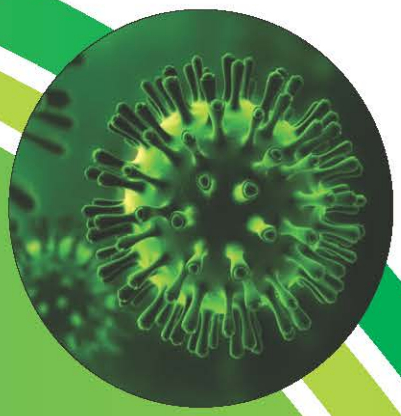
SCIENCE

Textbook for class IX

As per the latest syllabus issued by CBSE

• Dr. JOSHI • Dr. SAINI • Dr. TAMBER • GUPTA



9 CBSE

Best Seller
India's No. 1 Textbook

REVISED EDITION
2020-2021

VISHVAS®

BIOLOGY

Vishvas®

SCIENCE

Textbook for class IX

As per the latest syllabus issued by CBSE

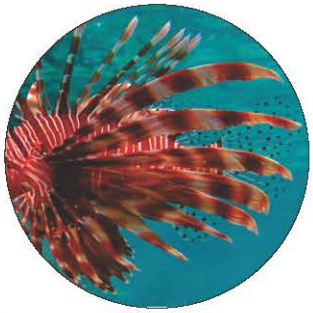
Authors

Dr. GURDEV SINGH JOSHI
M.Sc. (Hons), B.T., Ph.D., D.E.P.A. (N.I.E.P.A.)
Ex-Director
State Institute of Science
Pb., Chandigarh

Dr. AJMER SINGH TAMBER
M.Sc., M.A., M.Ed. Ph.D.
Ex. Dy. Director
o/o DPI (S) Pb, Chandigarh

Dr. NARINDER SINGH SAINI
DVM (Canada), M.V.Sc., Ph.D.
Ex. Professor–cum–Head Dept. of
Veterinary Surgery and Radiology
Guru Angad Dev Veterinary & Animal
Sciences University, Ludhiana (Pb.)

S. L. GUPTA
M.Sc., P.E.S.
Ex. Principal,
Govt. Co. Edu. S.S. School
Rajpura, Distt. Patiala (Pb.)



9
CBSE
Best Seller
India's No. 1 Textbook

REVISED EDITION
2020-2021

BIOLOGY

PUBLISHED BY
Vishvas Publications Pvt. Ltd.
Chandigarh–Bengaluru–Delhi–Guwahati–Hyderabad–Indore
Jammu–Jaipur–Kolkata–Lucknow–Mumbai–Patna–Ranchi

A FEW INTRODUCTORY WORDS

Science Textbook(Biology) has been written for the students of **Class IX** as per the latest syllabus and new instructions issued by CBSE. By making use of the long experience in the field of science education, every possible effort has been made, while writing the present book, to make it most useful to the students in their pursuit of knowledge. ***The following main features are making their appropriate contributions towards usefulness of this book :***

(i) The subject matter has been dealt with giving necessary and requisite details.

(ii) Scientific principles and facts have been written in an interesting and easy style using very simple language.

(iii) A number of neat and labelled diagrams have also been incorporated for the clarity of the subject matter wherever necessary.

(iv) The treatment of the subject matter is neither too brief to be difficult to find out the scientific facts nor it is so wide and spread out that the students may get lost while searching out the desired facts from it.

(v) The essential facts and principles as well as various topics and sub-topics have been given in bold prints so that the students may be able to locate and learn the required and needed information quite easily in the shortest possible time.

(vi) A large number of very short, short, long answer questions including numericals have been incorporated in the form of various exercises after covering the concerned topics or sub-topics so that the students by attempting these may prepare well with ease and self-confidence for the short term and long term examinations.

(vii) One of the unique feature of this book is that "Hints and Answers to Some Questions" have been given for all the questions appearing in the "Exercises" for encouraging and developing the process of self-study among the students.

(viii) A special care has been taken while writing the subject matter of this book that the acquired knowledge should provide a solid base for science subjects to be studied in the higher classes.

(ix) In this book, the subject matter has been given under unitwise heads in the form of concerned chapters as Quick Revision, Very Short Answer Questions (1 mark each), Short Answer Questions–I (2 marks each)], Short Answer Questions–II (3 marks each), Long Answer Questions (5 marks each), Numerical Problems (if any), Higher Order Thinking Skills (HOTS) Questions, Value Based Questions along with required model answers to the questions.

(x) Special effort has been made to add a number of Multiple Choice Questions (MCQ) related to the Theory Topics dealt with and as well as the concerned practicals for the benefit of the students.

(xi) All questions appearing in the Science Textbook for IX class by NCERT have been dealt with in each chapter under sub-head, **"NCERT Textbook Questions"**. **NCERT Science Examplar Questions** (with answers) are also added for follow up by the learners.

I am highly thankful to all persons who have extended their willing help and co-operation in their own way in the preparation of this book. Every effort has been made while writing this book to cater to the needs of the students, therefore, this book will certainly be helpful and useful to the students.

In spite of my sincere efforts, there might have crept in some deficiencies in the preparation of this book. Constructive suggestions for removing the deficiencies and improving the book by the students, teachers and educationists will be gratefully appreciated. Any point concerning improvement of the book may please be shared with the author without any hesitation.

Author
Dr. GURDEV SINGH JOSHI
#1631, Sec. 64, Mohali (PB)
Mob. +91-9876161631

PUBLISHED BY

Vishvas Publications Pvt. Ltd.

