UNIT - II

STRUCTURE OF A CELL AND ITS CONSTITUENTS

UNIT - II

Cell : Structural and Functional Unit of an Organism

Structured lecture notes:

Well friends, you have all studied in your earlier classes about living organisms. You also know the reasons as to why an organism is called as living and other things as non-living. Let us take the example of "human beings". Are they living or non-living? This question may be very simple to you. You may say that they are living beings, because they move, grow, respire, reproduce etc. You are right in thinking so about them. We shall consider this example of 'human beings' in details. The whole body of a 'human being' is comprised of different systems like circulatory system, respiratory system, digestive system etc. These different systems constitute the body of man. Now we shall see whether it is the same in plants also. We can take the example of a 'rose plant'. As you know, the rose plant gets water from the soil through its roots and this water is taken to the different parts of the plant. In the same way, the food that is manufactured in leaves is also transported to various parts of the rose plant. The system which helps in this process of transportation is called as vascular system. This vascular

system is made up of long tube like structures known as xylem and phloem vessels. You will be studying more about this system in your other classes. Now we shall go back to the example of 'human being' and consider one system, namely, circulatory system. It is comprised of organs like heart, arteries, veins, etc. In other words, these different organs performing the same function, namely, circulation of blood constitute one system that is 'circulatory system'. We shall go still further. You know that these organs like heart, blood vessels are all made up of tissues. Take the same example 'rose plant'. The xylem and phloem vessels are the organs. These vessels are made up of tissues. These tissues whether of plants or animals is further comprised of cells. In other words, a group of cells of similar type, of common origin and performing the same function combine together and form tissues. These cells which form tissues, carry out all metabolic activities such as digestion, respiration, growth etc. In simpler terms these cells are the basic units of life. A cell is nothing but a bit of protoplasm.

Now we know that cells which are similar and of common origin and performing the same function form tissues. Different tissues performing the same function form the organ. Different organs performing the same function form one system. Such systems form the whole structure of the living organism.

A diagramatic representation of what is explained, so far about living organisms is given in diagram 1.

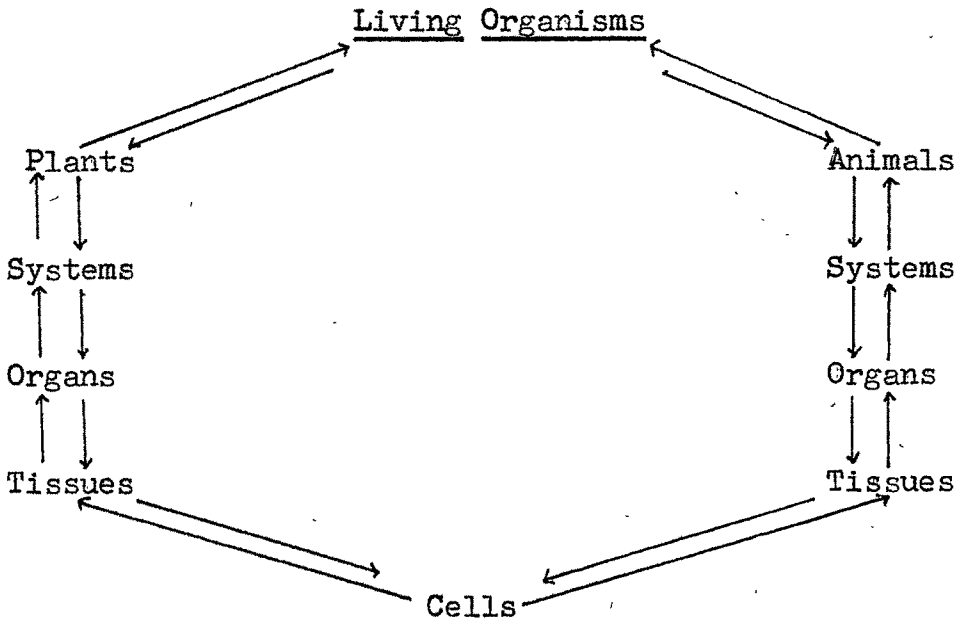

Diagram - 1

Now can we say that every living organism is made up of a number of cells? From the examples you saw earlier you may say 'yes'. But let us see whether there is any organism of only one cell. Let us take the example of the simple organism 'amoeba' (See the diagram 2). It is made up of only one cell. This single celled organisms carries out all the metabolic activities such as growth, reproduction etc.

Consider our own body. It is made up of millions and millions of cells. So, what can we conclude from this? We can say that there are organisms which are single celled as well as multicelled also. It is all right. But the question is how does this organism, whether single celled like amoeba or multicelled like man or any other organism starts its life? We shall take the same example of 'human beings" to find an answer to this question.

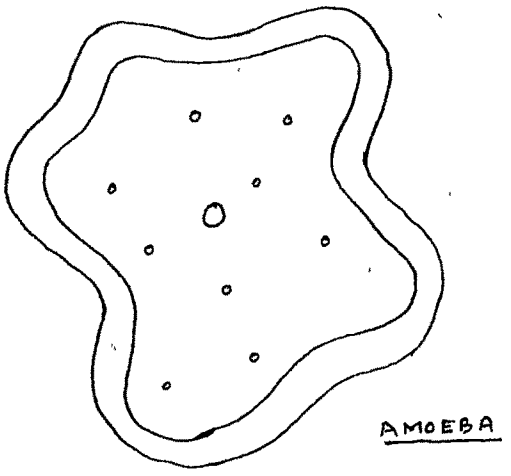

DIAGRAM - 2.

Every man or woman starts his/her life in the form of a single cell namely zygote. This zygote is formed by the union of sperm which comes from father with the egg which comes from mother. This single celled zygote formed in the womb of mother divides first into two, then into four, eight etc. (Refer to Diagram 3). Cells thus formed form tissues, which forms organs, tissues, systems, and complete organism that is child. In the case of plants also, they start their life in the form of single cell namely zygote, which later becomes seed. This seed grows into adult plant. What can we conclude

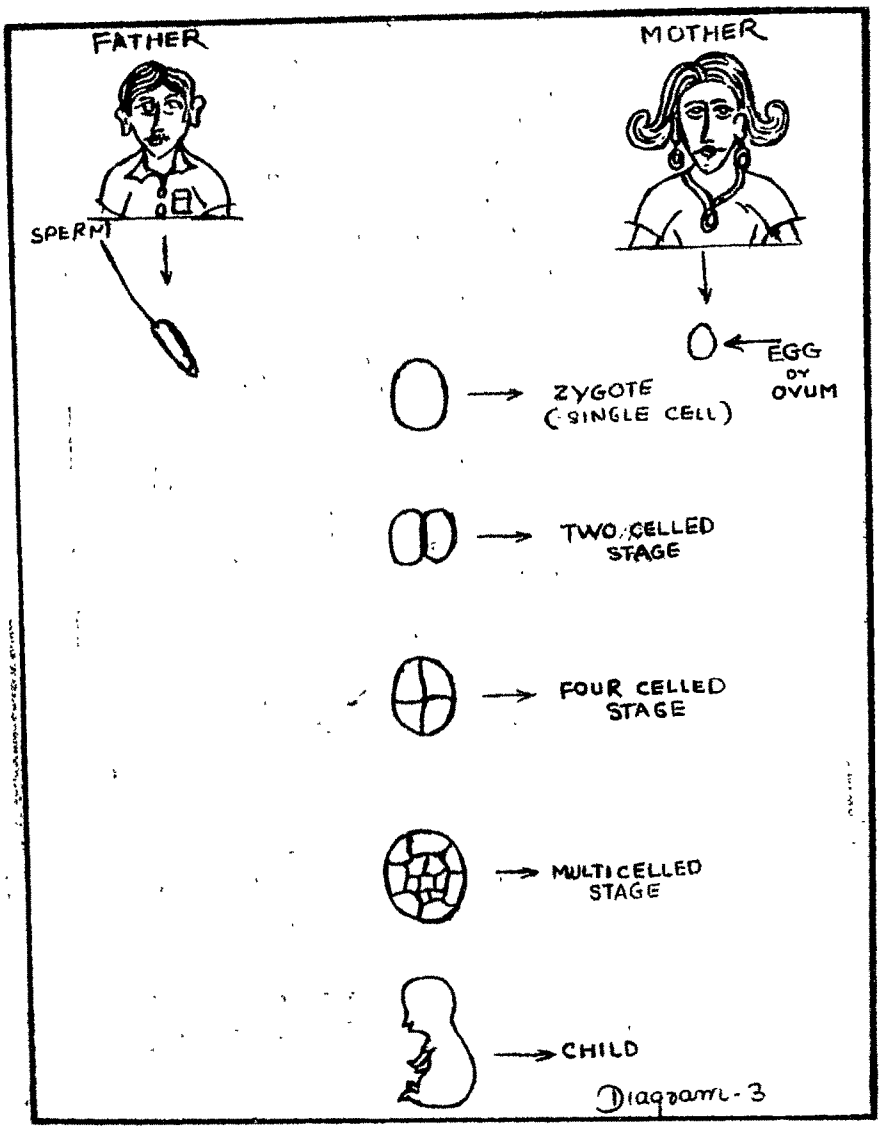
FATHER
MOTHER
SPERM
EGG
OR
OVUM
ZYGOTE
(SINGLE CELL)
TWO CELLED
STAGE
FOUR CELLED
STAGE
MULTICELLED
STAGE
CHILD

Diagram-3

from this. We can conclude by saying that "all organisms begin their life with a single cell". At this point another question arises, that is, how does this single cell exist? This also we can answer by taking the same example of 'humanbeings'. We know that human beings begin their life in the form of zygote. This zygote is formed because of the union of sperm with egg which are the pre-existing cells, which means they were existing even before the formation of zygote. So the answer is, all cells come from pre-existing cells. You think of any living organism existing on this world, these statements hold true. Let us summarise what we have studied.

(a) All living organisms are made up of one or more than one cell.

(b) All living organisms begin with single cell, which comes from pre-existing cell.

These two statements together is called as cell theory. This cell theory was first formulated by two persons namely Schleiden a botanist and Schwann a zoologist.

Now we know something about the living organisms, the two major components of cell theory, the persons who formulated the cell theory etc. But who was the first person to identify cells in living organisms?

The study of cell started from the year 1665 when plant cells were discovered for the first time. In the year 1665, Robert Hooke an English man, found interesting structures in bottle cork. In a thin section of bottle cork, under the microscope, he observed rows of small compartments, which reminded him of 'honey comb'. It is because of this he called them as cells.

To understand these cells better, you may observe some tissues under microscope as it was done by Robert Hooke. The only difference is, Robert Hooke's microscope was small. We have better microscopes. Who knows one day you may also find out something new as 'Robert Hooke' found.

PRACTICAL WORK

Observe the following sections under microscope and record your observations in the observation sheet

1. Section of bottle cork.
2. Section of Onion peel.
3. Section of elodia plant.
4. Section of frog's blood.
5. Cells of the inner lining of cheek.

Discuss with your teacher, your observations and also the advantages of straining a section.

UNIT - II : PART - II

PROTOPLASM AND ITS COMPOSITION

Introduction

Well friends, in your earlier period you had the experience of listening to your teacher about the structure of living organisms, that is, about the different systems, organs, tissues, cells, etc. which comprise the body of the living organisms. Now you know that all living organisms are made up of protoplasm, and a small bit of protoplasm surrounded by cell membrane is known as cell etc. In your practical classes you had the experience of observing mounted slides of onion scale, frog's blood, etc. Now you will be learning more about protoplasm that is

- what are the different chemical compounds that are present in protoplasm?
- what purpose these compounds serve?
- what is the physical nature of protoplasm? etc.

In otherwords, you will be learning the composition of protoplasm. This you will be learning in a very different way which you might not have experienced earlier.

Here is a learning material which you can read and

understand at your own speed, whenever you feel like it. The learning material is such that you will not require the presence of teacher when you are going through it, since every thing about protoplasm is presented in a very simple way in the form of small, small bits. Each bit of information is presented between two lines. This is called a 'frame'. In each frame, after going through the information, you will be asked to answer a small Question which is in the form of a blank. Don't worry, the Question is not intended to examine you. But it helps you to test yourself whether you have understood the idea or not. Another interesting thing about this material is that you will find while going through the bits of information certain words being underlined. This will help you in answering the Question given in the frame in the form of a blank.

Sometimes you will also find that in the blank itself some beginning or ending letters of the answer are given for e.g. 'All living organisms are composed of ce ____,' The letters 'ce' in the blank will give you a clue to the answer cells. Another thing about this learning material, is after writing the answer for the Question in each frame, you can check your answer with the correct answer given in the next frame. This will help you in knowing whether your

answer is right or wrong. All these things will enable you to learn on your own, without much help from the teacher. Is it not something very interesting to learn independently, that too at your own speed? Before you start reading the material, read the following instructions carefully. It will help you in understanding as to how to go through this learning material.

