LIVING AND NON-LIVING BODIES

The living bodies possess some distinctive characteristics by which they can be distinguished from the non-living bodies. These life processes are metabolism, respiration, growth and reproduction. The sum total of changes which take place in the protoplasm are referred to as metabolism. The constructive changes of the protoplasm e.g., photosynthesis, are called as anabolism, while the destructive changes e.g., respiration are known as catabolism. The two processes of building up and breaking down must go on simultaneously. Metabolic changes find expression in nutrition, respiration, secretion and excretion. Nutrition is the process of taking food. It is just comparable to the fuelling of a machine. The food is first taken in or ingested. The complex matters are broken down to simpler forms by secretion of digestive juices known as enzymes. In other words food is digested. The digested food is then diffused in the living body and is carried to the regions where they are mostly needed. That is how food is absorbed. The absorbed food is either immediately utilized for the repair of the body as a source of energy or it may be stored up for future use. The food is assimilated, the residue left during these changes is thrown out or ejected. Respiration implies much more than the mechanical breathing. Respiration helps in the conversion of potential energy stored up in the living body during anabolism into a utilisation kinetic form. Respiration is a process of biological oxidation, a process in which organic materials of the living body are broken down to inorganic form with liberation of energy. During metabolic changes protoplasm produces in many new substances, e.g., enzymes, digestive juices and hormones.

Anabolism (synthetic process) usually gains over the catabolism and the result is growth.

Movement is another character of the living things. Automatic or spontaneous movement is noticed in the protoplasm of aquatic plants. In higher animals movement is more prominent as they develop special organs for the purpose, e.g., fins for swimming, wings for flying and legs for walking. Irritability or power of responding to external stimuli is an inherent character of living bodies. The stimuli may be physical like heat or light, mechanical, e.g., a touch or contact, and even chemical like presence of acids and bases. The roots of the plants go down under the influence of gravity and a muscle contracts when stimulated by an electric shock.

Reproduction is a unique property of the living things which can produce young ones like themselves after having attained maturity, and can thus maintain continuity of life. There are different methods of production, but the young ones always resemble the parents in the long run. This is referred to as law of biogenesis.

Vital activities, e.g., nutrition, respiration, etc. exhibit rythmicity or periodicity. A stage of intense activity is always followed by a distinct pause, however, small that may be. In the mean time protoplasm gathers its vital force necessary for the next active phase.

Every living organism shows a distinct life cycle. In younger stage it takes food and grows actively. Having attained the maturity it produces

living beings of its own kind. In course of time it grows old or senescence sets in when protoplasmic activities gradually slow down. Finally it dies and death ends all.

Cell : Discrete mass of protoplasm, bounded by a plasma membrane (Dot.), as in Zoology, but including also the surrounding cell wall (usually of cellulose or chitin). Sometimes used for surrounding cell wall only.

Protoplasm : Most of the animals and plant cells can conveniently be considered as made up of protoplasm, which is a colourless semi-liquid gelatinous substance. This includes plasma-membrane of the cell also but usually taken to exclude large vacuoles, or masses of secretion or ingested material. In animals and plants it is differentiated into nucleus and cytoplasm. Thomas Huxley called it as "Physical basis of *life*". The system of enzymes present in the protoplasm is responsible for controlling the chemical reactions characteristic of living things and the nucleic acid system responsible for synthesis of enzymes.

Nucleus : Body containing the chromosomes present in nearly all the cells of plants and animals. The nucleus is the controlling centre of all the activities performed by the cell. Every nucleus has originated from a previous nucleus usually by mitosis or meoisis, occasionally by amitosis. It is variously shaped, usually spherical or ovoid with firm superficial membrane (nuclear membrane). If it is removed remaining cytoplasm soon dies.

Eukaryotic Cells : The cells in which nucleus contains nuclear membrane; all the cell organelles are known as eukaryotic cells.

Prokaryotic Cells : In some of the cells of the living organism, the nucleus lacks the nuclear membrane, nucleous and the cell lacks some organelles, *e.g.*, mitochondria. These cells are known as prokaryotic cells. The prokaryotic cells are found in blue-green algae, bacteria, etc.

