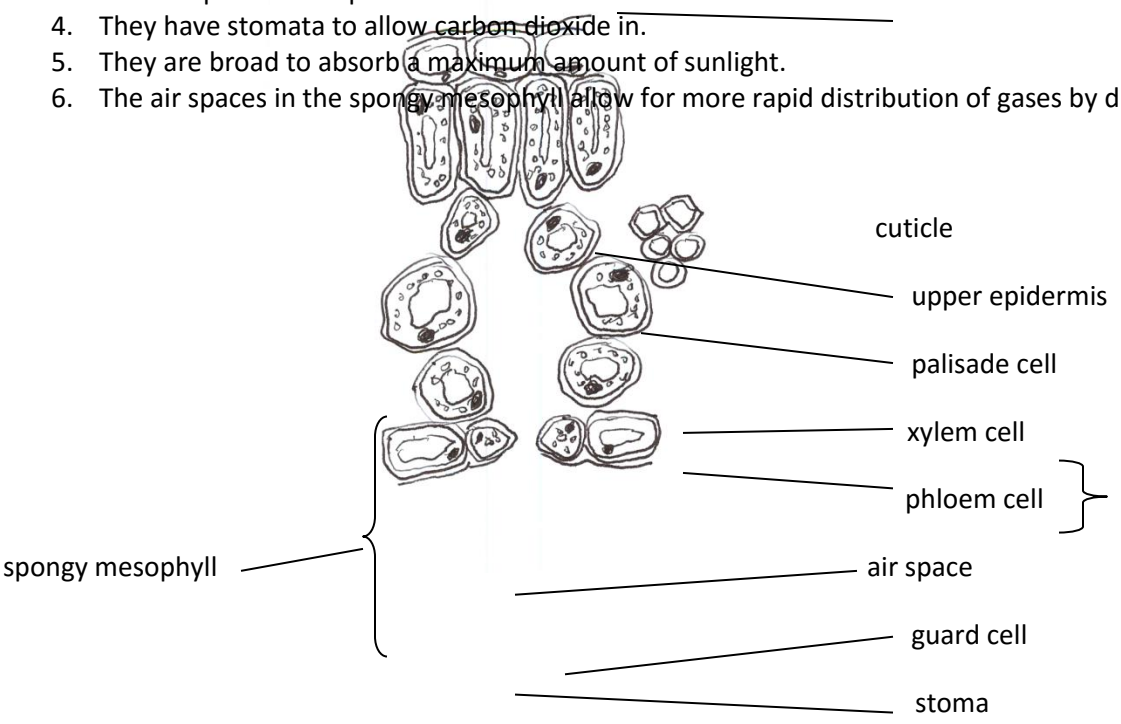
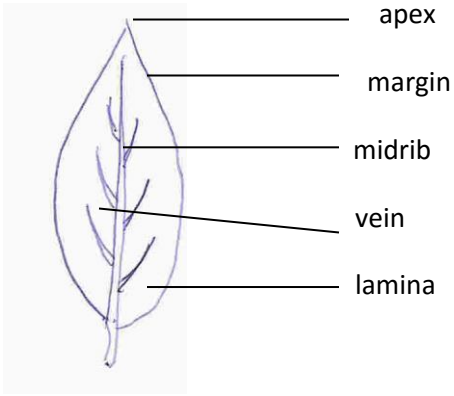


Diagram showing internal view of a leaf



petiole

Diagram showing external view of a leaf

THE IMPORTANCE OF PHOTSYNTHESIS

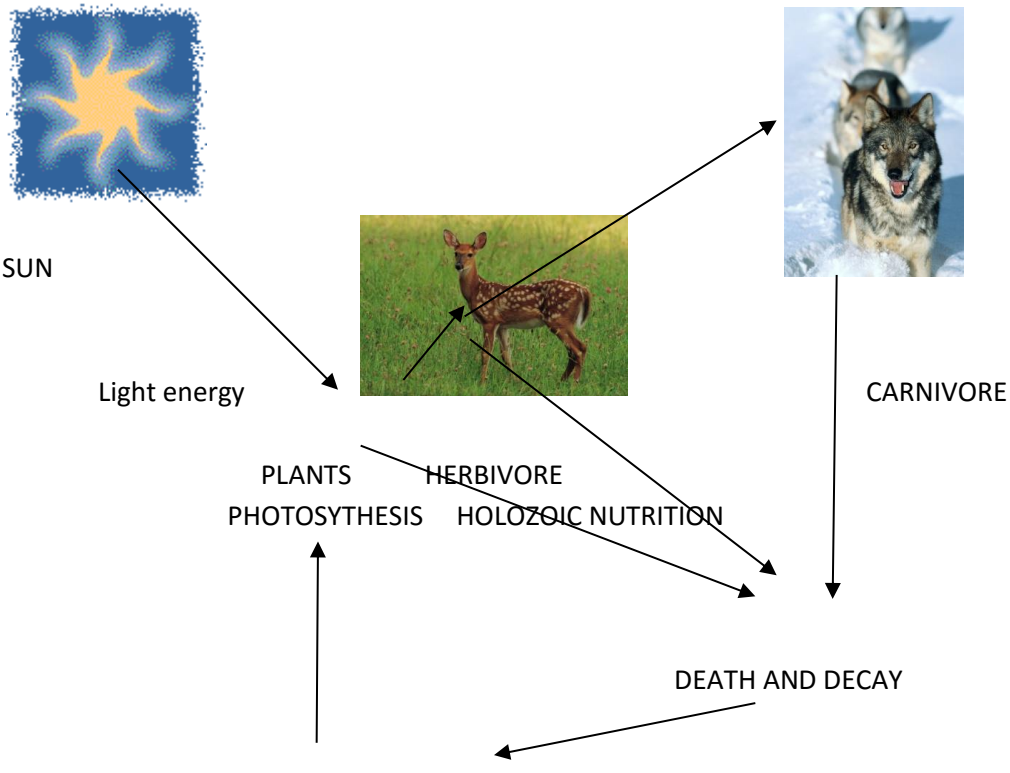
TO THE PLANT

- This is the way plants make foods for themselves
- The glucose and oxygen made by photosynthesis can be used for respiration. Remember all plants respire 24 hours a day.
- The glucose may be converted into other substances.