Instructions

1. Read the information given between two lines (i.e. frame) carefully and try to understand it. While going through the information, pay special attention to the words that are underlined. It will help you to answer the Question which follows this bit of information.

2. Soon after the information you will find a small Question in the form of a blank. You will have to answer this. You will be able to answer the Question with the help of the information given in the frame.

3. Write the answer in a separate answer sheet provided for this purpose.

4. Take care to write your answer against the appropriate serial number of each frame.

5. The correct answer for each frame is given on the left hand margin of the next frame. Check your answer with the correct answer given.

6. You will be right most of the time. If your answer happens to be wrong, read the frame once again and try to understand where you had gone wrong.

7. One more thing, you will not see the correct answer before you write your answer. You will study each frame and answer the question therein, without looking at the correct answer. This will help you learn better. For this, you are provided with a card with the help of which you can cover the correct answer.

8. You will understand better with the following illustration.

Illustration

Bit of information

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1. You know that cats, dogs, plants, human beings are all composed of cells. They are all living beings.

   We can say that all living beings whether plants or animals are composed of _____

Here the question is in the form of a blank. You will have to write the answer in the answer sheet.

'Cells' is the correct answer to the above frame.

Now you can start going through the material given to you. I hope you will enjoy this way of learning.

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1. Well friends, in your practical class you have observed slides of different types of cells such as cells of onion peel, hydrilla leaf, amoeba, paramaecium, etc. You have noticed in a slide of onion peel, rows of box like structures. Each box like structure is nothing but a bit of protoplasm surrounded by a thin outer membrane.

   These bits of protoplasm with their surrounding outer membranes are called as ce____.

Cells

2. In the case of hydrilla leaf also you have observed these small bits of protoplasm surrounded by the thin outer membrane.

   In otherwords, we can say that hydrilla leaf is also composed of _____.

Cells	3.	Let us take another example viz., R.B.Cs of frog's blood which also you have observed under microscope. They are small bits of protoplasm surrounded by outer membrane. Hence, R.B.Cs of frog's blood are also _____.
Cells	4.	From the above examples we can say that a _____ is nothing but a bit of protoplasm surrounded by a thin outer membrane.
Cell	5.	Now, you know that a cell is nothing but a bit of protoplasm surrounded by an outer membrane. Since this membrane covers the protoplasm, it is called as the plasma membrane. So, the membrane that encloses a small bit of protoplasm is called as _____ membrane.
Plasma	6	In the case of onion cells, cells of hydrilla leaf, etc., the outer membrane that encloses the protoplasm is called as _____ membrane.

Plasma

7. You are right. This plasma membrane which surrounds or encloses a small bit of protoplasm is also called as <u>cell membrane</u>, since a small bit of protoplasm is nothing but a cell.

So the other name for plasma membrane is _____ membrane.

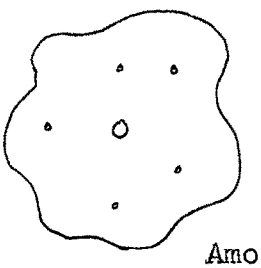
Cell

8. To put in simple words, a cell of a living organism is nothing but a bit of protoplasm surrounded by _____ membrane which is also called as _____ membrane.

Plasma, Cell

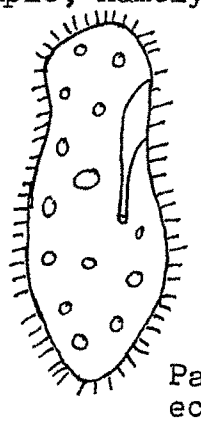
9. You are right. You know already that all living organisms are composed of cells which are small bits of protoplasm surrounded by cell membrane. Let us take the example of amoeba which you have already observed under microscope in your practical class. You know that the entire organisms is a small bit of protoplasm surrounded by cell membrane.

In other words we can say that the body of amoeba is composed of only a <u>s le</u> cell.



Amoeba

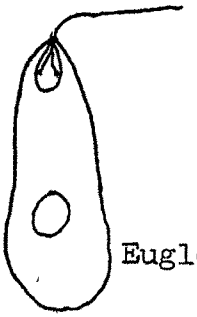
Single 10. Let us take another example, namely, paramaecium which also you have observed under microscope. like amoeba, the body of paramaecium is also composed of a small bit of protoplasm surrounded by cell membrane.



Parama-ecium

It means paramaceium is also composed only a _____cell.

Single 11. See the diagram. It is the diagram of an organism known as euglena. The entire organism is a small bit of protoplasm surrounded by cell membrane.



Euglena

Hence, Euglena is also a _____ celled animal.

Single 12. As the organisms mentioned earlier are single celled or unicelled, they are also known as unicelled or unicellular organisms.

So, calling amoeba, paramaecium etc., as _____ organisms, we mean that they are single celled organisms.

Unicellular	13.	Like amoeba, paramaecium, and Euglena, there are a number of single celled organisms existing in the environment. All organisms which are single celled are known as _____ organisms.
Unicellular	14.	In the laboratory, you have observed onion peel under the microscope. You might have noticed that onion peel is composed of a number of cells. As the onion is composed of a number of cells, it is not a _____ organism.
Unicellular	15.	Let us take the example of our own body. You know that it is composed of millions and millions of cells. It means human beings are also not _____ organisms.
Unicellular	16.	In the same way, the small and big plants, different animals which you see around you are all made up of many cells. In other words we can say that all these animals and plants are made up of more than o__ cell.
One	17.	Those organisms which are composed of more than one cell or many cells are called as multicellular organisms.

Multicellular organisms are organisms which are composed of _____cell (one/more than one).

More than one cell

18. In the earlier frames you have learnt about the number of cells in different organisms. On this basis, all organisms (both animals and plants) can be divided into two groups namely _____ _____ and _____ organisms.

Unicellular, Multicellular

19. All organisms, whether unicellular or multicellular, are composed of cells. You know already that a cell is nothing but a bit of protoplasm surrounded by a cell membrane.

Or in other words, we may say that all living organisms are composed of _____.

Protoplasm

20. To put in in a simple way, all living organisms may be single celled or multicelled, but they are basically composed of _____sm.

Protoplasm

21. So, we can say that all living organisms are composed of _____ which makes them differ from non-living things.

Protoplasm 22. It is because of the absence of protoplasm in non-living things, they cannot exhibit activities like movement, growth, respiration, reproduction etc. which are called as the physiological activities.

In other words, all the physiological activities that are exhibited by living organisms are due to _____ present in them.

Protoplasm 23. As you know, an organism which is dead cannot exhibit any physiological activity as living organisms do. It is because that the protoplasm is dead in dead organisms.

Dead organisms do not show physiological activities as the _____ is dead in them.

Protoplasm 24. You are sure that the non-living things and dead organisms to do not exhibit any of the physiological activities.

In the non-living things, it is due to the lack of _____in them, whereas, in the dead organisms it is because the _____ is dead.

Protoplasm, Protoplasm	25.	This shows that, protoplasm is responsible for all the physiological activities of a living organism, and hence it is called as the "physical basis of life". The main reason for calling protoplasm as _____ is because it is responsible for all the activities of the organism.
Physical basis of life	26.	We can say it in a different way, that is, protoplasm is the life of the organism, since it is responsible for different activities of living organism. Hence it is called as _____ _____ of life.
Physical basis	27.	It was Professor Huxley, in 1868, who called protoplasm as the physical basis of life. The first scientist to call protoplasm as physical basis of life was Professor _____ in 1868.
Huxley	28.	Well, now you know that all living organisms are composed of protoplasm, which makes them differ from the non-living things. These living organisms in order to live on this world require certain basic things. Let us try to understand by taking

one example, 'food'. You know that all living organisms require food (which may be of different types) which is a substance needed for all of their physiological activities.

In other words, food is one type of sub_____ which is required by all living organisms for their physiological activities.

Substance 29. Let us take another example, 'air'. All living organisms require air which is composed of carbondioxide, oxygen etc. for their physiological activities.

So another s_____ required by all living organisms for their maintenance of their life is air.

Substance 30. Like food and air, all living organisms require water, which is also a _____ for their maintenance of life.

required

Substance 31. From these examples of food, air and water, we can say that all living organisms require certain _____ for the maintenance of their life.

Substances 32. Now we know that all living organisms require certain substances for maintaining their life. But, we know that all living organisms are composed of protoplasm. We

also know that protoplasm is responsible for all the physiological activities of the organism.

Putting these two ideas together we may say that protoplasm is formed and maintained by different _____.

Substances 33. In protoplasm these substance are present in the form of compounds.

In other words, we may say that protoplasm is composed of a number of c_____.

Compounds 34. You may be wondering what these compounds are. But, you may remember that you have studied about compounds in your chemistry class. These compounds whether present in non-living things or in protoplasm are made up of a number of elements.

The different compounds found in protoplasm are made up of different combinations of _____.

Elements 35. About 25 elements are found in protoplasm of living organisms. But out of these 25 elements only Carbon, Hydrogen, Nitrogen and Oxygen are the major elements which form 95% of the weight of protoplasm.

The major elements that form 95% of the weight of protoplasm are _____, _____, _____, and _____.

Carbon, Hydrogen, Nitrogen & Oxygen	36.	In other words we can say that majority of the compounds found in protoplasm are made up of elements like _____, _____, _____ and _____.
Carbon, Hydrogen, Nitrogen & Oxygen	37.	The rest five percent of the protoplasm is composed of elements like calcium, phosphorous, iron etc. So, the percentage of elements like calcium, phosphorous, iron, magnesium etc. present in protoplasm is very less when compared to the percentage of elements like _____, _____, _____ and _____ present in protoplasm.
Carbon, Hydrogen, Nitrogen & Oxygen	38.	Now you know that protoplasm is composed of a number of compounds which are in turn made up of elements. Let us take one or two compounds as examples and examine the combination of elements in these compounds. Water is one such compound. You know already that a molecule of water is made up of two atoms of hydrogen and one atom of oxygen. Water is a compound and is made up of _____ and _____.
Hydrogen and Oxygen	39.	Have you heard about the compound hydrogen peroxide (H_2O_2)? You might not have. Just like water, hydrogen peroxide is also composed of hydrogen and oxygen. Now

You may be wondering how two compounds can be made up of the same two elements? But, they do exist.

Water and hydrogen peroxide are two different compounds made up of the same two elements _____ and _____.

Hydrogen and Oxygen

40. Then, how do they differ from each other. You may be knowing that in water, hydrogen and oxygen are in the ratio of 2:1.

Or in other words, water molecule is composed of ___ molecules of hydrogen and ___ molecule of oxygen.

Two, One

41. Let us see the combination of hydrogen and oxygen in hydrogen peroxide. As the name denotes (peroxide) it contains more oxygen. A molecule of hydrogen peroxide is made up of two molecules of hydrogen and two molecules of oxygen.

While the combination of hydrogen and oxygen in water is 2 : 1, the combination of the same element in hydrogen peroxide is _____.

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2 : 2

42 Here we may conclude that two elements can combine in different and definite ways to form two different _____.

Compounds 43. You have studied in the earlier frames that about 25 elements are there in the form of compounds in the protoplasm. It may be mentioned here that the protoplasm contains a large number of compounds.

All these compounds are made up of only a small number of _____.

Elements 44. This is possible because of the presence of these elements in a definite and regular pattern in different compounds. You may recall the examples of water and hydrogen peroxide to understand how these c_____ are made up of.

Compounds 45. As mentioned earlier there are a number of compounds present in the protoplasm. Major compounds present in protoplasm are carbohydrates, fats, proteins, nucleic acids and water.

Among the large number of compounds present in protoplasm, the major ones are _____, ____, _____, and _____ _____.

Carbohydrates, Fats, Proteins, Nucleic acids 46 Let us summarise what we have studied in the last few frames.

1. Protoplasm is the physical basis of life.
2. Protoplasm is composed of different

elements. The major elements are _____, _____, _____, and _____.

3. Elements in protoplasm exist in different and definite combinations in the form of compounds. The major compounds among them are _____, _____, _____, _____ _____ and _____.

Carbon, Hydrogen, Oxygen and N_2

Carbohydrates, Fats, Proteins, Nucleic acids and Water.

47. Now you know that there are many elements and compounds present in the protoplasm of living organisms. Let us take one such compound present in protoplasm, namely, carbohydrates. We shall split the word 'carbohydrate'. Carbo means carbon, and hydrate means water which is composed of hydrogen and oxygen.

Carbohydrates are compounds which are composed of _____, _____, and _____ atoms.