H.O. : 576, INDUSTRIAL AREA, PHASE-9, MOHALI-160062 (Chandigarh)

PHONES : 0172-2210596, 2215045, 2211596, 5027199

E-mail : vishvasbooks@yahoo.co.in; vishvasbooks@gmail.com

SALES OFFICES

DELHI	9818270717	JAMMU	9419190177	KOLKATA	9331003099
MUMBAI	9216629576	LUCKNOW	8859466488	HYDERABAD	9216520167
BENGALURU	7347029576	BHUBANESWAR	7347029576	PATNA	8146242167
INDORE	8146242167	GUWAHATI	9256657505	JAIPUR	9216521167

In spite of our sincere efforts, there might have crept in some deficiencies in the preparation of this book for which the Authors and Publisher should not be held responsible. However, constructive suggestions for further improvement of this book will be highly appreciated and looked forward in our subsequent editions.
For latest update in syllabus and marking scheme visit : www.cbse.nic.in

Printed at :
PRINTOMEX PRINTERS
MOHALI – 160062

SCIENCE (BIOLOGY) IX

CONTENTS

CBSE SYLLABUS
Class–IX

Theme : Materials

Unit I : Matter-Nature and Behaviour **(50 Periods)**

Definition of matter; solid, liquid and gas; characteristics - shape, volume, density; change of state- melting (absorption of heat), freezing, evaporation (cooling by evaporation), condensation, sublimation.

Nature of matter : Elements, compounds and mixtures. Heterogeneous and homogenous mixtures, colloids and suspensions.

Particle nature, basic units : Atoms and molecules, Law of constant proportions, Atomic and molecular masses. Mole concept : Relationship of mole to mass of the particles and numbers.

Structure of atoms : Electrons, protons and neutrons, valency, chemical formula of common compounds. Isotopes and Isobars.

Theme : The World of the Living

Unit II : Organization in the Living World **(45 Periods)**

Call - Basic Unit of life : Cell as a basic unit of life; prokaryotic and eukaryotic cells, multicellular organisms; cell membrane and cell wall, cell organelles and cell inclusions; chloroplast, mitochondria, vacuoles, endoplasmic reticulum, Golgi apparatus; nucleus, chromosomes - basic structure, number.

Tissues, Organs, Organ System, Organism : Structure and functions of animal and plant tissues (only four types of tissues in animals; Meristematic and Permanent tissues in plants).

Biological Diversity : Diversity of plants and animals - basic issues in scientific naming, basis of classification. Hierarchy of categories / groups, Major groups of plants (salient features) (Bacteria, Thallophyta, Bryophyta, Pteridophyta, Gymnosperms and Angiosperms). Major groups of animals (salient features) (Non-chordates upto phyla and chordates upto classes).

Health and Diseases : Health and its failure. Infectious and Non-infectious diseases, their causes and manifestation. Diseases caused by microbes (Virus, Bacteria and Protozoans) and their prevention; Principles of treatment and prevention. Pulse Polio programmes.

Theme : Moving Things, People and Ideas

Unit III : Motion, Force and Work (60 Periods)

Motion : Distance and displacement, velocity; uniform and non-uniform motion along a staight line; acceleration, distance-time and velocity-time graphs for uniform motion and uniformly accelerated motion, derivation of equations of motion by graphical method; elementary idea of uniform circular motion.

Force and Newton's laws : Force and Motion, Newton's Laws of Motion, Action and reaction forces, Inertia of a body, Inertia and mass, Momentum, Force and Acceleration. Elementary idea of conservation of Momentum.

Gravitation : Gravitation; Universal Law of Gravitation, Force of Gravitation of the earth (gravity), Acceleration due to Gravity; Mass and Weight; Free fall.

Floatation : Thrust and Pressure. Archimedes' Principle; Buoyancy; Elementary Idea of Relative Density.

Work, energy and power : Work done by a Force, Energy, Power; Kinetic and Potential energy; Law of conservation of energy.

Sound : Nature of sound and its propagation in various media, speed of sound, range of hearing in humans; ultrasound; reflection of sound; echo and SONAR. Structure of the Human Ear (Auditory aspect only).

Theme : Natural Resources : Balance in Nature

Unit IV : Our Environment (15 Periods)

Physical resources : Air, Water, Soil. Air for respiration, for combustion, for moderating temperatures; movements of air and its role in bringing rains across India. Air, Water and Soil pollution (brief introduction). Holes in ozone layer and the probable damages.

Bio-geo chemical cycles in nature : Water, Oxygen, Carbon and Nitrogen.

Theme : Food

Unit V : Food Production (10 Periods)

Plant and animal breeding and selection for quality improvement and management; Use of fertilizers and manures; Protection from pests and diseases; Organic farming.

1 CELL–THE FUNDAMENTAL UNIT OF LIFE

1.1 (A) Robert Hooke in 1665 observed in a thin slice of cork many compartment like structures with a primitive and self designed microscope. He named these structures as **cells.** Cell is a Latin word for 'a little room'.

(B) What are living organisms made up of ?

Activity (or *Experiment*)–1

Cut an **onion bulb** and separate the scales. Remove the thin transparent membrane or peel (epidermis) from the concave surface of a scale and place it in a petridish containing water to prevent the membrane from getting dry or getting folded. Cut a small piece of the membrane and place it on a glass slide having a small drop of water with the help of a paint brush to avoid folding of the piece. Now put a drop of **iodine(or Saranine) solution** on this piece. Place a coverslip on it. Coverslip should be placed softly with the help of a mounting needle to avoid the air bubbles. In this way you have prepared a **temporary mount of the onion peel**. Now, you can observe the slide under low power and then under high power of a **compound microscope** (Fig. 1.1).

Diagram

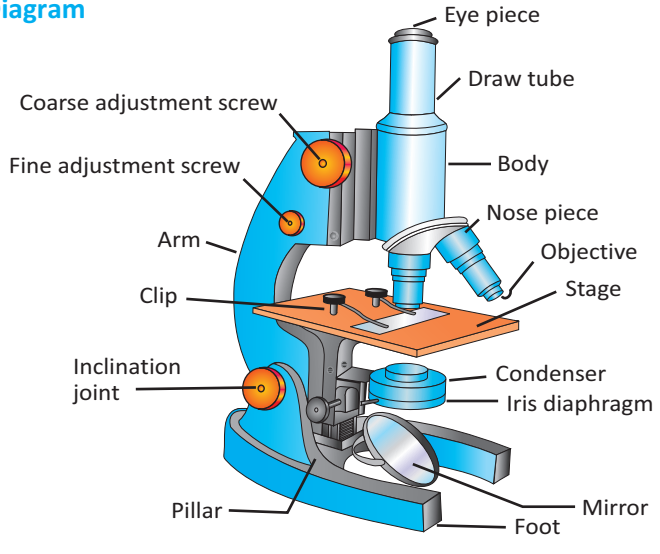


Fig. 1.1 - Compound Microscope

CHAPTER OVERVIEW

Draw the structures that you see through the microscope. It would look like in Fig. 1.2 given below.