TO ANIMALS

- Animals depend of plants for food. Herbivores depend directly on plants on food since they only eat plants. Carnivores depend indirectly on plants since they only eat other animals. Omnivores are both indirectly and directly dependent of plants since they eat both plants and animals.
- All animals breathe in oxygen that has been produced by plants.
- Many plants are used by animals as habitats.
- Humans are plants as medicines, for paper, furniture and decoration.

IMPORTANCE OF PHOTOSYNTHESIS



TESTING A LEAF FOR STARCH

1. Boil the leaf for five minutes

2. Put the leaf in a boiling tube with alcohol, turn off the Bunsen burner.
3. Place the boiling tube into the beaker of hot water. Leave until the leaf has lost most of its colour.
4. Remove the leaf from the alcohol and rinse it in hot water.
5. Place the leaf in a watch glass and cover it with iodine solution.

ASSIGNMENT
Answer questions 3 – 9 on page 61 and 1 – 5 on page 65;

NUTRITION IN HUMANS

What kind of nutrition do humans carry out?

Humans eat foods made by other organisms, this is called heterotrophic nutrition. We digest the food that we eat internally, this is holozoic nutrition. Since we also eat both plants and animals we are omnivores.

What is a balanced diet?

A balanced diet includes foods from all the food groups in the correct proportions. These food groups contain nutrients which are essential to good health.

TABLE SHOWING FOOD GROUPS

FOOD GROUP	EXAMPLES	MAIN NUTRIENT
STAPLES	Bread, pasta, potatoes, yams	Starch
FRUIT	Oranges, mangoes, apples	Sugars and vitamins
VEGETABLES*	Lettuce, spinach, pumpkin	Vitamins
LEGUMES	Beans and peas	Proteins, fats, vitamins
FOODS FROM ANIMAL SOURCES	Chicken, beef, pork, lamb and fish	Proteins, fats, minerals
FATS	Butter, shortening, oil	fats

- Green leafy and coloured non starchy vegetables

FOOD NUTRIENTS

The macronutrients include carbohydrates, fats and proteins. The micronutrients include vitamins and minerals. Water and roughage are not nutrients but they are important parts of a balanced diet.

CARBOHYDRATES

What are carbohydrates made of?

Carbohydrates contain the elements carbon, hydrogen and oxygen. The basic building blocks of carbohydrates are monosaccharides.

Monosaccharides Disaccharides Polysaccharides

There are three types of carbohydrates, monosaccharides, disaccharides and polysaccharides.

Differences between types of carbohydrates.
Monosaccharides are the simplest of the carbohydrates made of single units. Polysaccharides_ are made up of many monosaccharide units. The other difference between the different types of carbohydrates is the sweetness and whether they are soluble or not.

GROUP	CHARACTERISTIC	EXAMPLES
Monosaccharides	Sweet and soluble	Glucose, fructose and galactose
Disaccharides	Sweet and soluble	Maltose, sucrose and lactose
Polysaccharides	Not sweet and insoluble	Starch, glycogen and cellulose

Carbohydrates are used for energy. Good sources of carbohydrates include potatoes (especially sweet potatoes), rice (brown), fruit and some vegetables like pumpkin and carrots which have sugars. The diseases associated with carbohydrate intake, obesity and diabetes.

Obesity
Definition Excessive body fat or weight far in excess of recommended body mass index.

Excess carbohydrates are either stored as glycogen or converted to fat. Obesity can also be caused by too much fat in the diet, too little exercise or physical activity, hormonal problems and some medicines. Obese persons are more likely to suffer from diabetes, hypertension and heart disease, they also have problems breathing. They tend to have a low self esteem because they are made fun of by other persons.

HYPERGLYCEMIA – when the blood sugar level rises above 160 mg/100 cm^3. Symptoms include excess thirst and urination and a fruity breath odor.

HYPOGLYCEMIA – when the blood sugar becomes lower than 80 mg/100 cm^3. Symptoms include dizziness. Either condition may lead to a coma.

DIABETES MELLITUS
Insulin is a hormone which is produced in the pancreas. It converts excess glucose into glycogen in the liver, i.e. it lowers the blood sugar level. Insulin also opens passages in the cells for the glucose to enter. If there is no insulin, sugar remains in the blood and is unable to eneter into the cells. The cells become starved for energy and a number of complications occur.

Type 1 – Insulin dependent Diabetes – body does not produce enough insulin or does not produce it at all.

Type 2 – Non insulin dependent – insulin is produced but is rendered useless usually because of obesity.

What are the symptoms of diabetes?
Hunger, loss of weight, slow healing of skin infections, itching, especially between the toes, excess thirst and urination, weakened eye sight, blurred vision, weakness, tiredness and sexual dysfunction. Eventually the person may develop high blood pressure, heart disease, kidney damage and blindness caused by nerve damage. Diabetics are also more likely to get limb amputations because of gangrene.

How do you treat diabetes?
Type 1 - blood sugar level checks, regular injections with insulin, no consumption of sugar.
Type 2 – reduce carbohydrate intake, exercise, diabetes medicine and insulin shots if the disease is not controlled.

FATS

Fats contain the elements carbon, hydrogen and oxygen. The building blocks of fats are fatty acids and glycerol.