Carbon, Hydrogen and Oxygen

48. Let us consider another compound namely 'glucose D' with which you are all familiar. It is a carbohydrate present in the protoplasm of all cells whether of plants or animals. The chemical formula for this compound is $C_6H_{12}O_6$.

From the chemical formula for glucose we can say that, the compound glucose is composed of 6 atoms of _____ 12 atoms of _____ and 6 atoms of _____.

Carbon, Hydrogen, Oxygen

49. I hope you might have all seen red tomatoes and even tested it. The red colour of the tomato fruit is due to the presence of a compound called 'Lycophyll' in the cells of the tomato fruit. The chemical formula for this compound is $C_{40}H_{56}O_2$.

The chemical formula of the compound Lycophyll denotes that it is composed of 40 atoms of _____, 56 atoms of _____ and 2 atoms of _____.

Carbon, Hydrogen, Oxygen

50. Let us take another example of the compound namely 'Citric acid' present in Lemon fruits. The chemical formula for this compound is $C_6H_8O_7$.

The compound citric acid present in Lemon fruit is composed of 6 atoms of _____ 8 atoms of _____ and 7 atoms of _____.

Carbon, Hydrogen, Oxygen.

51. In the earlier examples namely 'glucose D', Lycophyll, and Citric acid you have noticed the presence of carbon atoms. There are many more compounds like the above, present in protoplasm containing <u>carbon</u> atoms.

In simple words, in the protoplasm of living organisms are present compounds containing c_____ atoms.

Carbon

52. These compounds which contain carbon atoms in them are called as <u>organic</u> compounds.

So or _____ compounds are compounds which contain carbon atoms.

Organic

53. So, the compounds namely 'glucose D', Lycophyll, Citric acid are all _____ compounds since they contain carbon atoms in them.

Organic

54. Now let us summarise what we have studied about organic compounds.

1. In protoplasm of all living organisms are present compounds containing _____ atoms.
2. These compounds which contain carbon atoms in them are called as _____ compounds.

Carbon, Organic

55. Now we shall try to understand whether are there any compounds present in protoplasm without containing carbon atoms. Let us take the example of water, which is present in protoplasm of all living organisms. You know very well that it is composed of hydrogen and oxygen atoms. Carbon atoms are absent in it.

We can say that water is not an organic compound since it does not contain _____ atoms in it.

Carbon 56. Like water, sodium chloride is another compound present in protoplasm of living organisms. It is composed of one atom of sodium and one atom of chlorine.

Just like water, sodium chloride is also not an organic compound since it does not contain _____ atoms.

Carbon 57. You are right. Like water, sodium chloride is also not an organic compound. There are many more compounds like water and sodium chloride present in protoplasm and which do not contain carbon atoms.

In other words, protoplasm of living organisms also contain compounds in which _____ atoms are absent.

Carbon 58. These compounds which do not contain carbon atoms in them are called as inorganic compounds.

So, _____ compounds are compounds which do not contain carbon atoms.

Inorganic 59. We shall summarise what we have studied about inorganic compounds.

1. In protoplasm of all living organisms are present compounds which do not contain _____ atoms.
2. These compounds which do not contain carbon atoms in them are called as _____ compounds.

60. Now we know that protoplasm of living organisms contain both organic and inorganic compounds. Let us try to study some of them in detail and try to understand their need for the cell.

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61. Let us start with inorganic compounds. You are all familiar with sugar cane. When this sugar cane is crushed, sugar cane juice comes out. This juice is nothing but <u>water</u> containing sugar in it. This juice was present in the cells of the sugar cane stem.

In other words, we can say that, cells of sugar cane contain* _____ in which is dissolved _____.

Water, Sugar

62. We shall take another example, say, water-melons. You might have all eaten it and experienced that just like sugar cane, it also contains lot of _____ in its cells.

Water

63. In the above two examples, we have seen the presence of water. You can do this small experiment at home to know the presence of water in cells of the plant. Take a well watered plant which is quite healthy and young. Squeeze the stem of the plant. You will find <u>water</u> coming out of the plant, which was in the cells of the plant.

		This will tell us once again that _____ is present in the cells of the plant.
Water	64.	Heitherto, we have seen the presence of water in plants. What about animals? We shall try to understand whether they also contain water by taking our own body as an example. You might have experienced profuse sweating during hot summer days. The sweat that is produced is nothing but water with some salts dissolved in it. It is produced in the underlying cells of the skin, namely, sweat glands. This process of sweating tells us that w____ is present in the cells underlying the skin of human beings.
Water	65.	Let us take another example 'blood' which is present in most of the animals. Major portion of this blood contains water. Our blood contains about 90% of water, and the rest 10% of proteins and other substances. Blood is another evidence to show that _____ is present in the body of living organism.
Water	66.	We shall see another example to understand the presence of water in animals. The cells that are present in our brain contain about 80% of water.

In other words, we can say that human brain cells contain about 80% of _____.

Water

67. What about the rest of the cells present in our body? They contain nearly 66% of water in them.

The cells that are present in our finger tips, hands, etc. contain about 66% of _____.

Water

68. Now, what can we conclude from the above examples taken from plants and animals.

We can conclude that all cells whether that of plants or animals contain _____ which is an inorganic compound.

Water

69. You are right, all cells contain water. But the question is why do cells need this water. We shall try to understand this need of water for cells by taking some examples. Suppose a pinch of common salt is put into water, what will happen to the salt? It <u>dissolves</u> in water.

So, common salt when put into water _____ in it.

Dissolves

70. We shall take the example of sugar cane juice which we have studied earlier. We know that it is nothing but water containing sugar <u>di lved</u> in it.

Dissolved	71.	You are right. Think of what all things we take along with our food. We take many things for e.g. sugar along with coffee, tea, or sweetmeats, salts along with soup and curries etc. There are many more food substances like sugar and salt that we take daily and which _____ in water.
Dissolve	72.	From the above examples what can we conclude about water. We can conclude that water has the property to _____ many of the food substances.
dissolve	73	It is because of this property of water to _____ many food substances, it is needed by cells. So, one important need of water to living organisms is that water can _____ many of the food substances.
dissolve	74.	In other words, all cells need water since it has the property to _____ many of the food substances.
dissolve	75.	Let us consider another example. You have all heard of ammonia gas. It is a waste-product produced in our body. Since it dissolves in water, it is thrown out of our body through urine.

So, we can say that certain body wastes like ammonia etc. also _____ in water.

---

dissolve

76. Now you know one reason as to why all living organisms need water. Since water dissolves many substances and body wastes, these substances can move into and out of the cell easily through cell membrane.

To put it in a different way, it is mainly because of water present in cells of the organism, many substances (food substances and body wastes) can move _____ and _____ of the cells easily, being dissolved in it.

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into, out

77. So, the second need of water to cells, is , it makes the food substances and body wastes to move _____ and _____ of the cell by dissolving them.

---

into, out

78. You are correct. We can conclude that water present in cells help for the free flow of substances ____ and ___ of the cells by dissolving them.

---

into, out

79. Let us summarise what we have studied about need of water.

1. Water is mainly needed by cells because, many of the food substances and body wastes _____ in it.

2. It helps for the free flow of substances _____ and ____ of the cells through cell membrane.

---

dissolves, into, out

80. Now you know about water which is one of the important inorganic compounds present in cells or protoplasm. We shall try to understand the other inorganic compounds present in protoplasm. In addition to water, the other inorganic compounds present in protoplasm are salts like phosphates, chlorides, sulphates etc.

So, the other inorganic compounds present in addition to water are salts like _____, _____, _____etc.

---

phosphates, chlorides, sulphates

81. Now we can say that, inorganic compounds like water, salts like _____, _____, _____ etc. are present in protoplasm.

Phosphates chlorides, sulphates.

82. By now, I hope you are clear about the different inorganic compounds present in protoplasm. Now we shall proceed further to understand the different organic compounds present in protoplasm, their composition and importance.

DEMONSTRATION

IDENTIFICATION TESTS FOR CARBOHYDRATES

(Teacher would demonstrate the presence of sugar and starch in plants with the help of following materials).

Materials : 1 Glucose sugar
2 Cane sugar
3 Apple
4 Potato
5 Wheat grains
6 Fehling's solution
7 Test tubes
8 Spirit lamp
9 Iodine solution
10 Microscope.

Your teacher would proceed in the following way to show you the presence of sugar and starch in plants.

Procedure:

Test for glucose: A tea spoon full of glucose sugar is taken in a test tube and is dissolved in water. The solution is gently warmed. To it, is added a few drops of fehling's solution and boiled. Observe and record the colour of the precipitate formed, in the observation sheet.

Test for sucrose: A tea spoon full of cane sugar is taken in a test tube and is dissolved in water. To it, is added 2-3 drops of dilute HCl and boiled. To this boiled solution,

is added a few drops of Fehling's solution. Observe and record the colour of the precipitate formed, in the observation sheet.

Presence of sugar in plants: A few pieces of apple fruit are crushed with water and it is filtered. To the filtrate is added a few drops of Fehling's solution and boiled. Observe and record the colour of the precipitate formed, in the observation sheet.

Composition of Carbohydrates: A very small amount of cane sugar is taken in a test tube and is heated over a spirit lamp carefully. Observe the charring of sugar and also the sides of the test tube. Record your observations in the observation sheet.

Presence of starch in plants: Thin sections of potato and wheat will be taken on a glass slide. To each is added a drop of iodine solution. The sections will be focussed under microscopes. Observe the sections under microscope and record your observations.

Disscuss with your teacher, the observations so far you have made and proceed to the frame number 83.

CARBOHYDRATES

83. Let us start our study about carbohydrates by taking the example of cane sugar, which we had tested to know whether it contains carbon atoms or not. In the experiment, we had seen that when cane sugar is burnt, a black substance is left behind. This black substance is nothing but carbon.

So, when cane sugar was burnt a black substance was left behind which is _____ .

carbon

84. You also saw in the experiment the collection of water drops on the sides of the test tubes. This tells us that when cane sugar was burnt in the test tube, vapours of water was evolved which condensed into _____ molecules on the sides of the test-tube.

water

85. You know very well that a molecule of water is composed of two atoms of hydrogen and one atom of oxygen. From the experiment what can we infer with regard to the composition of cane sugar?

We can infer that cane sugar is composed of _____ _____ and _____ atoms.

carbon, hydrogen, oxygen

86. You are rignt. Cane sugar is composed of carbon, hydrogen and oxygen atoms. The chemical name for this cane sugar is sucrose. Let us see the chemical formula of this sugar cane or sucrose. The chemical formula is $C_{12}H_{22}O_{11}$, where, 'C' stands for carbon, 'H' for hydrogen and 'O' for oxygen.

From the chemical formula we can say that sucrose or cane sugar is composed of 12 atoms of _____, 22 atoms of _____ and 11 atoms of _____.

---

carbon, hydrogen, oxygen

87 Now we shall examine the ratio of hydrogen and oxygen atoms present in sucrose (C_{12},H_{22},O_{11}) . We know that there are 22 atoms of hydrogen and 11 atoms of oxygen in sucrose.

In other words, we can say that hydrogen and oxygen atoms in cane sugar are in the ratio of ___:___ .

---

2 : 1

88. We can also say that, in cane sugar, the number of hydrogen atoms present are d le the number of oxygen atoms.

---

double

89 Now let us consider the example of apple which we have tested for the presence of sugar. From the experiment we know that it contains sugar. The chemical name for this fruit - sugar is fructose. It is denoted

by the chemical formula $C_6H_{12}O_6$. It is present in fruits and honey.

Examine the formula. Like cane sugar or sucrose, fruit sugar or fructose is also composed of _____, _____ and _____ atoms.

---

carbon hydrogen, oxygen

90. The number of hydrogen and oxygen atoms present in fruit sugar or fructose ($C_6H_{12}O_6$), are in the ratio of 2 : 1, as in sucrose or cane sugar.

In other words, we can say that fruit sugar contains do le the number of hydrogen atoms when compared to oxygen atoms.

---

double

91. From these two examples of carbohydrates, namely, sucrose and fructose, what can we conclude with regard to the ratio of hydrogen and oxygen atoms present in carbohydrates.

We can conclude that carbohydrates always contain hydrogen and oxygen atoms in the ratio of __:__.

---

2 : 1

92. Let us summarise what we have studied about carbohydrates.

1. Carbohydrates are compounds containing _____, _____, and _____ atoms.
2. The ratio of hydrogen and oxygen atoms in carbohydrates is always _____.

carbon, hydrogen, oxygen
2 : 1

93. In the earlier frames, we have studied two examples of carbohydrates, namely, sucrose and fructose. Now let us see some more examples of sugars. We know from the experiment that grape sugar or glucose is a type of sugar. It is the principle carbohydrate present in almost all living organisms.