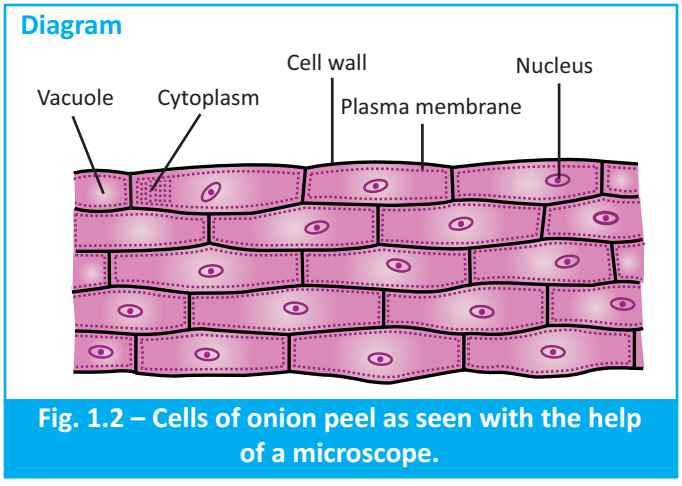


Fig. 1.2 – Cells of onion peel as seen with the help of a microscope.

(C) What are these structures found in onion peel ?

If you prepare temporary mounts of peels of different sizes from different onions, you will observe that they all have similar small structures regardless of the size of the onion. These small structures are the *basic building units of the onion bulb.* ***These structures are called*** **cells.** In fact, ***all organisms that you observe around consist of cells.*** Millions of living organisms of unlimited varieties inhabit our planet earth. They include single celled or *unicellular* (uni = single) organisms such as **bacteria** and **protista** *(Amoeba, Paramecium, Chlamydomonas).* It was the invention of microscope that led to the discovery of world of microscopic organisms. On the other hand, in some fungi, plants and animals, the body consists of many cells. These are called *multicellular (multi = many)* organisms.

The body of a multicellular organism consists of cells of different shapes and sizes which perform different functions. However, a multicellular organism begins its life as a single cell. This cell by repeated cell division produces body of the multicellular organism. Cells divide to produce cells of their own kind. In this way all cells come from *pre-existing cells.*

HISTORICAL BACKGROUND OF CELL

- **Robert Hooke,** an English scientist discovered cells in 1665. He observed the cells in a cork slice with the help of a primitive microscope and coined the term cell (Latin, *cellula* = a little room). He explained his observations in a book —*Micrographia).*
- **Anton Von Leeuwenhoek (1674),** with the improved microscope observed living cells like *bacteria, sperms* and some protozoans for the first time.
- **Robert Brown in 1831** discovered and named *nucleus* in a plant cell.
- **J.E. Purkinje in 1839** gave the term **protoplasm** for the living fluid substance present in the cell.
- Two German biologists **M. Schleiden (1838)** and **T. Schwann (1839)** proposed cell theory, which was further expanded and modified by **Virchow (1855),** a German physiologist.
- Now cell theory states that :
  (i) Cell is the structural and functional unit of life.
  (ii) All cells arise from pre-existing cells only.
  (iii) Every organism starts its life as a single cell.
- With the discovery of **electron microscope** in 1940, it was possible for us to observe and understand the complex structure of the cell and its various organelles.

Activity (or *Experiment*)–2

You can prepare temporary mounts of leaf peels, peels of onions of different sizes, tips of roots of onion, cheek cells or blood cells. You would observe :

(i) *Cells constituting the same structure, e.g., peel of onion look alike in terms of shape and size.*

(ii) *Cells of different parts of a plant are different in shape, size and structure depending upon the functions they perform.*

(iii) *There are present certain basic similarities among cells, e.g., they have a* **plasma membrane**, *a* **nucleus** *and* **cytoplasm** *with* **organelles**.

Some organisms such as human beings have cells of different kinds, e.g., muscle cells, blood cells, bone cells, fat cells, nerve cells, sperm and ovum, etc.