Lipid is the correct name for these nutrients. Fats are solid at room temperature and oils are liquids at room temperature.

What are fats used for?
Energy, insulation, cell membranes, storage

What are healthy sources of fats?
Fish oils, olive oil, milk and cheese.

HIGH BLOOD PRESSURE OR HYPERTENSION
High blood pressure causes narrowing of the arteries. It may affect the heart, brain or kidneys.

Heart
The heart works harder to get blood through narrow arteries. This leads to the narrowing of the heart which then does not get enough blood. This can lead to a enlargement of the heart. If fat or cholesterol becomes deposited in the walls of the arteries atherscleros is is said to have occurred. If the arteries become harded it is called arteriosclerosis. If the blood supply is cut off, a heart attack occurs.

Brain
A rupture of the blood vessels in the brain causes strokes. Strokes can cause partial paralysis where one side of the body is paralysed or death.

Kidneys
Narrowing of arteries in the kidneys prevents proper filtering of fluid and thus waste products build up in the body.

What causes high blood pressure?
Stress, smoking, diets high in carbohydrates, fats and salt.

How is blood pressure treated?
Exercise, reduction in salt intake, reduction in fat intake.

PROTEINS

Proteins contain the elements carbon, hydrogen, oxygen, nitrogen, phosphorous and sometimes sulphure. The basic building blocks of proteins are amino acids. Amino acids link up to form polypeptide chains and these link up to form proteins.

What are proteins used for?

Growth and repair, metabolism, cell membrane formation, they are found in skin, hair, fingernails, blood, muscle, tendons and cartilage. Enzymes, hormones and antibodies are made of proteins. If a person is suffering from starvation, protein in the body may be used for energy. This leaves the person skeletal.

What are good sources of proteins?

Meat, cheese, fish, eggs, dried peas and beans and nuts.

KWASHIORKOR

Cause: Children weaned and fed on starch porridge with little or no protein

Symptoms

Failure to grow in weight or height, swelling of hands and feet because of fluid retention, Weak or wasted muscles, Irritability, Loss of appetite, diarrhoea, vomiting, flaky skin, Hair drops out easily

Treatment

Feed child on foods rich in essential amino acids.

MARASMUS

Cause: This is due to general starvation.

Symptoms:

1. Ravenous appetite
2. Fretfulness
3. Shrunken appearance
4. Dehydration of body
5. Failure to grow, particularly in weight
6. Wastage of muscles.

Treatment: Feed individual with energy rich foods and foods rich in proteins.

VITAMINS AND MINERALS

VITAMINS

Vitamins are needed in small quantities in the diet. They prevent certain deficiency diseases.

Table showing five important vitamins required by humans.

VITAMIN	SOURCES	SYMPTOMS OF DEFICIENCY
A – retinol	Liver, egg-yolk, green vegetables, carrots, butter, cod liver oil.	Sore eyes, reduced night vision, colds and bronchitis, unhealthy skin

B_1 Thiamine	Unpolished cereals, beans, lean meat, egg yolks	Retarded growth, lack of appetite in children, nervous inflammation and weakness, paralysis – the disease called beri-beri
B_2 Riboflavin	Same as B_1	Skin disorders, eye and mouth membrane sores – dermatitis
C Ascorbic acid	Fresh fruit especially citrus fruit, raw vegetables	Bleeding from guns and other membranes, tooth disorders, reduced resistance to infection – scurvy
D Calciferol	Liver, fat, fish, egg yolk, formed in skin by sunlight.	Weak bones, particularly leg bones, poor teeth - rickets

MINERALS

Minerals are required in small quantities. They are usually taken in the form of salts. They are needed to make some complex compounds in the body.

ELEMENT	SOURCES	IMPORTANCE TO THE MAMMALIAN BODY
Nitrogen – N	Lean meats, fish, eggs, milk	For synthesis of protein and other complex chemicals, formation of muscle, hair, skin and nails
Iron – Fe	Liver, green vegetables, yeast, eggs, kidney	Forms haemoglobin in red blood cells. Absence causes anaemia which leaves the person weak and tired.
Calcium – Ca	Milk, cheese, green vegetables.	Formation of bones and teeth, necessary for muscle contraction and blood clotting. Absence causes rickets.
Iodine – I	Sea fish and other sea foods, cheese, iodised table salt	Formation of hormone in thyroid gland, absence causes goitre and reduced growth
Sodium - Na	Table salt, green vegetables	Maintenance of tissue fluids, blood and lymph, transmission of nerve impulses.

ROUGHAGE

This ensures regular bowel movement.

WATER

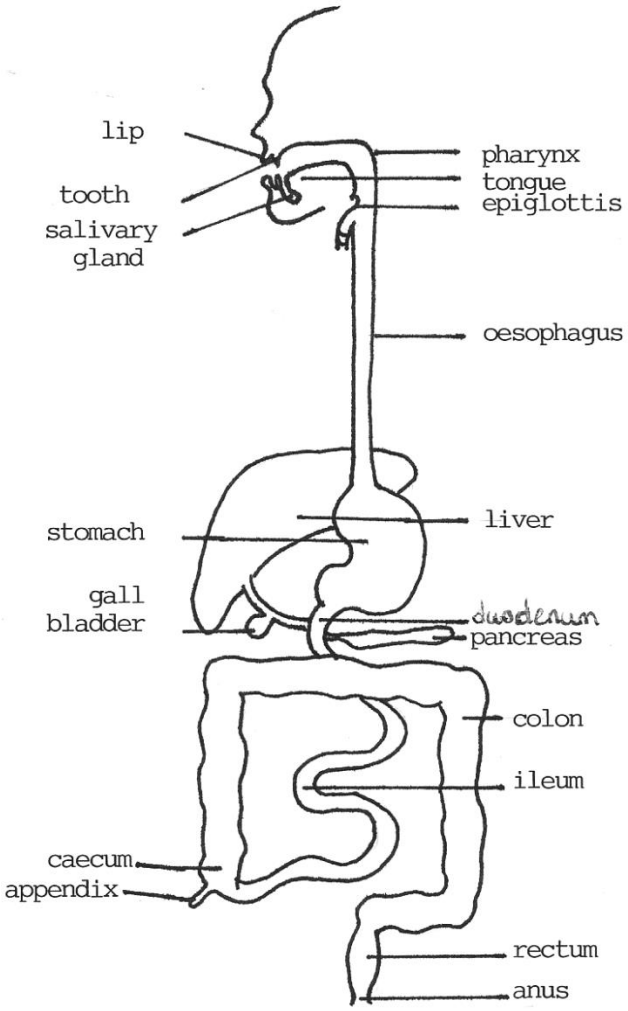
This is the major component of living organisms. It is a solvent and thus helps transport substances. It plays a part in many cellular reactions and it can absorb heat and thus prevent organisms from overheating.