In other words, we can say that _____ is found in almost all living organisms.

---

glucose

94. You might have all tasted raw milk without adding cane sugar. It is sweet to taste since it contains a kind of sugar. But you may think why people take milk along with cane sugar. The reason is they want to make it more sweeter. The sugar present in milk is called as lactose.

So, the carbohydrate present in the form of sugar in milk is _____.

---

lactose

95. Now we know that substances like sugar cane, honey, fruits, milk, etc. contain sugar in them. These substances are called as sources of sugar.

So, apple, mango, oranges, carrot etc. are all so _____ of sugars, since they contain sugar in them.

Sources

96. You might have noticed that the examples we had taken in the previous frame are all plants. Plants are the manufacturers of sugar. All animals depend for sugar on green plants since they cannot manufacture sugar in their body (In Chapter Photo-synthesis you will come to know why animals cannot manufacture food). We shall take the example of human beings to understand better. We consume sugar in different forms namely fruits, cane sugar etc. During digestion these food substances are broken down into smaller molecules of glucose and are absorbed by the cells. These glucose molecules combine together in a particular way to form another type of carbohydrate known as starch.

Another type of carbohydrate present in animals are s_____ and is formed by the combination of large number of sugar molecules.

---

starch

97 Let us consider the plant kingdom. In all green plants, sugar is manufactured in the form of glucose. These glucose molecules combine together and form starch.

In plants also carbohydrates are present in the form of sugar and _____.

starch 98. The starch thus formed in plants is stored in the form of small small grains. You have seen the starch grains of wheat, rice, potato, in your practical class. Recall its structure.

We can say that in plants starch is stored in the form of starch _____.

grains 99. What about animals? In animals starch is stored in liver and muscle as glycogen.

In animals, molecules of glucose combine together and form starch, which is stored in the form of _____ in muscles and liver.

glycogen 100. Now let us see some of the examples of starches; Rice, wheat, potato, jowar, etc., are all examples of starches.

In other words, we can say that rice, wheat, etc. are the sources of _____.

starche 101. Now you are familiar with the sources of starch and sugars. List out the different sources of starch and sugars which you have studied.

Sugars 1)_____ 2)_____ 3)_____

Starches 1)_____ 2)_____ 3)_____

102. So far we have tried to understand the chemical composition of carbohydrates present in protoplasm, the two different types of carbohydrates present in protoplasm etc. Now we shall try to see the need of these carbohydrates for living organisms. We shall take one example. You know that people usually take glucose after running or after playing. You might have had the experience of taking glucose when you were tired. Do you know the reason as to why we take glucose when we feel tired? It is because it contains energy.

People take glucose in order to get _____ which has been utilised for carrying out different activities.

energy

103. But many of us do not take glucose every day in order to get energy. Then, from where do we get energy for carrying out all activities? You know that we take cane sugar, milk, fruits, etc. which contain 'sugar', and wheat, rice etc. which contain 'starch'. Recall what you have studied about digestion of these substances. During digestion,these food stuffs will be broken down into smaller and smaller molecules of glucose and are absorbed by the cells.

In other words, these sugars and starches which are examples of carbohydrates

serve as the source of _____ to us.

---

glucose

104. You are right. The different sugars and starches we take, serve as the sources of glucose. We know that glucose contains energy.

Since, the different sugars and starches contain glucose in them, we can say that they are the sources of e___y .

---

energy

105. All plants and animals can utilise carbohydrates only in the form of glucose.

During respiration in cells, these glucose molecules will be burnt and energy is released (In chapter respiration, you will study more about this burning process) which is utilised for different activities of the organism.

From the above discussion, we can say that all living organisms require carbohydrates, since they are the sources of e_____ to them.

---

energy

DEMONSTRATION

IDENTIFICATION TESTS FOR FATS

(Teacher would demonstrate that groundnuts, coconut endosperm and castor seeds contain oil, with the help of following material).

Materials:
1. Coconut oil
2. Groundnuts (fresh)
3. Coconut endosperm
4. Castor seeds
5. Sudan IV solution
6. Test tubes
7. Water
8. Microscope
9. Brown paper.

Your teacher would proceed in the following way to show the presence of oil in coconut, groundnuts, and castor seeds.

Procedure

1. A drop of coconut oil is put to one corner of a brown paper. To another corner, is put a drop of water. The paper is allowed to dry. Observe whether any mark is left on the paper even after drying. Record your observation in observation sheet.

   Coconut endosperm, groundnut and a castor seed is rubbed against the brown paper. Observe whether any mark is left on the brown paper.

Record your observation in the observation sheet.

2. To 3 ml of water in a test tube, is added a drop of sudan IV. To this solution is added 1 ml of coconut oil, and is shaked well. Observe and record the colour change in the solution, in the observation sheet.

3. Thin section of castor seed will be taken on a glass slide. To it is added a drop of iodine solution. The section will be focused under microscope. Observe the fat droplets and their colour, under microscope. Record your observation in the observation sheet.

Discuss with the teacher your observations and proceed to frame number 106.

F A T S

---

106. In our experiment, you observed that when a drop of coconut oil was put on a brown paper (or white paper) a transluscent spot was left on the brown paper, which remained even after allowing it for evaporation.

This experiment tells us that o___ leave a transluscent spot on the brown paper.

---

oils

107. Recall our experiment of rubbing coconut endosperm on brown paper. We noticed a translucent spot on the paper, which did not fade even after allowing it for evaporation.

So, we can say that coconut endosperm contains _____ in it.

---

oil

108. In our experiments we also tested for the presence of oil in groundnut and castor seeds, and noticed a transluscent spot on the brown paper.

The transluscent spot left on the brown paper proved the presence of ____ in groundnut and castor seeds.

---

oils

109. Like coconut, groundnut etc., there are many more plants namely cotton, mustard, sandal wood etc., which contain oil in them.

In other words, peanut plants, sandal wood, cotton seed etc. are some of the examples of plants which contain _____ in them.

---

oil

110. In the previous frames we have noticed the presence of oil in plants. It is a kind of <u>fat</u>.

So, coconut endosperm, castor seeds, ground-nuts, etc. contain <u>F</u>__ in the form of oil.

Fat	111.	In other words, we can say that, in plants F___ is present in the form of oil.
Fat	112.	You may be wondering whether fats are present in animals also. Let us take the example of the animal 'shark'. It is a type of fish. You know that 'shark liver oil' is extracted from this animal. So, we can say that the fish 'shark' contains ____ in the form of oil in its body.
fat	113.	All the examples we have studied so far tells us that protoplasm of plants and animals contain fat in it. But the question is in what form are they present? Recall what you have seen in the slides of castor seed and groundnut. You have observed fat in protoplasm as <u>fat droplets</u>. Cells of groundnut, castor seed etc., contain fat in the form of ____ _____.
fat droplets	114.	Just like castor seed or groundnut cells, cells of animals also contain fat in the form of <u>fat droplets</u>. In simple words, fat is present in animals in the form of ___ _____.

---

fat droplets

115. In the earlier frames, you found the examples of both plants and animals containing fats. From these examples we may conclude that protoplasm of living organisms contain ____ in the form of fat droplets.

---

fat

116. We know that protoplasm of living organisms contain fat in the form of fat droplets. We shall examine the fat present in coconut endosperm. The fat present in coconut endosperm is known as capric acid. It is composed of 10 atoms of carbon, 20 atoms of hydrogen and 2 atoms of oxygen ($C_{10}H_{20}O_2$). From the formula of capric acid we can say that it is composed of c_____, h_____, and o_____ atoms.

---

carbon, hydrogen, oxygen

117. Let us take another example of fat namely 'Butyric acid' present in butter. The chemical formula for butyric acid is $C_3H_6O_2$.

The formula for butyric acid denotes that it is composed of _____, _____ and _____atoms.

---

carbon, hydrogen, oxygen

118. From the examples of fats namely capric acid and butyric acid, what can we generalise with regard to the composition of fats?

We can generalise that fats, like carbohydrates are also composed of _____, _____, and _____ atoms.

---

carbon, hydrogen, oxygen

119. You are correct. Fats are composed of carbon, hydrogen and oxygen atoms. you know already why compounds are called as organic and inorganic.

Since fats contain carbon atoms in them, they are called as _____ compounds.

---

organic

120 Now we know three things about fats. We shall summarise them.

1. Protoplasm of living organisms contain _____ in the form of fat droplets.
2. Fats are composed of _____, _____ and _____ atoms.
3. They are _____ compounds.

---

fat

121. Now let us examine in detail a compound 'stearin' found in all vegetable fats. It is composed of 57 atoms of carbon, 110 atoms of hydrogen and 6 atoms of oxygen.

The chemical composition of 'stearin' can be represented by the formula_____.

$C_{57}H_{110}O_6$

122. You are right. The chemical formula for stearin is $C_{57}H_{110}O_6$. Compare this formula of stearin with the formula of cane sugar ($C_{12}H_{22}O_{11}$), which you know is a carbohydrate. You will notice a difference in these two compounds with regard to the number of carbon and hydrogen atoms.

The number of carbon atoms present in s_____ is greater than the number of carbon atoms present in c_____ s_____.

---

stearin, cane sugar

123. Now you compare the number of hydrogen atoms present in stearin $C_{57}H_{110}O_6$ and cane sugar $C_{12}H_{22}O_{11}$.

In _____ there are more number of hydrogen atoms than in _____ _____.

---

stearin, cane sugar

124. In the earlier two frames we have compared the composition of the fat 'stearin' with carbohydrate namely cane sugar, with regard to their carbon and hydrogen content. Now, let us compare them for oxygen content.

The number of oxygen atoms are less in _____ when compared to _____ _____.

---

stearin, cane sugar

125. We shall take another example of fats namely oleic acid. The chemical formula for oleic acid is $C_{18}H_{34}O_2$.

The comparison will tell us that _____ contains more number of carbon and hydrogen atoms and less number of oxygen atoms than _____ _____.

---

oleic acid, cane sugar

127. What can we conclude from the comparison of stearin and oleic acid with cane sugar about the number of carbon, hydrogen and oxygen atoms present in fats?

We can conclude that F____ have more number of carbon and hydrogen atoms and less number of oxygen atoms when compared to car drates.

---

fats, carbo-hydrates

128. In earlier frames we have seen two examples of fats namely 'stearin' and 'oleic acid'. The other common examples of fats are butter, ghee, vanaspathi, wax, etc.

So, the products which we use daily like butter, ghee, etc. are all the examples of ____ .

---

fats

129. In addition to butter, ghee, etc., we also make use of groundnut oil, coconut oil, mustard oil, etc., for various purposes. These are all fats. They are called as oils because they remain as liquids at room temperature, whereas, butter, ghee, etc., remain as solids at room temperature.

The reason for calling coconut oil, groundnut oil, etc. as oils is they remain as _____ at room temperature.

---

liquids

130. Now we know that butter, ghee, different oils etc. all contain fat in them. They are utilized by human beings for various purposes. In other words, they are the sources of fats.

So, butter, ghee, oils are the s_____ of fats to human beings.

---

sources

131 Now you are familiar with the different sources of fats. Give three examples of fats that remain as solids at room temperature, and three examples of fats that remain as liquids at room temperature.

Fats that remain as solids at room temperature) 1)_____, 2)_____ 3)_____

Fats that remain as liquid at room temperature) 1)_____, 2)_____ 3)_____.

---

132. So far, we have studied about the composition of fats, the different sources of fats, etc. But why they are needed by living organisms? During respiration, like carbohydrates, fats are also burnt or oxidised and energy is liberated, which is utilised by the organism for its different activities.

It means, when _____ are burnt or oxidised, they release _____ just like carbohydrates.

---

fats, energy

133. In other words, like carbohydrates, fats also contain _____ in them.

---

energy

134. We can conclude the need of fats for living organism by saying that, fats are the sources of e_____ and hence living organisms need it for carrying out their activities.

DEMONSTRATION

IDENTIFICATION TEST FOR PROTEINS

(Teacher would demonstrate the presence of protein in plant cells and animal cells with the help of the following material)

Materials:
1. Groundnuts
2. Egg albumin
3. Castor seed
4. Test tubes
5. Biuret reagent
6. Millon's reagent
7. Iodine solution
8. Microscope.

Your teacher would proceed in the following way to show you the presence of proteins in plant and animal cells.

Procedure:

Presence of proteins in plants

1. A few groundbuts will be crushed with water and is filtered. To the filtrate is added 5 to 10 drops of Biuret reagent. Observe the change of colour. Record your observation in the observation sheet.

Presence of proteins in animal cells

1. To a portion of egg albumin in a test tube is added a few drops of millions reagent. Observe the colour of the precipitate formed. Record your observation in the observation sheet.