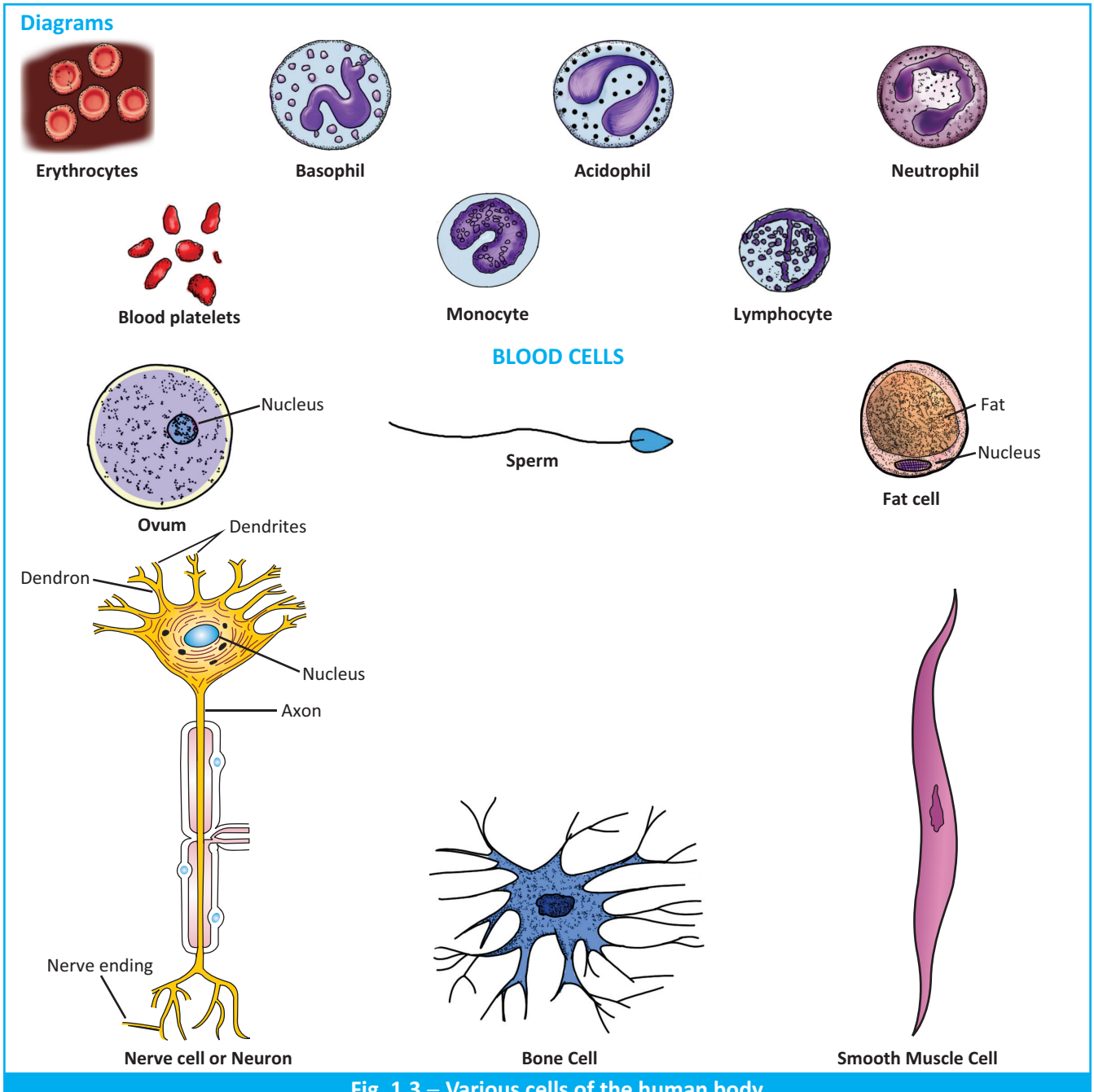


Fig. 1.3 – Various cells of the human body.

SHAPE AND SIZE OF CELLS AND DIVISION OF LABOUR

(D) Shape and size of cells vary not only in different organisms but also in different parts of the same organism. Unicellular organisms differ in shape and size. *Amoeba* has no fixed shape. It goes on changing its shape to engulf the food materials. *Euglena* and *Paramecium* which are also unicellular have fixed shapes. In multicellular organisms cell shape is fixed and characteristic of a particular type of cell. *The shape of a cell depends mainly on the functional adaptations.* The size of the cell also vary very much.

We know that in a multicellular organism, e.g., human being, different parts of the body perform different functions. Heart pumps the blood, stomach digests the food, skeleton gives shape to the body, kidneys excrete poisonous substances from the blood in the form of urine and so on. *This is called division of labour.* Similarly, division of labour is also present within a single cell. Each cell has different cell organelles which perform specific functions, e.g., ribosomes* make new materials in the cell (synthesis of proteins), lysosomes clear up the waste substances from the cell. Thus, presence of different organelles enable a cell to live and perform its functions. These organelles constitute the basic building unit called the cell. Interestingly, all cells have the same organelles irrespective of their function or what organism they are found in. Each living cell performs certain basic functions that are characteristic of all living forms e.g., *nutrition, respiration, growth, irritability* and *reproduction.* So, *the total activities of an organism is the sum total of the activities of its cells.* Thus, ***cell is the structural and functional unit of all living forms.***

STRUCTURAL ORGANISATION OF A CELL

1.2 (A) Cells vary in shape, size and function. However, a generalised pattern of cells is there, for, ***all the cells have three major functional regions, viz. plasma membrane, nucleus and cytoplasm.*** (See Fig. 1.10 & 1.11) *given ahead.* All the activities inside the cell and interaction of the cell with its environment are possible due to these features.

PLASMA MEMBRANE OR CELL MEMBRANE

(B) ***All animal or plant cells are bounded by a living, extremely delicate, elastic semipermeable or selectively permeable membrane called plasma or cell membrane.*** It separates the cell contents from the external environment. *If the plasma membrane ruptures the whole cell contents would come out and the cell would perish.* It determines the substances which can pass in or out of the cell, hence called semipermeable or selectively permeable membrane. So, ***a membrane which allows only some selected solvents to pass through it is called a semipermeable or selectively permeable membrane.***

The semipermeable membrane is made up of organic molecules called lipids and proteins. Structure of the plasma membrane can only be observed through an **electron microscope** which is a very large and sophisticated instrument. First electron microscope was designed by **Knoll and Rusca** of Germany in 1932 and was improved later on by several workers. It has a very high resolving power because it uses electromagnets in place of lenses and electron beam instead of light for illuminating the object. ***The magnification of electron microscope is 100000 to 500000.*** *It has enabled the scientists to observe and study the ultrastructure of the cell and its various organelles.*

Functions of Plasma Membrane

(i) *Plasma membrane binds the semifluid cytoplasmic contents of the cell.*
(ii) *It functions as a barrier between the protoplasm and the external environment of the cell.*
(iii) *It regulates the movement of molecules in and out of the cell.*
(iv) *The elasticity of the cell membrane enables the cell to engulf in particles of food and other materials from the external environment. Such processes are known as* **endocytosis.** So, ***ingestion of food or other materials through the plasma membrane is called*** **endocytosis.** *Amoeba* acquires its food by

Ribosomes are minute organelles without a membrane around them.