DNA (Deoxyribonucleic acid) : It is a compound (biological) consisting of a large number of nucleotides attached together in a single file to form a long strand. Usually two such strands are linked together parallel to each other by base pairing and coiled into a helix. They may be separated ('melted' or 'denatured' DNA) by heat. Each nucleotide contains the sugar deoxyribose, and one of the 4 different bases, 2 pyrimidine (thymine and cytosine) and 2 purine (adenine and guanine). It is now clear that DNA is the material of inheritance of almost all living things. It has the necessary great variety of structures produced by different arrangements of the four different nucleotides. It passes on its structure to copies of itself, probably made by separating the two strands and forming a new matching strand. This is done by base pairing with individual nucleotides, for each of the old strands (semi-conservative replication). Its structure is also translated into the structure of protein molecules when these are synthesized, by an elaborate mechanism involving matching with RNA (messenger RNA). It is found mainly in the chromosomes of prokaryotes and eukaryotes, and also in the mitochondria of eukaryotes.

RNA (Ribonucleic acid) : It is a molecule consisting of a large number of nucleotides attached together in single file to form a long strand. Each nucleotide contains the sugar ribose and one of the four different bases present in DNA, except that uracil replaces thymine. In most of the living organisms RNA occurs mainly as ribosomes to a lesser extent as *t*-RNA (transfer RNA) and less still as *m*-RNA (messenger RNA). All these forms being concerned with translating the structure of DNA into the structure of protein molecules. In eukaryotic cells there are also various kinds of nuclear RNA. In some viruses RNA is the inherited material, but undergoes translation into DNA before replication in the host cells.

BRANCHES OF LIFE SCIENCES

Biology can be divided into two main subjects: Botany- the study of plants, and Zoology—the study of animals, but this separation is not clear cut. Taxonomy (systematics) involves classification of organisms. Morphology is concerned with the size and form of whole organisms and their organs and the spatial relationships of the parts of the body to each other. Histology is the study of the types of cells present in the body whereas cytology deals

with the minute structures within the cell. Embryology is the study of the development of organisms, and physiology involves all the life processes and the functions of different organs and tissues. Ecology deals with the relationship of organisms to one another and to their environment. Genetics is the branch of biology devoted to the study of inheritance and paleontology deals with fossil organisms.

Classification

Plants can be classified as follows :

(*i*) **Thallophyta.** They have two sub-divisions.

(*a*) Algae (*b*) Fungi

(*ii*) **Bryophyta.** They are of two kinds.

(*a*) Mosses (*b*) Liverworts

(*iii*) **Pteridophyta** : They were the first land plants having vascular or conducting tissue

(*iv*) **Gymnosperms** : They were the first land plants bearing naked seeds without any ovary and fruit.

(*v*) **Angiosperms** : They are highly evolved land plants having seeds and fruits.

The animal kingdom is divided into two groups :

(*a*) Invertebrates (*b*) Vertebrates

The vertebrates having long skeletal structure called notochord which is replaced by a cartilaginous or bony backbone in higher chordates.

Invertebrates have following sub-divisions :

(*a*) Protozoa (*b*) Puridera

(*c*) Coelenterata (*d*) Platyhelminthese

(*e*) Nemathelminthese (*f*) Annelida

(*g*) Arthropoda (*h*) Molluscs

(*i*) Echinodermata

Vertebrates have the following classes :

(*a*) Pisces or Fishes (*b*) Amphibia

(*c*) Reptilia (*d*) Aves Or Birds

(*e*) Mammalia

Amphibia are cold-blooded vertebrates which have to return to water for breeding. They have some advancement over fishes. Pentadactyle (five fingered) limbs are usually present and the skull is jointed at its connection with the vertebral column so that the head can be moved. Reptiles were the first land animals with vertebral column. Though they are cold blooded (Temperature of the body changes with the change of atmospheric temperature) but have a more complex bony skeleton and highly organized blood system than other amphibia, *e.g.*, snakes, lizards, turtles, tortoises, crocodiles and alligators

Mammals are the dominant land animals at present. They are warm-blooded (Temperature of the body does not change with the temperature of the atmosphere) and have glandular skin bearing hairs. The body cavity is divided into thorax and abdomen by a muscular diaphragm, the former containing the lungs and heart. The hears is divided into four chambers. The red blood corpuscles lack nuclei.