2. A thin section of the castor seed$ endosperm is taken on a glass slide. To it is added a drop of iodine solution. Observe the brownish yellow crystal like bodies of proteins. Record your observation in the observation sheet.

Discuss with your teacher, your observations and proceed to frame number. 135.

PROTEINS

---

135. Recall what you have seen in the experiment. First we mashed a few ground-

nuts along with a few drops of water. To this solution (5 ml) we added 5 to 10 drops of biuret reagent. We noticed the change of colour in the biuret reagent. This change in colour proved the presence of proteins in groundnut.

So, from the experiment we can say that groundnut contains p_____ in it.

---

proteins 136. In our second experiment, we took a little white of an egg, and to it added Millon's reagent. We noticed settling of a white precipitate of proteins.

This experiment proves that while of an egg contains _____ in it.

---

proteins 137. Recall what you have seen in the section of castor seed endosperm under microscope. You have observed brownish yellow crystals of proteins.

So, castor seed is another example containing p_____ in it.

---

proteins 138. Similarly, if you test for the presence of proteins in other plants also, you will find that all plant cells contain protein.

In other words,_____ is present in all plants.

---

proteins

139. Like plants, all animals also have protein in them. It is an abundant compound present in all plants and animals.

It is the same as saying that all living organisms contain abundant _____ in them.

---

proteins

140. Let us take one example of a protein present in wheat, namely, gliadin. It is composed of 685 atoms of carbon, 1068 atoms of hydrogen, 196 atoms of nitrogen, 211 atoms of oxygen and 5 atoms of sulphur.

From the above composition we can write the chemical formula for 'gliadin' as _____.

$C_{685}H_{1068}N_{196}O_{211}S_5$

141. The chemical formula which we arrived at, namely, $C_{685}H_{1068}N_{196}O_{211}S_5$ for gliadin denotes that the protein 'gliadin' is composed of c_____, h_____, n_____, o_____ and s_____ atoms.

---

carbon, hydrogen, nitrogen oxygen, sulphur

142. We shall consider another example of protein, namely, 'zein' present in maize. The chemical formula for this protein 'zein' is $C_{736}H_{1161}N_{184}O_{208}S_3$.

From the chemical formula, we can say that like 'gliadin', protein 'zein' is also composed of _____ _____ _____ _____ and _____ atoms.

---

carbon
hydrogen,
nitrogen,
oxygen,
sulphur

143. So far, we have seen two examples of proteins present in plants. We shall take the example of a protein present in our body, namely, Haemoglobin. It is an iron containing protein and is found in red blood corpuscles. It is called as iron protein because it contains the metal iron in addition to carbon, hydrogen, nitrogen, oxygen and sulphur atoms.

In other words, we can say that haemoglobin, an iron containing protein, is composed of _____, _____, _____, _____ and _____ atoms along with an atom of iron.

---

carbon,
hydrogen,
nitrogen,
oxygen,
sulphur

144. From the examples of gliadin, zein, and haemoglobin, what can we conclude with regard to the chemical composition of proteins?

We can conclude that proteins are composed of _____ _____ _____ _____ and _____ atoms.

---

carbon,
hydrogen,
nitrogen,
oxygen,

145. Let us compare the chemical composition of proteins with that of carbohydrates ($C_6H_{12}O_6$) and fats ($C_{58}H_{110}O_6$). Carbohydrates and fats do not have <u>nitrogen</u> and <u>sulphur</u> atoms in them.

In other words, proteins differ from carbonhydrates and fats in its chemical composition by having _____ and _____ atoms.

---

nitrogen, sulphur

146. So far, we have tried to understand the chemical composition of proteins by taking different examples of proteins. By this time you might have noticed that protein molecules are much bigger in size when compared to carbohydrates and fats for e.g. ($C_{685}H_{1065}N_{196}O_{211}S_5$). You can compare this formula for 'zein' with that of cane sugar and 'stearin'.

We can say that among the three types of organic compounds, namely, carbohydrates, fats and proteins, protein molecules are much L____ in size.

Larger

147 You are right. Protein molecules are much larger in size when compared to molecules of carbohydrates and fats. It is because of this reason protein molecules are called as "molecular giants".

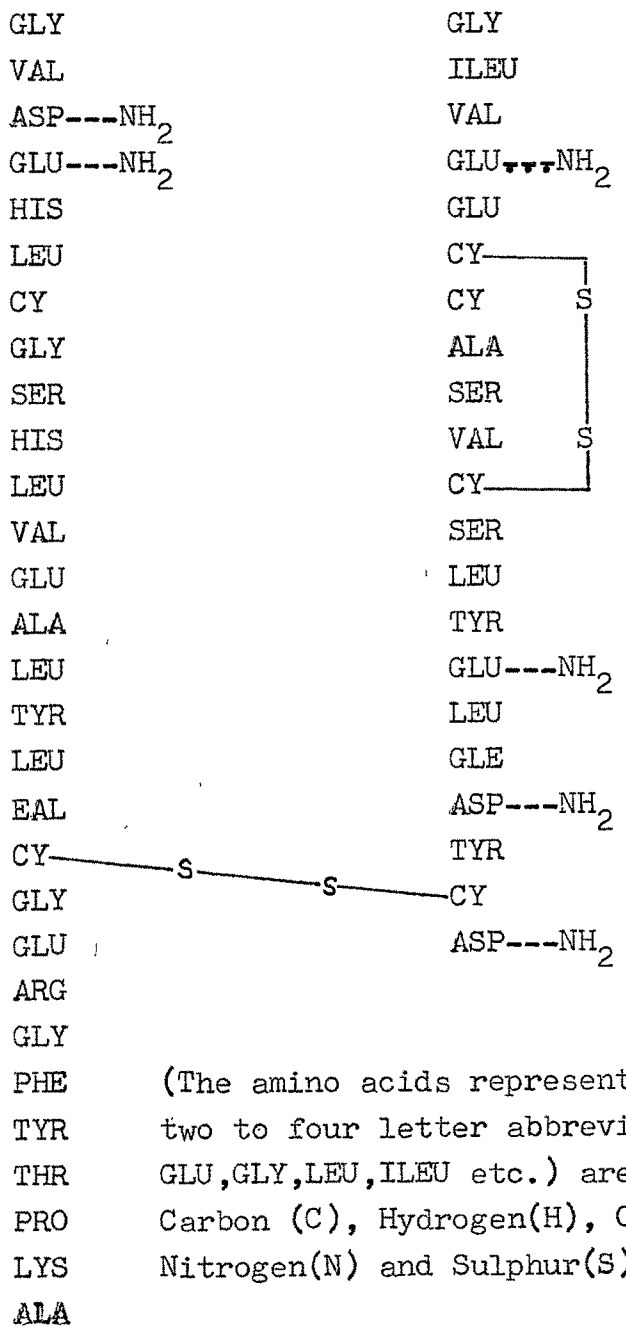
Since molecules of proteins are very large in size, they are called as _____ _____.

---

molecular giants

148 Let us take the example of one type of protein present in our body, namely, 'Insulin'. Refer to the diagram 1, wherein

A REPRESENTATION OF THE STRUCTURE OF AN INSULIN MOLECULE



(The amino acids represented here by two to four letter abbreviations(e.g.: GLU,GLY,LEU,ILEU etc.) are made up of Carbon (C), Hydrogen(H), Oxygen(O), Nitrogen(N) and Sulphur(S)

Diagram - 1

the structure of a single insulin molecule is given. From the diagram you can make out that insulin molecule is composed of small units which are labelled as GLY, ILEN, VAL, etc. If you count such small units, you will find 51 such small units in the whole of insulin molecule.

So, a molecule of insulin protein is composed of 51 _____ _____.

---

small units

149. You are right. Insulin molecule is composed of 51 small units. In the diagram you have noticed that these small units are represented by 2 to 4 letter abbreviations like GLY, GLU, ILEN, etc.

So, the abbreviations such as GLY, GLU, ILEN, etc. in the diagram of the structure of insulin molecule represents s____ u____ of the whole insulin molecule.

---

small units

150. You are correct. Each 2 to 4 letter abbreviations represent a small unit. We know that there are 51 such small units in a insulin molecule. These small units are called as amino acids.

Since each small unit is called as an amino acid, we can say that insulin molecule is made up of 51 a____ a____ .

---

amino acid

151. Yes, your thinking is right. A molecule of insulin is composed of 51 amino acids. You know that each amino acid is represented in the diagram by 2 to 4 letter abbreviations such as GLY, GLU, etc.

In other words, each abbreviations like 'GLY' 'GLU' ILEN etc. in the diagram of the insulin molecule represent a single _____ _____.

---

amino acid

152. Now we know that the protein insulin is made of amino acids. Insulin is the simplest protein molecule. There are other protein molecules made of hundreds of amino acids.

So, we can say that protein molecules are made of _____ _____.

---

amino acid

153. Yes, all proteins are made of amino acids. Twenty amino acids are found to be present in proteins. These amino acids combine in different ways to form different protein molecules.

The number of amino acids known to be present in proteins are _____.

Twenty

154. Let us once again refer to the diagram of insulin molecule. You can see that it is made up of 16 different amino acids. You

can also notice that, out of these 16 different amino acids some are present more than once in the molecule, for e.g. the amino acid 'GLY'(GLYSINE) is present 7 times. Hence, the total number of amino acids present in insulin molecule are 51, eventhough there are only 16 different amino acids present in insulin molecule.

We can say that one insulin molecule is made up of or built out of 16 different _____ _____. But the total number of amino acids present in insulin are _____ since many amino acids are present more than once.

---

amino acids

155. We shall put the whole thing in simpler words. About 20 amino acids are known to man that are present in proteins. These amino acids combine in different and definite ways and build different p_____ molecules.

---

protein

156. You are correct. A protein molecule is built out of amino acids. Let us take one simple amino acid, namely, Glysine(GLY). It is composed of carbon, hydrogen, nitrogen, oxygen and sulphur atoms.

The amino acid glysine is composed of _____, _____, _____, _____, and _____ atoms.

carbon, hydrogen, nitrogen, oxygen, sulphur

157. Like glysine, the other amino acids are also composed of carbon, hydrogen, nitrogen, oxygen and sulphur.

So, we can say that the 20 different amino acids,known at present,that build different protein molecules are all composed of C_____, h_____, n_____, o_____ and s_____ atoms.

---

carbon, hydrogen, nitrogen, oxygen, sulphur

158. Now, we know that proteins are built of amino acids and each amino acid is composed of carbon, hydrogen, nitrogen, oxygen and sulphur atoms.

From the above information, we can say that proteins are compounds which are composed of _____, _____, _____, _____ and _____atoms.

---

carbon

159 Let us proceed further to know more about proteins and amino acids. Majority of the proteins are built of 300 to 3000 amino acid sub-units. With so many individual amino acids in the protein molecule and 20 amino acids to choose among, you can imagine the enormous number of possible protein molecules which might exist in plants and animals.

Let us try to understand this by taking a simple analogy.

160. You know very well that in English language there are 26 letters of alphabets from A to Z. With these 26 letters of alphabets we construct thousands and thousands of words. We know that the number of amino acids known to man are 20, which is less than the number of alphabets in English language. As in the case of English language, the number of amino acids found in living organisms can combine together in particular sequence to form different protein molecules.

This analogy tells us that the 20 amino acids combine together in different and definite _____ to form different proteins.

---

sequence

161. We shall know more about this word 'sequence' by taking four alphabets of English language, namely, 'F', 'O', 'L', 'W'. We can arrange these in different forms e.g. Flow, Fowl, Wolf etc. all giving different meanings. This arrangement is the sequence. In the same way in living organisms also the amino acids combine together in definite sequence to build bigger protein molecules.

It means, amino acids in a particular protein molecule are arranged in a particular _____.

---

sequence

162. You are right. Different amino acids combine together in different and definite sequence to form different protein molecules.

In other words, different protein molecules differ from each other with regard to the _____ of the amino acids present in them.

---

sequence

163. Every plant or animal is made up of different kinds of proteins. If we take our own body as an example, our hair, muscle, skin, finger nails etc., are all made up of different kinds of proteins. We say different because the nature of protein depends upon the different kinds and sequence of amino acids present. Hence, these amino acids are called as building blocks of proteins.

Since the nature of protein depends upon the different kinds and sequence of amino acids, these amino acids are called as _____ _____ of proteins.

---

building blocks

164 In other words, the smaller units of protein molecules known as amino acids are called as _____ _____ proteins, since the nature of protein molecule depends upon them.