ASSIGNMENT

1. Questions 1 and 2 on page 115 and the question on page 117.
2. This must be done on paper. It may be typed.
   Mrs. Kent's family includes her husband, her elderly mother, her teenage twins – Daniel and Alice and four year old child, Mary. Mrs. Kent is a secretary and Mr. Kent is a construction worker. Mrs. Kent's mother is overweight and diabetic. Mrs. Kent gets upset when her son Daniel eats so much more food than his twin Alice. She is eating as much as her husband and is frustrated because she is gaining weight while her husband is not.
   Use the information on pages 118 and 119 in your text book to explain to her why each of the members of the family have different nutritional needs. Explain your answer by briefly describing foods that each member of the family should eat, with amounts if necessary.

TEETH AND DIGESTIVE SYSTEM

This topic is about how food is taken into the body and broken down. The **alimentary canal** begins with the mouth and ends at the anus. It is over 7 m long and most of it coiled within the abdominal cavity.



What happens in the Alimentary Canal?
Ingestion - the process by which food is taken into the body.

Digestion – the process by which food is broken down.

Chemical digestion – the food is broken down by enzymes.

Mechanical digestion – the food is physically broken down.

Why is digestion important?
The foods we eat are too large and complex to be used as they are thus they must be broken down into smaller simpler compounds.

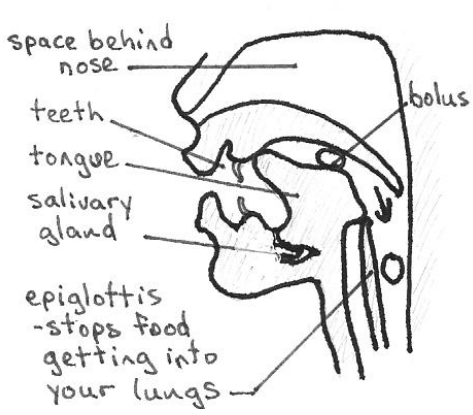
Absorption – the digested food moves into the blood stream to be distributed throughout the body.
Assimilation – the food is taken into the cells of the body to be used for energy, growth and repair.
Egestion of Defecation - The process by which food passes out of the anus.

What happens in the alimentary canal?
Food is ingested using the lips, teeth and tongue. Mechanical digestion begins as the teeth chew the food.

Chemical digestion occurs as the salivary glands produce amylase. The food is formed into a small ball at the back of the throat called the **bolus** which is swallowed.

The food then passes through the oesophagus to the stomach.

Stomach – mechanical and chemical digestion, proteins are



Digested here.

Duodenum – chemical digestion, it receives secretions from

the liver and pancreas. Starch, proteins and fats are digested here.

Liver – produces bile, this helps break up the fats into smaller particles, this makes it easier for enzymes to digest them.

Pancreas – produces enzymes.

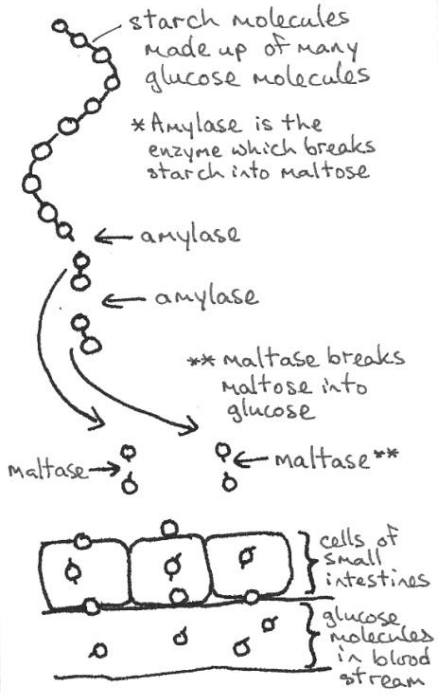
Ileum or small intestines – digestion is completed and food is
absorbed into the blood stream
Large intestine or colon – water is absorbed here and faeces are formed.
Rectum – stores faeces
Anus – Hole through which the faeces leave

How do enzymes work?

The foods that we eat must be broken down into their simplest units i.e. carbohydrates into monosaccharides; proteins into amino acids and fats into fatty acids and glycerol.