this process. *Amoeba* feeds on microscopic algae, bacteria, diatoms and other protozoans. *Amoeba* ingests food from any point on the surface of body by using the **pseudopodia.** Pseudopodia are formed around the prey or the food particle. A cup like structure is formed. Ultimately, the tips of pseudopodia encircling the food particle touch each other. The membrane at that place dissolves and the food particle is engulfed with a little amount of water to form a **food vacuole** in the cytoplasm of *Amoeba.*

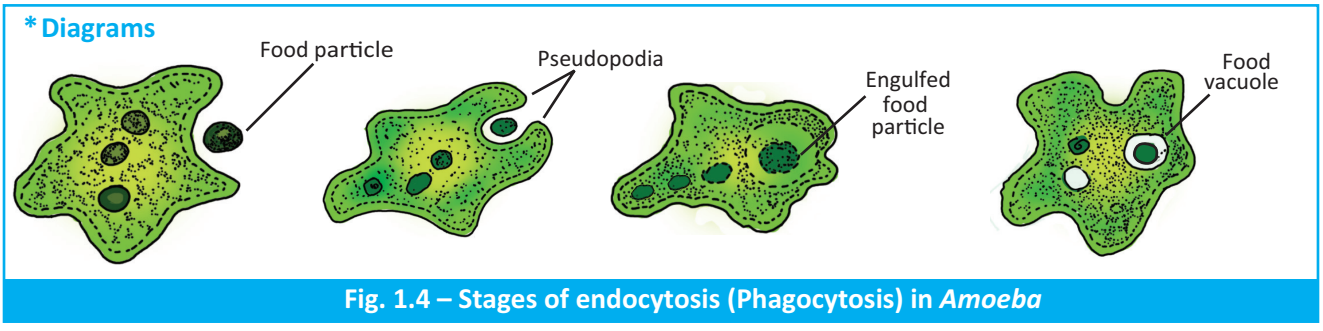


Fig. 1.4 – Stages of endocytosis (Phagocytosis) in *Amoeba*

TRANSPORT ACROSS THE PLASMA MEMBRANE

(C) 1. DIFFUSION ***is the spontaneous movement of a substance from a region of its higher concentration to the region where its concentration is low.*** Some substances like carbon dioxide or oxygen can move across the plasma membrane by diffusion.

Carbon dioxide (CO_2) which is produced by respiration inside the cell, is a cellular waste and requires to be excreted out by the cell. Carbon dioxide gets accumulated in high concentration inside the cell. So, as compared to inside of the cell concentration of carbon dioxide in the external environment of the cell is low. Due to this difference of concentration of carbon dioxide between inside and outside of the cell, carbon dioxide diffuses out of the cell, i.e., from the region of its high concentration to a region of low concentration outside the cell. Similarly, oxygen (O_2) enters the cell by the process of diffusion when the concentration of oxygen inside the cell decreases.

2. OSMOSIS : Water is essential for life. It also follows the law of diffusion. ***The movement of water from a region of its higher concentration to a region where its concentration is low, through a semipermeable (selectively permeable) membrane is called*** **osmosis.**

Cells Placed in Solution

Animal cell or plant cell placed in solution of sugar or salt will behave in one of the following ways depending upon the concentration of the surrounding solution.

(a) *If the solution surrounding the cell has a higher water concentration as compared to cell contents i.e., the* ***outside solution is very dilute,*** *the cell will gain water by osmosis and such a dilute solution is called* **hypotonic solution.** ***This is endosmosis. If during osmosis, the flow of water from the surroundings into a cell takes place, the process is called*** **endosmosis.** In fact, water molecules will pass across the plasma membrane in both directions. However, more water molecules will enter into the cell than will leave. So, the net result is that the cell gains water and becomes **swollen** or **turgid.**

(b) If the solution surrounding the cell has exactly the *same concentration* as that of the cell contents *(**isotonic solution**),* there will be no net movement of water across the plasma membrane. Water crosses the semipermeable cell membrane in both directions but the amount of water going inside the cell is the same as the amount of water going out of the cell. The cell size will remain the same.

(c) If the solution surrounding the cell has a *lower water concentration as compared to cell contents, i.e. the outside solution is a very concentrated solution (**hypertonic solution**),* the cell will lose water. Water crosses the plasma membrane in both directions, but more water leaves the cell than enters it. ***If during***

*** For better understanding.***

osmosis, water diffuses out of the cell towards the external solution, the process is called **exosmosis.** Consequently the cell will shrink. *Such a plant cell with shrunken protoplast is said to be* **plasmolysed** *and the phenomenon is called* **plasmolysis.**

OSMOSIS WITH AN EGG

Activity (or *Experiment*)–3

Dip an egg in dilute hydrochloric acid to remove the shell. The shell gets dissolved in the acid as it is made up of calcium carbonate. Wash the egg with water. A thin outer skin which is a semipermeable membrane encloses the egg. Now place this egg in pure water for five minutes and observe the change. The egg swells up because water enters the egg by *osmosis* called **endosmosis.**

Place a similar de-shelled egg in a concentrated salt solution for about five minutes. You will observe that the egg shrinks because water passes out of egg solution into the surrounding salt solution which is more concentrated. This phenomenon is called **exosmosis.**

OSMOSIS WITH RAISINS OR APRICOTS

Activity (or *Experiment*)–4

Put dry raisins or apricots in a petridish having plain water. Observe after about 30 minutes. Raisins or apricots gain water and swell up due to **endosmosis.** When the swollen raisins or apricots are placed in a concentrated sugar or salt solution for some time they lose water and shrink to previous form.

***Diagram**

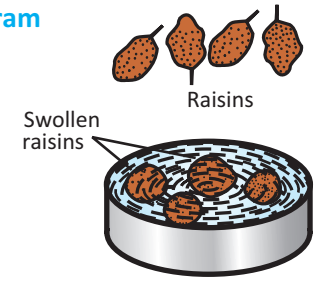


Fig. 1.5 – Experiment to show endosmosis.