---

building blocks	165.	Now, you know about proteins, their composition etc. The question is where from animals get these proteins. We shall take the example of human beings. You can recall how we get carbohydrates and fats from different food stuffs. In other words, we get them from different sources of carbohydrates and fats. In the same way, we get proteins from different food stuffs, namely, meat, milk, white of an egg, groundnuts etc. So, meat, groundnuts, milk etc., are _____ of proteins.
sources	166	During digestion, these food stuffs containing proteins are brokendown into amino acids and are absorbed by the cell. Proteins present in food stuffs are broken down into smaller units that is _____ _____ and are absorbed by the cell.
amino acids	167	The amino acids thus absorbed by the cell, combine in definite sequence in the cell to form different proteins. Animals form their _____ in their cells by the combination of different amino acids in different and definite ways.

proteins

168. Now let us try to understand how plants meet their protein requirements. Plants do not seem to take any food like us, then how do they get proteins? Plants have the ability to form all the amino acids by utilizing inorganic substances from the air and the soil. These amino acids build various protein molecules in the cells as in the case of animals.

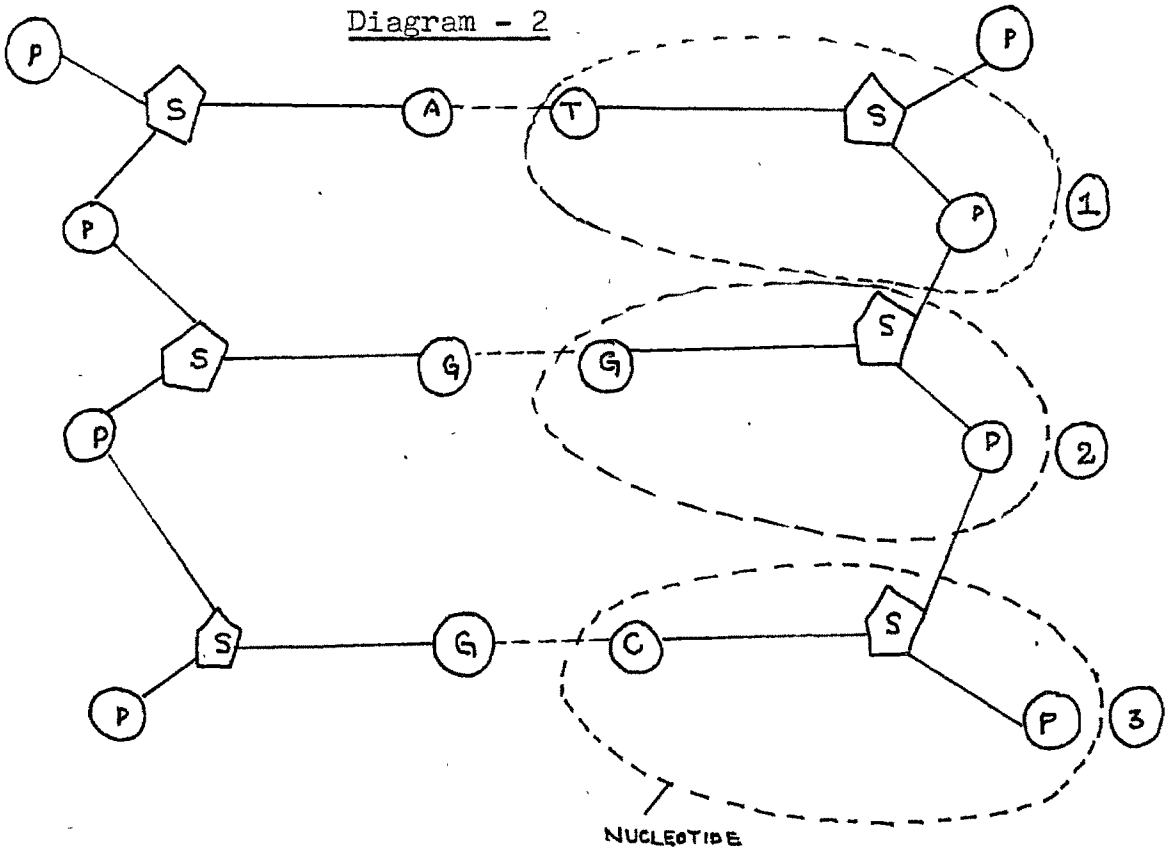
This means plants need not depend on any other organism for amino acids, since they have the ability to form all the _____ _____ needed for the building up of protein molecules.

---

amino acids

169. From the previous frames, you might have got the idea that plants have the ability to form amino acids whereas animals do not have. This is not so. Even animals have the ability to form amino acids, but not all as in the case of plants. Animals have to depend on plants for some amino acids which cannot be formed in the body. We can say that both plants and animals have the ability to form amino acids. Plants can form all the amino acids required for the formation of proteins, whereas, animals have to depend on plants for certain _____ _____ required for the formation of proteins.

Diagram - 2



Structure of a Nucleotide acid

Note: In the diagram - 2(1), (2), (3) represent Nucleotides. Each nucleotide is composed of three parts, namely, sugar, a nitrogen base and phosphate.

The abbreviations (A), (C), (G), (T) represent nitrogen bases, (S) represents sugar molecule (P) represents phosphate molecule.

NUCLEIC ACIDS

170. So far, we have studied about three types of carbon containing compounds, namely, carbohydrates, fats and proteins present in protoplasm. Now we will be studying the fourth type of carbon containing compounds present in protoplasm, namely, nucleic acids.

In other words, we will be trying to understand another type of _____ compounds present in protoplasm, namely, nucleic acids.

---

organic

171. We can say it in a different way that is, in addition to organic compounds like carbohydrates, fats, proteins, another type of organic compounds is present in protoplasm of all living organisms, and it is called as _____ _____.

---

nucleic acids

172. Now let us try to understand the composition of nucleic acid. Refer to diagram No.2. You will notice that like proteins, nucleic acids are also made of small units.

In other words, like proteins, nucleic acids are made of s_____ _____.

---

small units	173.	These small units which build the nucleic acids are called as nucleotides. So, a nucleic acid is built of a number of n_____.
nucleotides	174.	In other words, we can say that as amino acids are to proteins, so are _____ to nucleic acids.
nucleotides	175.	To put it in simple words, just as protein molecules are built of amino acids, nucleic acids are built of n_____.
nucleotides	176.	You are right. Nucleic acids are built of small units called as nucleotides. Now let us examine a single nucleotide. Refer to the diagram 2. You will notice that three things are circled round and is labelled as a nucleotide. Each nucleotide molecule is made up of a nitrogen base, a sugar, and a phosphate. (Read the explanation below the diagram No.2). It means, the small units of nucleic acids, namely, nucleotides are formed of a _____ base, a _____ and _____.
nitrogen sugar phosphorous	177.	It can also be said in a simple way, that is, the nucleotide molecules which is a small unit of nucleic acid has got three parts.

They are 1)_____base 2)_____
3)_____.

---

nitrogenous sugar, phosphorous

178. You are correct. A nucleotide molecule has three parts, namely, nitrogenous base, a sugar, and a phosphate. Let us now examine each of these parts. First, we shall take up nitrogenous base. The name indicates that it contains nitrogen in it.

So, one part of nucleotide,namely, nitrogen base is composed of _____.

---

nitrogen

179. Let us consider the sugar part of nucleotide. Recall what you have studied about sugars.

We know that sugars are composed of c_____, h_____, and o_____ atoms.

---

carbon, hydrogen, oxygen

180. In other words, elements such as _____, _____ and _____ atoms from the sugar part of nucleotide.

---

carbon, hydrogen, oxygen

181. You are right. Now we shall examine the third part of nucleotide that is phosphate. It contains phosphorous.

So, the phosphate part of nucleotide contains _____.

---

phosphorous

182. Now, we shall summarise what we have studied about nucleotide. Nucleotides are the units of nucleic acids, and each nucleotide is composed of carbon, hydrogen, oxygen, nitrogen, and phosphorous. With this information, what can we say about the composition of nucleic acids?

We can say that nucleic acids are formed of _____, _____, _____, _____ and _____ atoms.

---

carbon, hydrogen, oxygen, nitrogen, phosphorous

183. The sugars that are present in the nucleotides of nucleic acids are of two types. One is ribose sugar and the other deoxyribose sugar.

So, the two different types of sugars that are present in nucleic acids are _____ and _____ sugars.

---

ribose
deoxyribose

184. But, these two types of sugars are not present together in a single nucleic acid. Some nucleic acids contain ribose sugar and some others contain deoxyribose sugars. Those nucleic acids which contain <u>ribose sugar</u> are called as ribose nucleic acids and those which contain <u>deoxyribose sugar</u> are called as deoxyribose nucleic acids.

Therefore, Ribose nucleic acids are nucleic acids which contain _____ sugar, whereas, deoxyribose nucleic acids contain _____ type of sugar.

---

ribose, deoxyribose

185. We can also say that _____ type of sugar is present in deoxyribose nucleic acids, and _____ type of sugar is present in ribose nucleic acids.

---

deoxyribose, ribose

186. In short form, Ribose nucleic acids are usually written as R.N.A. and deoxyribose nucleic acids as D.N.A.
R.N.A. denote _____ _____ _____
D.N.A. _____ _____ _____

---

ribose nucleic acid, deoxyribose nucleic acid

187 In R.N.A. 'R' denotes _____type of sugar whereas in D.N.A. 'D' denotes _____ type of sugar.

---

ribose, deoxyribose

188. Now let us try to understand the functions of D.N.A. and R.N.A. Recall what you have studied about protein synthesis. You know that every living organism synthesises (forms) its own specific proteins. D.N.A. and R.N.A. are mainly responsible for this process of protein synthesis.

In other words, D.N.A. and R.N.A. helps in the process of _____ synthesis.

---

protein

189. We can say that D.N.A. and R.N.A. help in the synthesis of _____ in all living organisms.

proteins

190. So, one of the functions of D.N.A. and R.N.A. is that they help in the process of protein synthesis. Let us see another function of D.N.A. Can a dog give birth to a cat, or a mango tree bear banana fruits? No, they cannot. As each organism is having D.N.A. which is specific to itself, a dog cannot give birth to a cat, or a mango tree cannot bear a banana fruit. In other words, D.N.A. is mainly responsible for inheritance.

Thus, another role of D.N.A is in i_____.

inheritance

191. Let us take the example of human beings. You can compare your colour of hair, eye colour, colour of skin, etc., with your parents. You resemble either your father or mother. That means you have inherited certain characteristics from your parents. D.N.A . is responsible for this. It has been passed on from your parents to you.

In other words, D.N.A. plays a key role in in_____.

inheritance

192. D.N.A. has many other roles. But, the two mentioned are the major roles it plays.

First D.N.A. along with R.N.A. is responsible for the synthesis of _____ in living organisms. Second, D.N.A. plays a major role in in_____.

---

proteins, inheritance

193. Well friends, so far we have studied the chemical composition of protoplasm. We know that protoplasm is composed of both organic as well as inorganic compounds. We have studied a few of these compounds in detail . Recall what you have studied about water which is inorganic compound present in protoplasm. You know that major portion of protoplasm is composed of water, and in which are present different compounds.

We can say that protoplasm is a mixture of so many substances with w_____ as the medium.

---

water

194. You are correct. Protoplasm is a mixture of substances with water as the medium. The question is with so many compounds present, how does protoplasm appear like? Does it look like a solid or liquid? Is it transparent or semi-transparent or opaque etc? In other words, what is the physical nature of protoplasm?

The study of _____ nature of protoplasm tells us whether protoplasm appears as a solid or liquid whether it is trans-

parent or semi-transparent etc.

---

physical.

Assignment : Find out from an advanced book certain Organic Compounds present in living organisms. Analyse their composition. Discuss your analysis with your friends, or teacher.

Now let us start our study of the Physical nature of Protoplasm by doing a small activity.

ACTIVITY

Instructions to the Teacher:

Teacher to divide the students into 4 or 5 groups, and each group would be given a set of test tubes containing mixture of:

1. Starch and water
2. Gum
3. Agar agar with water
4. Common salt with water
5. Potassium permanganate with water
6. Potassium dichromate with water
7. Sand and water
8. Chalk powder and water
9. White of an egg.

To the Student:

Make your observations in the observation sheet, about the mixtures given to you. Discuss your observations with your teacher and proceed to the frame number 195.

---

195. Recall what you have observed in the test tubes containing a mixture of chalk powder and water, and the other containing sand and water. You have noticed the settling of chalk powder and sand in the test tubes after a few minutes. It is because, the particles of sand and chalk do not get mixed completely with the molecules of water.

From the experiment we can say that when chalk powder or sand is put into water they do not get _____ completely with water molecules, and they separate out by settling at the bottom.

---

mixed

196. You have also observed that after the settling of the chalk powder and sand in the test tubes, water in the upper portion of the test tube became transparent which means it allowed light to pass through it.