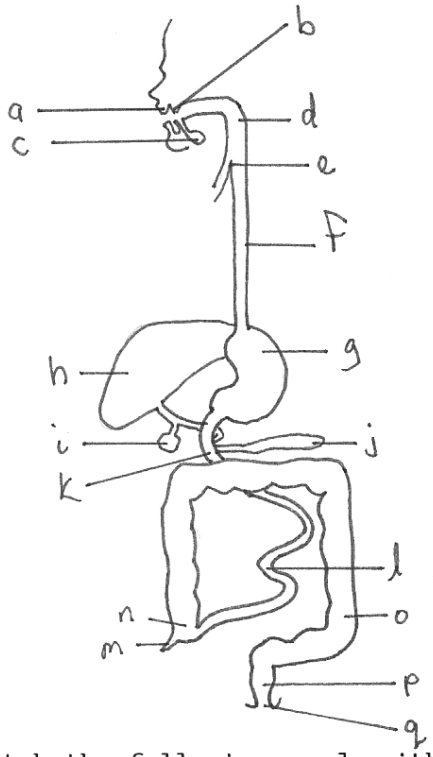
Enzymes are organic catalysts i.e. they speed up the rate of a reaction. Different enzymes work on different types of food.

The diagram below shows how enzymes do their job.



TEST YOUR KNOWLEDGE

1. Write down the labels for a - q.



2. Match the following words with their correct definitions.

a	ingestion	1	the breaking down of food
b	egestion	2	the taking in of food into the mouth
c	assimilation	3	the movement of food from the gut into the blood
d	absorption	4	the use of food for energy, growth and repair
e	digestion	5	the removal of undigested materials

5 points

3. What are enzymes? 1 point

4. Name three organs in which digestion occurs? 2 points

5. Why is digestion important? 1 point

6. Without absorption we would die, why? 2 points

7. What happens in the colon? 1 point

8. What does the liver do? 1 point

9. What does the pancreas do? 1 point

Questions 1 – 4, pg 125; 1 – 5 pg 127

TEETH

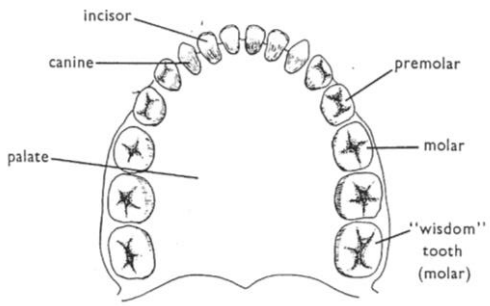


Fig. 25.7 Arrangement of teeth in man's upper jaw

Four types of teeth are found in the human mouth.
Incisors are chisel shaped for biting.
Canine teeth are sharp and pointy for tearing.
Premolar and Molars have sharp biting surfaces called cusps.

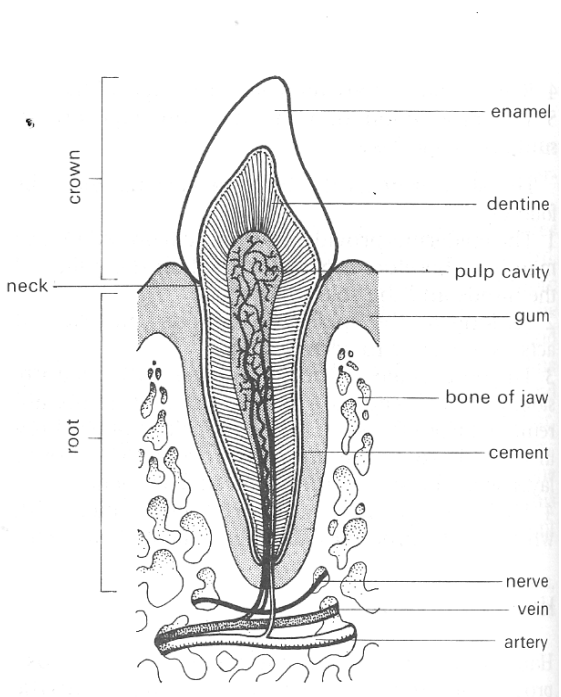
Human children have 28 teeth. Four wisdom teeth grow around the age of 18. The first set of teeth a human has are called milk teeth or baby teeth. There are lost and replaced by larger adult teeth.

TOOTH CARE

The bacteria which cause tooth decay eat food left on and between the teeth. The acids they produce as a result, eat away at the enamel, dentine until a hole reaches the pulp cavity and nerves causing pain. Any method which reduces bacteria will prevent dental carries or cavities.

1. Brushing removes food particles from the surface of the teeth.
2. Flossing removes food particles from between the teeth.
3. Rinsing removes loose food.
4. Diet, foods rich in vitamin D and minerals calcium and phosphorous contribute to healthy teeth as well as crunchy foods like apples and raw carrots.
5. Two visits to the dentist a year are recommended.

TOOTH STRUCTURE



Enamel is the hardest substance made by animals. It is harder than bone. This biting surface is non-living and found on the surface of the tooth.

Dentine is found under the enamel, it is hard but not as hard as enamel. Cells of the dentine can add more enamel to the inside of the tooth.

Pulp cavity is found in the centre of the tooth and contains blood capillaries and nerves.

Cement keeps the tooth in place.

Carnivores
Carnivores have teeth which are adapted for holding prey and tearing off flesh.