Activity (or *Experiment*)–4(a) : (To show osmosis)

Take four peeled potato halves and scoop each one out to make potato cups. One of these potato cups should be made from a boiled potato. Place each potato cup in a trough containing some water so that water remains below the rims of cups. Now :

- Keep cup A empty.
- Put one teaspoon of cane-sugar in cup B.
- Put one teaspoon of common salt in cup C.
- Put one teaspoon of sugar in the boiled potato cup D.

Keep these for two hours and then observe the potato cups.

(i) Water gathers in hollowed portion of potato B and C because there is either sugar or salt. Water passes from the trough into the cavity through the potato cells due to osmosis. Sugar or salt forms a very strong hypertonic solution in the cavity.

(ii) Potato cup A functions as control experiment. Empty cavity cannot induce movement of water.

(iii) Potato cup D is of boiled potato. So all the cells of potato cup D are dead. *Osmosis does not occur in dead cells.* Therefore, despite the presence of sugar in the cavity, no water passes into the cavity through potato cells.

Examples of Osmosis

Unicellular fresh water organisms and most of the plant cells tend to gain water through osmosis.

Absorption of water by plant roots is an important example of osmosis.

**** For better understanding.***

3. ACTIVE TRANSPORT : *Movement of certain molecules into or out of the cell against the concentration gradient involving the expenditure of energy is called* **active transport**. Glucose, amino acids, potassium and sodium ions move across the plasma membrane by active transport.

Table 1.1 : Differences Between Diffusion and Osmosis

Diffusion	Osmosis
(i) *Diffusion is the movement of a substance from a region of its higher concentration to the area of its lower concentration.*	*Osmosis is the movement of a solvent (usually water) through a semipermeable membrane from the area of its higher concentration to the area of its lower concentration.*
(ii) *Diffusion can operate in any medium.*	*Osmosis operates only in liquid medium.*
(iii) *Diffusion is applicable to solids, liquids or gases.*	*Osmosis is applicable to only solvent part of a solution.*
(iv) *It does not need any semipermeable membrane.*	*It needs semipermeable membrane.*
(v) *It helps in equalising the concentration of the diffusing substance throughout the available space.*	*It equalises the concentration of the solvent on the two sides of the semipermeable membrane.*

CELL WALL

(D) ***A plant cell in addition to plasma membrane has a rigid, non-living, and freely permeable cell wall which lies outside the plasma membrane.*** It is mainly made up of *cellulose.*

Cell wall performs the following functions:

(i) *Cell wall provides mechanical strength and determines the shape of the plant cell.*

(ii) *It prevents bursting of the cell in fungi, bacteria and plants due to hypotonic external media. In such a condition cells tend to take up water by osmosis (**endosmosis**). This builds up pressure against the cell wall. Because of their walls, plant cells can tolerate much greater changes in the surrounding medium than animal cells.*

(iii) *It provides structural strength to the plant.*

Activity (or *Experiment*)–5 (Plasmolysis)

***Shrinkage of the protoplast (protoplast means the whole of protoplasm in a plant cell) of a cell from its cell wall under the influence of a hypertonic solution is called* plasmolysis.** *It occurs only in living cells.* To observe this phenomenon you can perform the following activity :

Mount the peel of a *Rhoeo* leaf in water on a slide and examine cells under the high power of microscope. Note that the cells are fully turgid [Fig. 1.6(A)]. Small green granules called chloroplasts are also visible. Now, replace the drop of water with a strong salt or sugar solution on the slide. Wait for a few minutes, you will see that the cell shrinks in size [Fig. 1.6(B)]. The shrinking protoplast becomes easily conspicuous due to the presence of green chloroplasts. Ultimately, protoplast is pulled away from the cell wall [Fig. 1.6(C)]. This phenomenon is called ***plasmolysis***. Now, put the *Rhoeo* leaf in boiling water for a few minutes to kill the cells. Repeat the above procedure. Observe under microscope. No plasmolysis occurs. So, it is clear that the phenomenon of osmosis occurs only in living cells. The dead cells cannot perform osmosis.

*Diagrams

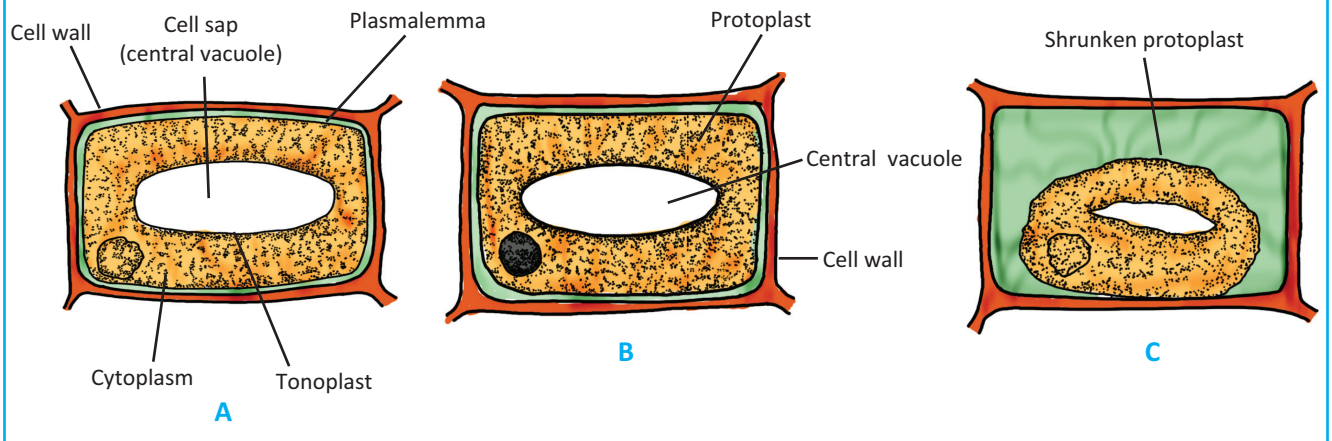


Fig. 1.6 – (A) Turgid or normal cell; (B) Shrinkage of protoplast starts; (C) Shrunken protoplast.