We can say that since chalk powder and sand settled down in the test tubes, water in the test tubes became clear and t_____.

transparent

197. Let us take other examples of the mixtures we saw, namely, common salt solution, potassium permanganate solution and potassium dichromate solution. Common salt, potassium permanganate and potassium dichromate completely dissolved in water. It means the molecules of common salt, potassium permanganate and potassium dichromate got completely mixed up with the molecules of water and they did not settle at the bottom. This type of mixtures are called as true solutions.

So, true solutions are mixtures, where, the molecules of one substance will be completely _____ with the molecules of another.

---

mixed

198. In the earlier three examples of mixtures, namely, common salt with water, potassium permanganate with water and potassium dichromate with water, we noticed that they allowed light to pass through completely.

In other words, potassium permanganate, potassium dichromate and common salt solutions were completely t____nt solutions.

---

transparent

199. Now, we shall take the other three mixtures that we observed, namely, starch

solution, agar agar and gum. We noticed that there was no settling of any particle at the bottom of the test tubes. In these three mixtures, the particles of the starch, agar agar, or gum did not either mix with the molecules of water or remain separated by settling at the bottom. They remained <u>suspended</u> in water without settling.

In other words, the molecules of starch, agar agar, gum remain _____ in water, and they neither mixed with the molecules of water nor settled at the bottom.

---

suspended

200. We also noticed that these mixtures of starch, agar agar and gum were much thick and sticky when compared to potassium permanganate or common salt solutions. Such substances are called as <u>viscous</u> substances.

So, when substances like starch, agar agar, gum etc. are put into water, they form a _____ mixture.

---

viscous

201. Now, let us consider another observation, we have made regarding starch, agar agar, and gum mixtures. We observed that the three mixtures were not completely transparent, rather they were incompletely transparent. In other words, we can say that they were <u>semitransparent</u>.

The mixtures of starch, agar agar, gum etc. were _____ since they were partially transparent.

---

semi-transparent

202. Let us summarise what we have observed about the three mixtures of starch, agar agar and gum with water.

1. In all the three mixtures, there was no s___ling of particles at the bottom of the test tubes.
2. All the three mixtures were thick and sticky, in other words, they were v_____ in nature.
3. All the three mixtures were incompletely transparent or se_____nt in nature.

---

settling
viscous,
semi-transparent

203. The chemical name for these type of mixtures is colloids.

The mixtures which are viscous in nature, semitransparent, and in which particles are suspended in the medium are called as _____.

---

colloids

204. So far, we have observed eight mixtures. We can classify the eight mixtures we observed into three categories.

1. Mixtures in which particles of a substance settled at the bottom and thus separated out from water.
2. True solutions.
3. Colloids.

Recall the last mixture, namely, white of an egg. It contains many compounds with water as the medium. One such compound you know already that is proteins.

From your observation, under which category would you place it (put a tick against the category and go to the frame indicated against the category

a) First category .....,(go to frame 205)
b) Second category.....,(go to frame 206)
c) Third category.....,(go to frame 207)

---

205. You have classified the mixture, namely, white of an egg under category one by thinking that some particles settled at the bottom. But it is not so. From your observation record you will find that there was no settling of particles at the bottom. Hence, it does not come under the category one.

Now read your observation about the white of an egg from your observation record. With the help of your observation, under which category would you place the white of an egg (put a tick against the category and go to the frame indicated against the category).

a) True solutions ..... (go to frame 206)
b) Colloids ..... (go to frame 207)

---

206. You know very well that solutions are not viscous and they are completely transparent, Whereas the white of an egg was viscous and was incompletely transparent. Hence, white of an egg is not a so _____ but is a c _____.

(go to frame No.207)

---

207. You are right. White of an egg is a colloid. It was viscous in nature and was semi-transparent. You know that an egg is a single cell, and a cell is nothing but protoplasm surrounded by cell membrane.

Hence, we can say that the protoplasm of the egg is a c _____.

---

colloid

208. Like the protoplasm of egg, protoplasm of plants and other animals also appear to be viscous and simitransparent.

In other words, we can say that protoplasm of plants and animals exist in the form of c _____.

---

colloids

209 From the earlier frame, we can conclude that protoplasm of all living organisms exists in the form of _____.

---

colloids

210. Let us summarise what we have studied about physical nature of protoplasm.

1. protoplasm appears to be v _____ in nature.
2. protoplasm appears to be s ___ transparent.
3. protoplasm exists in the form of c _____

Home Assignment

Note: DONOT COPY THE ANSWERS FROM YOUR FRIEND OR THE BOOKLET SUPPLIED TO YOU

1 The following are the chemical substances present in protoplasm. Write "I" in the brackets if it is Inorganic substances and "O" if it is Organic substance.

a) Carbohydrates ( )
b) Potassium salts ( )
c) Fats ( )
d) Sulphur ( )
e) Proteins ( )
f) Nucleic acids ( )
g) Sodium salts ( )
h) Water ( )

2 Fill up the blanks:

1) Carbohydrates are substances which are made up of _____ _____ and _____ elements and the ratio of _____ and _____ is always 2 : 1.

2) Fats differ from carbohydrates by having greater number of _____ and _____ atoms.

3) Proteins include _____ and _____ in addition to carbon, hydrogen and oxygen.

4) The Nucleic acid D.N.A. contains _____ type of sugar whereas Nucleic R.N.A. contains _____ type of sugar.

5) De-oxyribose nucleic acid helps in

a) _____

b) _____

6) Name three sources of sugar.

1) _____

2) _____

3) _____

UNIT - II

THE ORGANELLES OF A CELL

Introduction:

Well friends, so far you have studied the different inorganic and organic compounds present in protoplasm, their need for the organism, the physical nature of protoplasm, etc., through practical work and the self-learning material supplied to you. In practical sessions, you had the experience of observing different tissues under microscope. You might have observed some structures which are deeply stained, for eg., the central deeply stained structure in the case of onion cells.

- What are those structures?
- What function they perform?
- Do all the cells whether of plants or animals have the same type of structures?

These are some of the questions that are before us. Let us try to seek answers to these questions in this unit. As you have observed different tissues and cells under microscope, many biologists also have observed different tissues and cells under microscope in their laboratories, and have identified different structures present in the cells of plants and animals. Exact nature and functions of many

of these structures are not yet known to scientists even today. Scientists are working in their laboratories to understand these structures. They make use of microscopes of high power for studying these structures or otherwise known as the organelles. Since many of the organelles cannot be seen with the type of microscope we are having in our school, you will be learning about these organelles through slides* and commentary.

How you would be learning:

You will be viewing the diagrams of different organelles present in the cells of plants and animals on the screen and will be hearing to the explanation about each diagram from your teacher. After a few diagrams and teacher's explanation are over, you will be required to answer a few questions in the work-booklet which is supplied to you. By answering these questions, you will come to know how much you have learnt. After answering the questions in the work-booklet, if you have any doubts regarding the concepts you have learnt, you can clarify them with your teacher bbefore he proceeds further.

After all the slides and teacher's explanation are over, if you feel like seeing the slides and listening to

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(*The slides have been provided at the end of the Commentary; The slides have been marked 1,2, etc., in correspondence with the Commentary).

the recorded commentary once again, you are welcome. You can also tell your friends who were absent, that, they can see the slides alongwith the commentary. You can take the materials from the teacher and utilize them.

Now let us start our study of the different organelles present in plant and animal cells, and their function.

I hope you will enjoy this way of learning too.

Slide No.	Commentary
1.	This is an enlarged diagram of an onion peel which you have already observed under microscope in your practical class. What do you observe in this diagram? You will observe a number of box like structures which are called as cells. You will notice that each cell is separated from the rest of the cells by the plasma membrane.
2.	In this diagram you will see the cells of the inner lining of our cheek. Each cell is almost round or polygonal in shape, and, is separated from the rest of the cells by the plasma membrane. You can notice that the shape of these cells differ from that of onion cells.
3.	Here are shown the diagrams of three different types of cells. They are red blood cells of frog, while blood cells of man and also a single nerve cell. From the examples of cells which we have seen so far, what can we conclude with regard to the shape of the cells?
4.	We can conclude that all cells of living organisms are not similar in their shape. In other words, we can say that cells vary in their shape. Let us examine the different types of cells in terms of their size.

Slide No.	Commentary
5.	These are the diagrams of five different types of cells, namely, Nerve cell, Liver cell, Red blood cell, White blood cell and Bacteria. Note the diameter of each type of cell. Nerve cell is having the biggest diameter, whereas, bacteria have the smallest. In between, you will see liver cells, red blood cells, white blood cells of different diameters. In other words, we can say that each cell is having its own size. Bacteria are the smallest cells known to man.
6.	These are the two diagramatic views of hen's egg and egg of an ostrich. Both the eggs are nothing but single cells. Egg of an ostrich bird is the biggest, while, bacterium is the smallest cell known to man. What can we conclude from these examples regarding the size of the cells?
7.	We can conclude that all cells are not of the same size. In other words, the cells of living organisms vary in their size. Now you know that cells vary in their size and shape. Let us see whether they vary in any other way.
8.	Here are shown the diagrams of the cells which you have seen already. You know that nerve cells belong to nervous tissue and help in sending messages to different parts of the body. R.B.C. s help in carrying oxygen to different parts of the body,

Slide No.	Commentary
8.	W.B.C's help in guarding the body against diseases. The last type of cells, namely, bone cells help in giving strength to the body. What can we conclude from these different cells with regard to their function?
9.	We can conclude that cells of different tissues differ in their function also.
10. 1	Here what you see are the diagrams of onion cells, an amoeba, and white blood corpuscles, which you have already observed under microscope. While observing you might have noticed the central deeply stained spot, and the surrounding transparent fluid as shown in these diagrams. The central deeply stained spot is called as nucleus of the cell, and surrounding fluid is called as the cytoplasm of the cell. Let us see some more examples.
11. 2	These are the diagrams of a yeast cell, and cells of a higher plant. You will notice in both the types of cells a central nucleus and the surrounding cytoplasm. The cytoplasm and nucleus together constitute the protoplasm of the cell. In other-words, protoplasm consists of two major areas namely (1) cytoplasm and (2) nucleus.
12.	In almost all cells of the living organisms these two areas of protoplasm can be seen, except in the case of R.B.C's of vertebrates, and bacteria, where true Nucleus is absent.

Slide No.	Commentary
12. 3	Now let us see the diagram of an amoeba and a single onion cell and try to understand these two areas of protoplasm.
13.	Here, in both the diagrams you will notice the central nucleus and the surrounding cytoplasm which together constitute the protoplasm. Under microscope, you have observed that the protoplasm is surrounded externally by the plasma or the cell membrane, as shown in the diagrams. Cytoplasm is that part of the protoplasm which is outside the nucleus and within the cell membrane. It looks transparent jelly like material under microscope. The composition of which you know already; it is being composed of both inorganic and organic compounds.
14. 4	These are the diagrams of a generalised animal and a plant cell. In both the cells you will notice the external membrane which is called as cell membrane or plasma membrane. In the diagram of plant cell, in addition to cell membrane, you will notice another layer external to cell membrane. This layer is called as cell wall. It is present only in plant cells and is absent in all animal cells. This cell wall is made up of a type of carbohydrate known as cellulose.
15.	Plant cells differ from animal cells by having cell wall. This cell wall is made up of an organic substance cellulose, which is a carbohydrate.

Slide No.	Commentary
16.5	What is seen in the visual is one animal cell and a plant cell. Here, the arrows indicate the movement of substances into and out of the cells. You know already the functions of water present in protoplasm. It dissolves many of the food substances (glucose etc.) and body wastes (ammonia). Dissolved in water, these substances pass into and out of the cell through cell membrane. e.g. Amino acids and glucose particles can move more easily into the cell than any other substances. Potassium ions also can move easily into the cell, but not sodium ions. Like these, there are other substances of which some can easily pass into and out of the cell through cell membrane, whereas, some cannot pass through. In other words, cell membrane allows only certain substances to pass into and out of the cell. Hence, it is selectively permeable in nature. So, this tells us that cell membrane is a selective permeable membrane. (You will study more about selective permeability in your chemistry classes).
17.	One of the differences between plant cells and animal cells is, plant cells have cell wall, whereas animal cells do not have cell wall. The cell membrane present in plant and animal cells allows only certain substances to pass into and out of the cell. Hence, it is selectively permeable in nature.