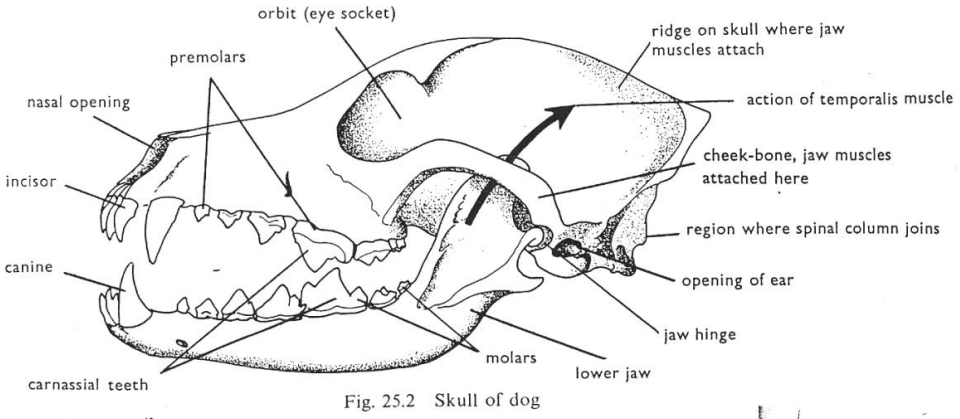
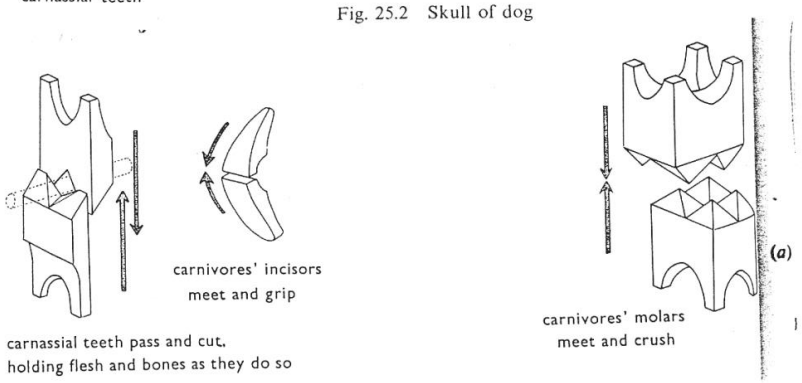


Fig. 25.2 Skull of dog



Example: Dog
The incisors of a dog meet at the front of the mouth so that they can tear off meat near to the bone.
They are very sharp. The canines are long and pointed and found near the front of the mouth to hold and kill prey. Four of the molars are called carnassial teeth. They have sharp cutting edges and can slice off flesh and crack bones. The other molars have more flattened surface for crushing food before swallowing. Just like humans, the teeth of carnivores stop growing at some point.

Herbivores
The permanent teeth of herbivores continue to grow throughout the animal's life because they are constantly being worn down. The lower jaw moves sideways or backwards and forwards, grinding the teeth across each other. This wears the cement, enamel and dentine down.

The molar and premolar teeth of the upper and lower jaw fit each other exactly. The grass and vegetation is ground and crushed between these fitted edges. Some herbivores do have canine teeth but they usually look like incisors. There is usually a toothless gap between the incisors and premolars. This allows the tongue to manipulate the food. The premolars and molars are almost identical in shape and size.

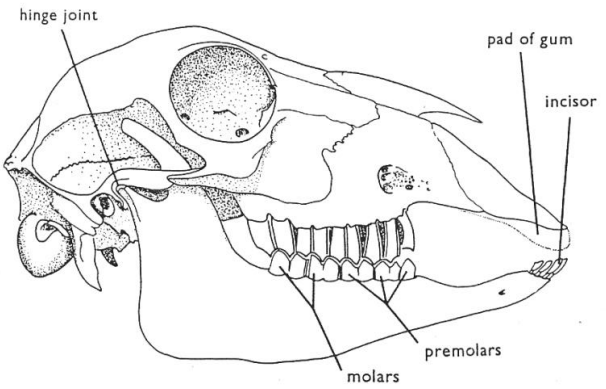


Fig. 25.4 Sheep's skull

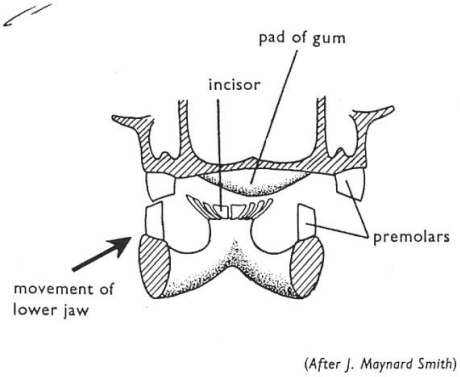


Fig. 25.6 Section through herbivore's skull to show action of teeth

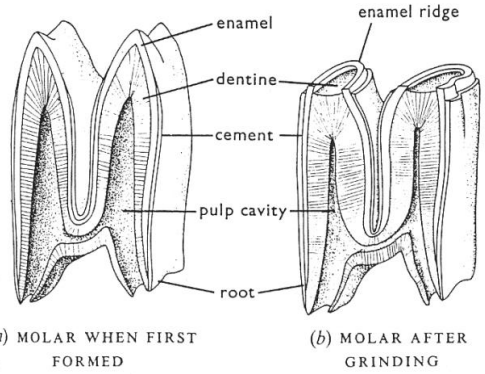


Fig. 25.5 Sections of herbivore's molar to show how it is worn down

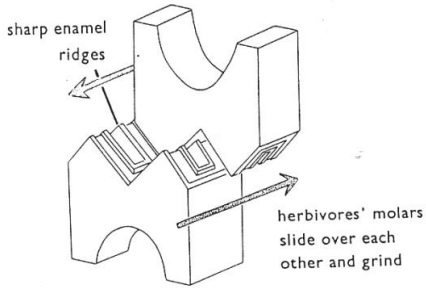


Fig. 25.3 Action of specialized teeth

RESPIRATION

DEFINITION: Respiration is the process by which energy is released from carbohydrates.

EQUATION FOR AEROBIC RESPIRATION

$C_6H_{12}O_6 + 6O_2 \rightarrow 6CO_2 + 6H_2O + energy$
Glucose + oxygen → carbon dioxide + water + energy

Respiration occurs on a cellular level, i.e. it occurs in every cell of an organism, in the mitochondria. The more energy a cell requires on a regular basis, the more mitochondria it contains.