NUCLEUS

(E) In Activity–1 you have seen that cells of onion peel get coloured when stained with iodine solution. Some regions of the cell become more darker than the other regions. This happens due to their chemical composition. You have also observed one dark spot in each cell. It is called the **nucleus.** The use of a stain renders the nucleus quite conspicuous. Apart from *iodine solution, safranin solution* or *methylene blue solution* could also be used to stain the cells.

Activity (or *Experiment*)–6(Cheek Epithelial Cells)

*Diagram

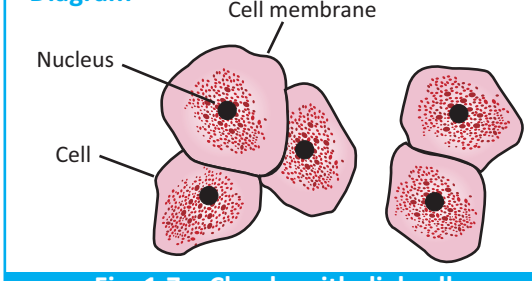


Fig. 1.7 – Cheek epithelial cells.

In this activity you can observe cells from your own body. Softly, scrap the inside of cheek of your mouth with a blunt toothpick or ice-cream spoon. Place a small part of the scrapped material on a slide and put a drop of water on it. Spread the material on the slide with the help of a needle. Put one drop of **methylene blue stain** on the material and keep it as such for 2 – 3 minutes. Remove the excess of stain with the help of a piece of filter paper. Put one drop of glycerine on the material and carefully place a coverslip on it. Observe the material under a microscope. Flat irregular shaped cells are seen which are joined together. Each cell has a thin cell membrane, a nucleus and cytoplasm.

(a) Structure of Nucleus

Nucleus may be located at different positions in the cytoplasm but generally it is centric in position and spherical or oval in shape. It consists of four parts : *Nuclear membrane* or *nuclear envelop, nucleoplasm, chromatin material* and *nucleolus.*

(i) **Nuclear membrane or Nuclear envelop :** *It bounds the nucleus on the outside so it separates the nucleus from the cytoplasm. Nuclear membrane is made up of two membranes. It has a large number of pores. The two membranes of the envelope become continuous in the region of pores. Pores allow exchange of materials between nucleoplasm and cytoplasm.*

(ii) **Nucleoplasm or Nuclear sap :** *It is semifluid, transparent, colloidal ground substance in which nucleoli and chromatin material are present. It contains nucleosides and other raw materials for the synthesis of nucleic acids and proteins.*

*Only for better understanding.

(iii) **Chromatin Material :** *It is named so because of its ability to get stained with certain dyes.* ***Chromatin occurs in the form of elongated fibres, which overlap one another to form a network called*** **chromatin reticulum.** *Chromatin fibres are mainly made up of DNA (deoxyribo nucleic acid). DNA is the genetic material and forms the genes. At the time of cell division chromatin fibres condense into compact rod-like bodies called chromosomes.* ***Chromosomes are formed of DNA and protein.*** *The number of chromosomes is fixed for a species, e.g., human beings have 46 chromosomes in each of their body cells. Chromosomes contain genes which are segments of DNA. A* **gene** *is a functional unit of chromosome. The genes act as units of heredity and variations.*

*Diagram

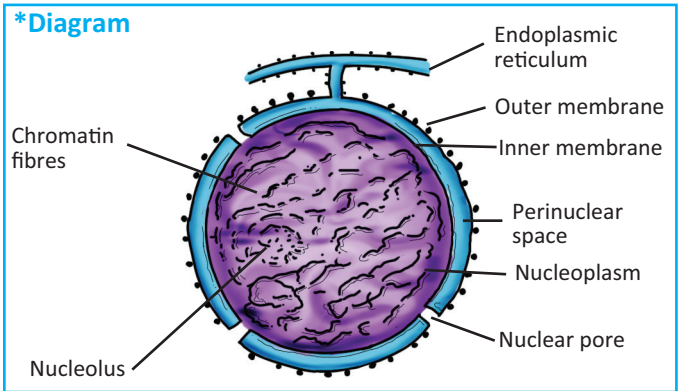


Fig. 1.8 – Structure of Nucleus

(iv) **Nucleolus :** *It is a rounded or slightly irregular structure which is attached to the chromatin. It is devoid of any limiting membrane. Commonly, 1–4 nucleoli are found in the nucleus.*

(b) Functions of Nucleus

(i) Nucleus plays a central role in cellular reproduction, i.e., cell division.

(ii) It directs and controls all the cellular metabolic activities by directing chemical activities of the cell. Along with the environment, it determines the cell differentiation and form it will exhibit at maturity. ***If the nucleus is removed from a cell the cell dies.***

(iii) It is responsible for the transmission of hereditary traits from the parent to the offspring.

CYTOPLASM

(F) ***Homogeneous, colloidal ground substance present between the plasma membrane and nuclear envelop is called*** **cytoplasm.** It takes up very little stain and forms the larger part of the cell. Certain non-living *(inclusions)* and living structures *(organelles)* remain suspended in it.

Types of Cells

Some cells have poorly defined nuclear region due to the absence of nuclear membrane. ***An undefined nuclear region containing only nucleic acids in the cytoplasm of the cell is called*** **nucleoid.**

A cell lacking an organised nucleus and having DNA without a nuclear membrane and having without membrane bound organelles is called a **prokaryotic cell.**

The organisms having cells without nuclear membrane, i.e., having prokaryotic cells are termed as **prokaryotes.**

Diagram

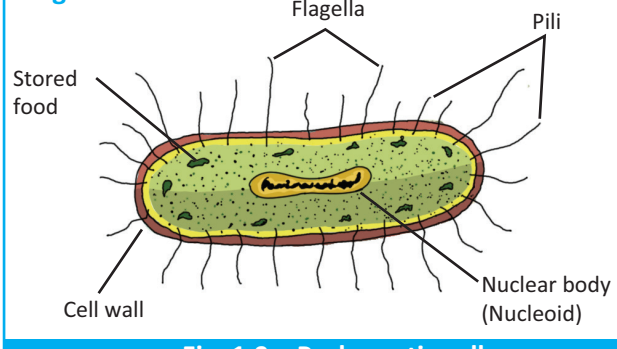


Fig. 1.9 – Prokaryotic cell

A cell having organised nucleus enclosed in a nuclear membrane and membrane bound organelles is called a **eukaryotic cell.**

The organisms having cells with nuclear membrane, i.e., having eukaryotic cells are known as **eukaryotes.**

The differences between prokaryotic cell and eukaryotic cell are classified ahead in table 1.2.