HUMAN BODY PARTS AND THEIR ROLE

The human body is a complex machine, made up of different systems. The various systems by their coordinate activities function in unison and work efficiently carrying out the vital body functions. The important systems are :

I. Digestive System : Digestive system helps in the food digestion. The organs involved in this process are :

1. Alimentary canal
   (*i*) mouth (*ii*) gullet
   (*iii*) oesophagus (*iv*) stomach
   (*v*) small intestine (*vi*) large intestine
   (*vii*) rectum (*viii*) anus
2. Glands
   (*i*) liver
   (*ii*) pancreas
   (*iii*) stomach
3. Secretions or Enzymes
   (*i*) gastric juice
   (*ii*) pancreatic juice
   (*iii*) bile juice

II. Circulatory System : The system helps in the tansportation inside the body. It consists of the following components :

1. Blood :
   (*i*) plasm
   (*ii*) blood cells
   (*a*) white blood cells

(*b*) red blood cells
(*c*) blood platelets

2. Blood groups.
(*i*) A, (*ii*) B, (*iii*) AB, (*iv*) O

3. Heart

4. Veins

5. Arteries

III. Nervous System : This helps in sensory functions and consists of :

(*i*) brain	(*ii*) spinal cord
(*iii*) veinous nerves	(*iv*) spinal nerves
(*v*) sensory nerves	(*vi*) motor nerves

IV. Respiratory System : This helps in the gaseous exchange and intake of O_2. The organs are :

(*a*) nostrils	(*b*) trachea
(*c*) bronchi	(*d*) branchioles
(*e*) lungs	

V. Endocrine System : It consists of ductless glands which secrete their juice directly into the blood. They are :

(*a*) pituitary	(*b*) thyroid
(*c*) parathyroid	(*d*) adrenal
(*e*) pancreas	(*f*) gonads

IV. Excretory System : It helps in the removal of wastes from the body. It includes :

(*a*) kidney
(*b*) urethra
(*c*) urinary bladder

Digestive enzymes and their functions

Enzyme	*Function*
Amylase	Starch digestion
Trypsin	Protein digestion
Pepsin	Protein digestion
Maltose	Maltose (sugar) digestion
Sucrose	Sucrose (sugar) digestion

BLOOD GROUPS

Blood Group	*Antigen in RBC*	*Antibody present*	*Blood can be taken from group*
A	A	*b*	A, O
B	B	*a*	B, O
AB	AB	none	AB, A, B, O (universal acceptor)
O	None	*ab*	O (universal donor)

HUMAN DIET

Diet refers to the constituents of food a person eats. A balanced diet is one which provides suitable amounts of all nutrients required for normal, healthy living. It needs to include carbohydrates, proteins, liquids, mineral salts, and vitamins. The ideal amount of each varies depending upon age, sex, body weight, and the life style of the individual concerned. Principal sources of these nutrients, their function and effects of their deficiency are given below in the tabular form.

Nutrient	*Principal Sources*	*Functions*	*Effect of Deficiency*
1. Energy food starch	Bread, flour products, potatoes, rice	Provides for the work of the body, forms the structure of many biological compounds	Underweight, weakness
Sucrose and fructose	Household sugar, sweets, jam, cake, fruits		
Glucose	honey, fruits	Same as above	Same as above
2. Building food Proteins	Meat, fish, eggs, cheese, certain vegetables, *e.g.*, peas and pulses	Body building and maintaining body tissues to form new tissues during the period of growth or pregnancy	Retarded growth, under weight

Nutrient	*Principal Sources*	*Functions*	*Effect of Deficiency*
3. Lipids, fats and oils	Milk, dairy, products, *e.g.*, butter, cheese, fat meat, *e.g.*, bacon	For proper growth and healthy skin, source of energy and prevents heat loss.	—
4. Roughage (not a nutrient but needed to provide bulk)	Wholemeal bread, pulses, vegetables, fruit	Adds bulk to the body and gives the muscles of the gut wall something to grip on during peristalsis	Constipation
5. Water (not a nutrient in itself, but essential for life)	Most foods and drinks, direcet intake	Indispensable for digestion, metabolic processes regulation of body heat	Dehydration
6. Minerals			
(*i*) Calcium	milk and milk products, green leafy vegetables, citrus fruits, dried peas and beans	for healthy bones and teeth, nerve action	unhealthy bones, teeth, nails
(*ii*) Phosphorous	meat, poultry fish, eggs and whole grain foods	one of the major constituents of bones, teeth, also occurs in DNA, ATP, and some enzymes.	
(*iii*) Sodium	milk, eggs, fish, meat, bread, table salt.	helps to maintain normal water balance inside and outside the cells, plays a key role in the transfer of impulse along nerves	
Chlorine	common salt	present in gastric juice and is important in food digestion in the stomach	
Iron	liver, meat products, egg yolk, fish, green leafy vegetables, dried fruits and iron enriched cereal products	Iron is a part of haemoglobin which is the oxygen carrying substance of the red blood cells.	Anaemia
Iodine	sea foods	essential for normal functioning of thyroid gland.	Thyroid enlargement (goitre)
Flourine	water, tea	helps in solid tooth formation, retains calcium in the bones of older people	tooth decay