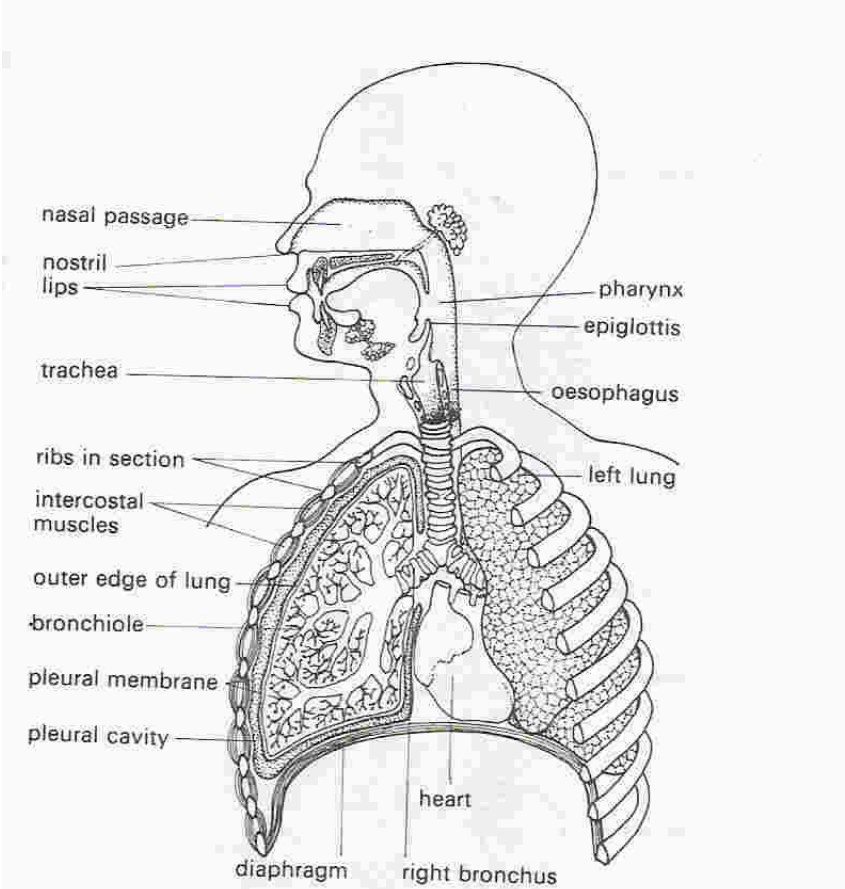


Fig. 14.6 Diagram of human head and thorax in longitudinal section: left lung complete, right lung in section.

ASSIGNMENT
Questions 2 and 3, pg 89; questions 1 – 6 pg 93.

CIRCULATORY SYSTEM

INTRODUCTION

The circulatory system is a transport systems which is required in multicellular organisms because simple diffusion is too slow to supply each cell of the organism with its needs. Transport systems transport respiratory gases, food, waste products and hormones.

TRANSPORT IN HUMANS

Components of the Circulatory System

COMPONENT	FUNCTION
Blood	Transports substances
Blood vessel – arteries, veins and capillaries	Carry blood
Heart	Keeps blood in circulation
Tissue fluid	Supplies tissues with substances absorbed from the blood.
Lymph	Returns substances from tissue fluid to the blood
Lymphatics	Tubes through which lymph is carried.

BLOOD

Blood has three main components plasma, blood cells and platelets.

Plasma – the liquid part of the blood
Blood Cells – there are two types red and white.
Pl~~atel~~ets – help form a plug for blood clotting

Functions of Blood

1. Carrying Respiratory Gases – most oxygen is carried in the blood by haemoglobin a complex protein which contains iron. It combines with oxygen in the lungs, transports it to the tissues and gives it up.

2. Transport of Solutes - The liquid part of the blood or **plasma** transports soluble digested food, hormones, blood proteins and waste products.

3. Distribution of Heat - The blood distributes heat produced by the organs especially the liver and muscles.

4. Immunity or Defence against Disease - White blood cells fight pathogens (disease causing organisms). There are two main types of white blood cells, phagocytes and lymphocytes. Phagocytes consume pathogens and lymphocytes cause pathogens to clump together.

5. Blood Clotting – this important function of the blood prevents the excessive loss of blood due to bleeding injuries.

ASSIGNMENT

Questions 1 – 6, page 103; questions 1 – 3, page 104; questions 1 – 5, page 105..

Draw a concept map which shows the components of the circulatory system (references pages 96 – 105.

ECOLOGY

Ecology Definitions

Ecology – the study of how living organism interact with their environment.

Habitat – the place where an organism lives.

Environment – describes the living and non-living factors which affect an organism.

- Biotic factor – an influence on an organism caused by another organism.
- Abiotic factor (physical) – an influence on an organism caused by a non-living feature of its environment.

Population – a group of organisms of the same species in a particular place.

Community – several populations living together in a particular place.

Niche – the place of a living organism in a community.

Food Chains

Food chairs show simple feeding relationships between organisms.

Trophic levels – the position of an organism in a food chain.

Producer – an organism that feeds on other organisms i.e. it feeds autotrophically.

Consumer – an organism that feeds on other organisms i.e. it feeds heterotrophically.

Consumers can be divided into three groups:

- **Herbivores** eat only plants (primary consumer)
- **Omnivores** eat plants and animals (primary or secondary consumer)
- **Carnivores** eat only animals (secondary consumers, tertiary consumers and up.

How to Construct a Food Chain

1. Always start at the bottom with the producer.
2. Above the producer write the primary consumer, then the secondary consumer and so on.
3. Link the organisms with arrows pointing upwards.