Only for better understanding.

Table 1.2 : Differences between Prokaryotic (pro = primitive, karyote = karyon = nucleus) and Eukaryotic (eu = good, karyon = nucleus) cells.

Character	Prokaryotic Cell	Eukaryotic Cell
(i) Occurrence	*Prokaryotic cells are found in Bacteria and Cyanobacteria.*	*Eukaryotic cells are found in Protista, Fungi, Animals and Plants.*
(ii) Size	*Generally very small, i.e., 1 to 10 µm (1 µm = 10–6 m).*	*Generally quite large in size, i.e., 5 to 100 µm.*
(iii) Nuclear region	*An organised nucleus having nuclear membrane, chromatin-reticulum and nucleoli is absent. Undefined nuclear region containing only nucleic acids in the cytoplasm of the cell is called nucleoid.*	*Well defined and surrounded by a nuclear membrane, i.e., true nucleus is present.*
(iv) Chromosome	*Chromosome is single, circular, double stranded, naked DNA, i.e. it is without histones.*	*Chromosomes are two to many and DNA remains covered over by histones.*
(v) Cell organelles	*Membrane-bound cell organelles are absent.*	*Membrane-bound cell organelles are present.*
(vi) Chlorophyll	*Chlorophyll in photosynthetic prokaryotic bacteria is associated with membranous vesicles.*	*In eukaryotic cells chlorophyll is associated with plastids.*
(vii) Cell division	*Cell division is by fission or budding.*	*Cell division is mitotic or meiotic.*

CELL ORGANELLES

(G) Every cell is enclosed by a membrane which keeps its contents separate from the external environment. More evolved cells or cells of multicellular organisms need a lot of metabolic activities to support their complicated structures and functions. These cells use membrane-bound cell organelles to keep the different types of activities going on in them separate from each other. So, **cell organelles *are living, sub-cellular membrane-bound structures.*** The importance of membrane can be illustrated with the example of viruses. Viruses do not have any membrane and hence do not show characteristics of life, e.g., no multiplication, until they enter any living cell. They lack their own metabolic machinery. So, they enter the living cell and utilise its metabolic machinery to multiply.

Diagram

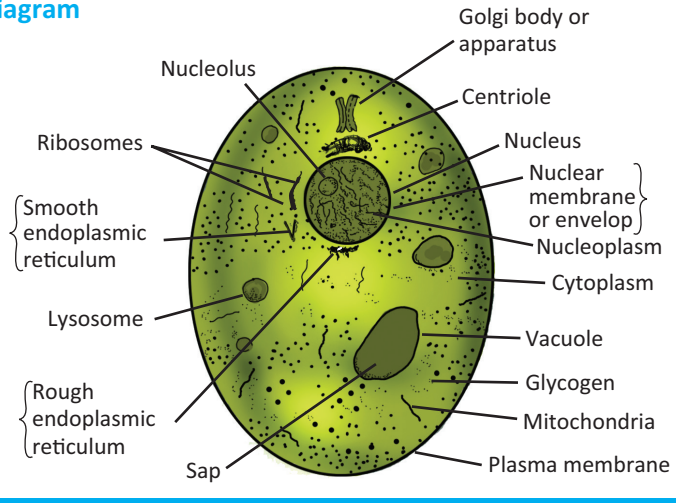
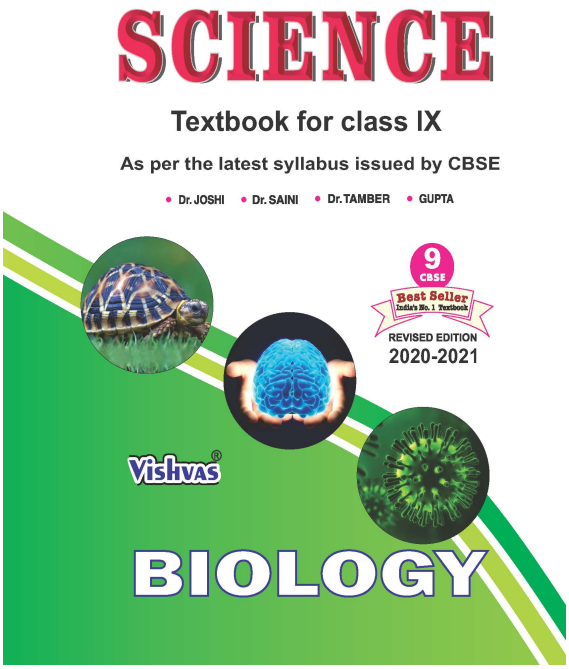


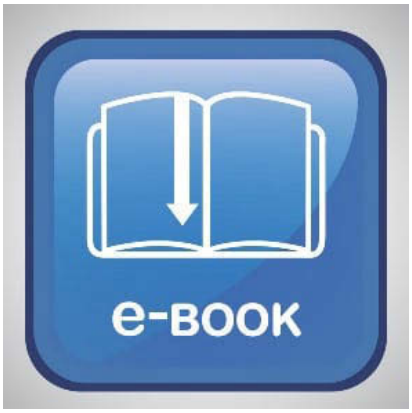
Fig. 1.10 – A Generalised animal cell under light microscope

The various cell organelles are :

(i) Endoplasmic Reticulum *(ii) Golgi Apparatus*

To Purchase the full version of the Ebook
Please click here or below





To Purchase an Ebook Please Click here

Our Other Books you may Like

Visit Website- VishvasBooks.com