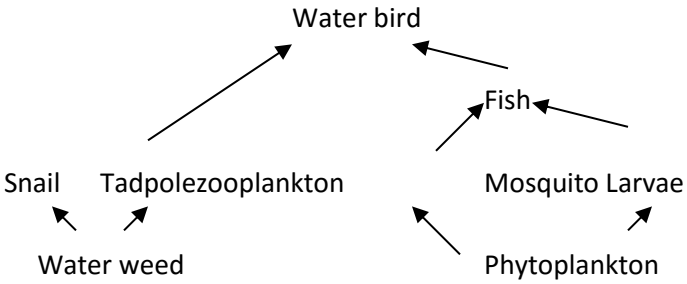
Example

	Trophic Level	
Grizzly bear	3	(secondary consumer)
↑		
Baby moose	2	(primary consumer)
↑		
Willow shoots	1	(producer)

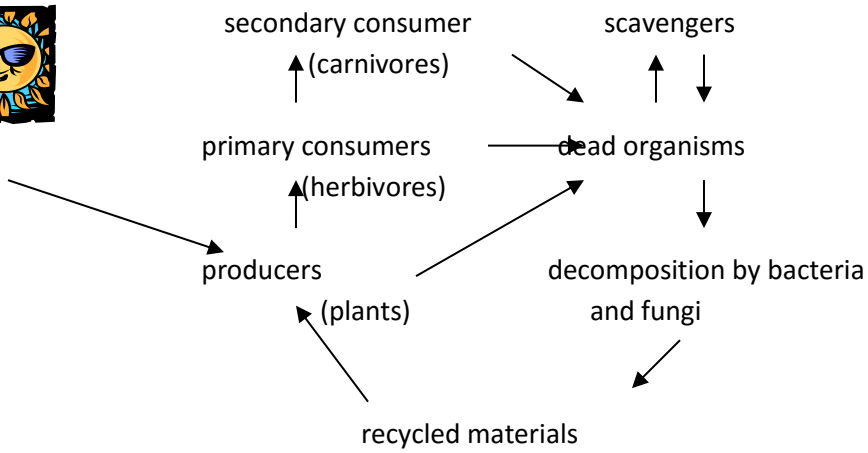
N.B. The baby moose is the herbivore and the grizzly bear is the carnivore.

Food Webs
Food webs show complex feeding relationships or interrelated food chains in a community.

Example



ENERGY RELATIONSHIPS

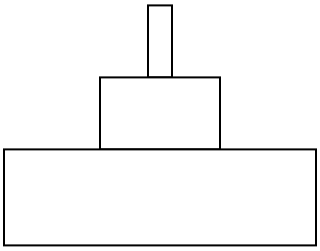


Energy is transferred from the sun to producers to consumers and decomposers.

1. Green plants make high energy foods by photosynthesis. Some of the foods are used for respiration, metabolism or making other compounds.
2. Primary consumers at the plants, digest the food and use it for respiration, metabolism, growth or repair.
3. Secondary consumers eat primary consumers, digest them and use the resulting compounds for respiration, metabolism, growth and repair.
   N.B. At every link in the food chain, 90 % of the energy is lost.

FOOD PYRAMIDS

Pyramid of numbers – Each block represents the total number of the organism in a particular habitat.



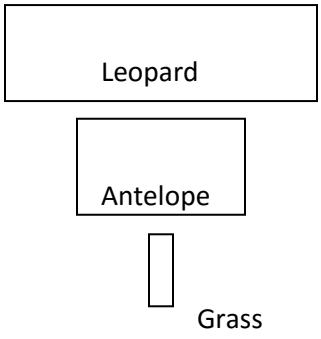
Leopard

Antelope

Grass

At each trophic level there are fewer organisms because of the energy losses at each level.

Pyramid of Biomass – each block represents the mass of living material at each level.



The higher the trophic level, the larger the organism.

IMPORTANCE OF DECOMPOSERS

Decomposers release nitrates and other materials from dead animals and plants. These materials include minerals which are essential for the healthy growth of plants. Without plants all animals would eventually die. Decomposers thus maintain life on earth by recycling materials.

ASSIGNMENT

Questions 1 – 5 page 171.

Interdependence of Plants and Animals

Animal/Plant relationships

Animals get energy, oxygen and shelter from plants. Plants get carbon dioxide from animals; inorganic salts released from decaying animals; pollinating agents e.g. butterflies and dispersal agents from their fruits and seeds.

Predator/prey relationships

Quite often predators control the prey populations and thus prevent over-population. Predators are specially equipped for their role as hunter. They have good sense organs, they are good at catching/trapping their prey, they often have sharp teeth and claws to tear up prey.

Prey are often specially equipped for escaping from predators. They may have a combination of any of the following: speed, camouflage, a threatening look or they may be poisonous or spiny.

Symbiotic Relationships

These consist of two different species living together intimately. There are three types of symbiotic relationships.

Parasitism – one partner (usually the smaller) benefits from the association and the other suffers. The parasite may feed from the inside or outside. Examples flea/dog, tapeworm/man

Commensalism – one partner benefits and the other does not gain from the relationship. Examples remora/shark, cow and egret, anemone and crab

Mutualism – both organisms gain from the association, sometimes neither can live without the other. Examples, termites and cellulose digesting bacteria in their gut, coral polyps and algae.

SOIL PROJECT

FORMAT

TITLE PAGE – NAME, DATE, TEACHER, TITLE OF PROJECT

INTRODUCTION – Define the term soil. Briefly describe how it is formed.

DISCUSSION – Name common organisms present in the soil.

Name the three main types of soil.

State the main components of soil and their functions.

Discuss the importance of soil and soil conservation.

Describe thee soil conservation methods

CONCLUSION – Reflect on what you have learnt about soils.

Reference Pages from Text – page 192, 193.