Slide no.	Commentary
17.	Now let us try to concentrate on one of these major areas of protoplasm, namely, cytoplasm, and try to understand the different structures present in it. Let us start with a single animal cell.
*18.6	This is the diagram of a generalised animal cell. You can see the different structures present in the cytoplasm. These structures are called as the organelles of the cell. The different organelles present in cytoplasm are: 1. Centrosome, 2. Golgicomplex, 3. Mitochondria, 4. Fatdroplets, 5. Vacuoles. Now we shall try to understand the location of each of these organelles and the functions performed by them. Centrosome: Observe the location of centrosome in the diagram. It is situated near the nucleus. It looks star shaped under high power microscope. It is usually absent in plant cells.
19. 7	This centrosome, during cell division, divides into two. One of the two goes to the opposite pole of the cell and helps in the division of the cells. Thus centrosome functions during cell division. Let us summarise what we have studied about centrosome.
20.	We know three things about centrosome. They are (1) Centrosome is a star shaped structure situated near nucleus (2) It is absent in plant cells, and (3) It functions during cell division.

Slide No. Commentary

Let us see the next organelle present in Cytoplasm, namely, Golgi complex.

21.8 Golgi complex looks like a collection of plate like structures under microscope. It ie because of this appearance of collection of plate like structure, it is called as a complex. The name Golgi is given to this structure because it was first identified by a person named Golgi.

Observe the location of this organelle. It is situated near the nucleus surrounding the centrosome. Its function is not yet definitely known. But, it is believed that they are secretory in nature since they secrete some substances.

22. This tells you what all you have studied about Golgi complex. First, it is a collection of plate like structures, hence it is called as a complex. Secondly, it is named after the person Golgi. Third, it is located near nucleus surrounding centrosome. Fourth, it is believed to be secretory in function.

23. 9 The third type of organelles present in cytoplasm are mitochondria. All cells, whether plant or animal cells, contain hundreds of these structures. 'Mitos' means threqd like and 'chondros' means granular.

See the location of these structures. They are dispersed in the cytoplasm. They may be in the form of granules, globules, rod or thread like in appearance.

Slide No.	Commentary
23.	These structures help in breaking the food material present in the cell and releasing energy. In other-words, the main function of mitochondria is to help in releasing energy from the food by breaking or oxidising them. Hence they are called as "power houses of cells". Let us try to understand more about these structures.
24.	The respiratory enzymes present in mitochondria help in the oxidation of carbohydrates and fats into carbon-dioxide and water, and releases the chemical energy. This chemical energy is transferred to certain complex substances containing phosphates and is stored as Adenosine triphosphate (ATP). In the diagram is shown the composition of (ATP). It is made up of adenosine and three phosphate groups. The other substance present is ADP, which takes up the energy released in the form of high energy phosphate molecule and becomes converted to ATP. During physiological activities, this ATP breaks down releasing energy, and loses one molecule of phosphate and becomes ADP. This ADP again receives one high energy phosphate group and becomes ATP (You will study more about this energy formation in respiration)
25.	Now we shall summarise what we have studied about mitochondria. They are thread like, granular structures; second, they are dispersed in cytoplasm; third, they are the power houses of cells, since they are responsible for the release of energy. Let us see the other organelles present in cytoplasm.

Slide No.	Commentary
26. 10	The other organelles present in cytoplasm are vacuoles and fat droplets. These vacuoles are also dispersed in the cytoplasm like mitochondria. The shape of the vacuoles are almost round and they are smaller in size. These vacuoles are filled with a fluid known as vacuolar fluid. The membrane which surrounds the vacuoles from the rest of the cytoplasm is known as vacuolar membrane. Dissolved in this vacuolar fluid are many inorganic and organic substances. Hence, vacuoles are called as "store houses" of cells. In the figure you will see some more structures,namely, fat-droplets. You know already that they store fat in them.
27.	So far we have studied about different organelles present in animal cells. They are centrosome, Golgi complex, mitochondria,vacuoles, fat-droplets etc. Now let us study a single plant cell and find out the different structures present in it.
28. 11	This is the diagram of a generalised plant cell. In the cytoplasm you will notice mitochondira, vacuoles, fat droplets and plastids. Observe the nature of vacuoles. The vacuoles of plant cells are much bigger than that of animal cells and occupy most of the area of the cell. Since the vacuoles are bigger in size, the nucleus is pushed towards one side. These vacuoles as in animal cells contain vacuolar fluid in them and perform the same function of storing food materials.

Slide No. Commentary

29. So the third difference between plant and animal cells is that plant cells have bigger vacuoles when compared to animal cells.

30. 12 This is a three dimensional view of a plant cell. You will notice in the diagram a number of plastids suspended in the cytoplasm. These plastids are spherical or round in nature and they are absent in animal cells. Three types of plastids are seen in plant cells, they are: 1) Leucoplasts 2) Chloroplasts and 3) Chromoplasts. We shall take up each one of them, and try to understand their location and also the functions performed by them.

31. The first type of plastids, namely, leucoplasts are colourless and are found in the cells of roots, underground stems, storage roots, very young fruits etc. For e.g. : A young tomato fruit is almost pale-white in colour. It is due to the presence of leucoplasts in it. Leucoplasts help in the storage of starch.

32. The second type of plastids are the chloroplasts. An enlarged view of the cells of Vallisnaria plant, which you have observed under microscope, is shown here. Recall what you have observed. The green spots which you have observed are Plastids, and are represented in the diagram. These green plastids are known as chloroplasts. The green colour is due to the presence of a pigment known as

Slide No. Commentary

32. chlorophyll. You know the different parts of the plant which are green in colour, e.g. leaf, stem etc. They all contain chlorophyll in their cells.

33. Here are shown the diagrams of an unripe tomato, chilly, and mango, with which you are all familiar. You know that they are green in colour, when they are unripe. Recall what you have observed in tomato skin under microscope. You have observed green plastids. They are the chloroplasts and contain chlorophyll. It is because of this pigment, plants are able to manufacture Food. (in Chapter Photosynthesis you will study more about this manufacture of food by plants.)

34. Here what you see is the enlarged view of the cells of ripe tomato, which you have observed under microscope. You have noticed coloured plastids. These are the third type of plastids seen in plant cells. The red colour of the tomato is due to the presence of chromoplasts. 'Chromo' means coloured. 'Plasts' means plastids. This type of plastids are present in the cells of the skin of ripe fruits, petals of flowers, etc.

35. Well, one interesting thing you will notice here in these diagrams. You know that unripe tomato, or chilly or mango is green in colour. But they change their colour when they become ripe. What may be the reason? It is due to the change of chloroplasts into chromoplasts. Let us take the example of tomato fruit to understand better about the change of colour.

Slide No. Commentary

36.13 Here are shown three diagrams of a single tomato fruit at different stages; one, when it is pale whitish in colour, second, when it is green in colour, and third, when it is red in colour. This colour change is due to the change of leucoplasts into chromoplasts. From this, what can we conclude regarding the plastids about their change of colour?

37. We can conclude that one type of plastids can change into another form of plastids imparting colour to the structure or parts. Now we shall summarise what we have studied about plastids.

38. From the table you can make out what all you have studied about plastids. There are types of plastids. These plastids can change from one form to another and impart colour to the structure in which they are present.

39. Plastids are present only in plant cells. They are absent in all animal cells. So, the fourth difference between plant cells and animal cells is, plant cells have plastids whereas animal cells do not have.

40. So far we were concentrating on one of the major areas of protoplasm, namely, cytoplasm. Now we shall try to concentrate on the second major area of protoplasm, that is, nucleus. Recall what you have observed in onion cells under microscope. You have observed nucleus as a dense spherical

Slide No. Commentary

40. body situated in the centre of the cell. In almost all plant cells it is pushed towards one side due to big vacuoles. It controls all the activities of the cell. You observe the diagram carefully. You will find that it is bound by a delicate membrane known as nuclear membrane. This nuclear membrane separates nucleoplasm from cytoplasm. Just as cell membrane, nuclear membrane also controls the flow of substances into and out of the nucleus. In other words, it is selectively permeable in nature.

41. In this diagram only parts of nucleus are shown. You know that it is spherical in shape, and surrounded by nuclear membrane. The interior of nucleus is filled with protoplasm. Since this part of protoplasm is within nucleus it is called as nucleoplasm. It is rich in proteins, DNA, RNA, etc., about which you know already.

42./5 This is an enlarged diagram of nucleus. Only nucleus is drawn to show you the different structures present inside the nucleus. In the nucleoplasm you can see many thread like structures which appear like a net. These threads are known as chromatin threads and since they appear like a matrix or net, it is called as chromatin matrix. These chromatin threads are also called as chromosomes and appear very clearly during cell division.

Slide No.	Commentary
43. 16	Here is shown the diagram of nucleus at the time of cell division. The chromosomes appear thick and are very clear. The figure 2 is of only a single chromosome enlarged. If you observe the Figure 2 carefully, you will notice that it is made of two spiral threads. Each chromosome is made of proteins, DNA, and RNA. These structures, namely, chromosomes are responsible for the transmission of hereditary characters from parents to their children. We shall now know how these characters are transmitted from parents to children.
44.	The chromosomes present in nucloplasm bear extremely minute bodies known as genes. These genes are composed of DNA. These genes are passed on from parents to children through chromosomes. Genes are the carriers of hereditary characters.
45.	Here, in the diagram, you will notice the figures of a father, mother, zygote, and child. The child receives chromosomes from both the parents, and it is because of this a child resembles either his/her father or mother in many respects. You can compare your colour of hair, eyes, skin, etc. with that of your parents. You will resemble either your father or mother. This resemblance is because of the genes, which had been transferred from your parents to you, through chromosomes.

Slide No. Commentary

46. We have studied that Nucleus is surrounded by nuclear membrane. Inside the nuclear membrane is the nucleoplasm in which are suspended the chromatin matrix. Chromatin matrix is nothing but chromosomes which are bunched together. These chromosomes bear extremely minute bodies, namely, genes which are the hereditary carriers.

47. 17 In this diagram you will see one more structure, namely, nucleolus in addition to the structures we have studied so far. It is a dense structure and disappears at the time of cell division. The function of nucleolus is not yet known to Biologists.

48. Now you are clear about the different structures that constitute nucleus, which is one of the two major areas of protoplasm. The structures which constitute nucleus are 1)nuclear membrane, 2) nucleoplasm, 3) chromosomes, 4) nucleolus.

49. In the diagram you will notice the number of chromosomes present in the cells of human beings. In human beings, the number of chromosomes present in the cells are 46, or we can say it as 23 pairs of chromosomes. This number is fixed for human beings, which means, all cells of all human beings will have 23 pairs of chromosomes.

50. This is the diagramatic representation of the roundworms seen in the intestine of human beings. Each

Slide No. Commentary

50. cell of a round worm will have only 2 chromosomes or one pair of chromosome. This number is fixed. It means, all round worms will have only two chromosomes in their cells. We shall see in the case of plants. Let us see the number of chromosomes in a couple of plant cells.

51. This is a diagram to show you that cells of wheat plant contain 42 chromosomes or 21 pairs of chromosomes. Like wheat plant, all plants have a definite number of chromosomes present in their cells. From these examples what can we conclude with regard to the number of chromosomes present in the cells of living organisms?

52. We can conclude that the number of chromosomes for each type of plant or animal is fixed. In otherwords, we can say that every organism has a fixed number of chromosomes.

53. Well, so far we have tried to understand the different organelles present in the protoplasm of plant and animal cells, the difference between plant and animal cells with regard to organelles, etc. This is not something final that is known to man. Many biologists are working in their laboratories to know more and more about cells, with instruments such as electron microscope, etc. Electron microscope is a special type of microscope which can magnify several hundred times the actual size of the structures. Now we shall study about another structure that has been identfied

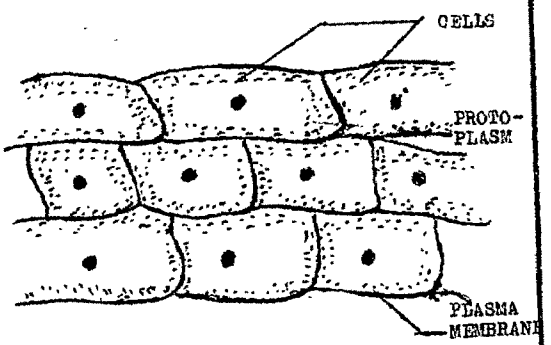
Slide No. Commentary

53. recently with the help of electron microscope, namely, Endoplasmic Reticulum.

54. 18 In the diagram, what you see in the form of a network is the endoplasmic reticulum. 'Endo' means within, 'plasmic' means mould, and 'reticulum' means net like structure. Endoplasmic reticulum forms a sort of skeleton to the cell. Observe the endoplasmic reticulum in the diagram carefully. You will notice small grain like structures on the outer surface of the reticulum. They are the ribosomes which help in protein synthesis. The exact function of this structure is not yet known.

5. This is the diagram of a portion of cell enlarged to show the endoplasmic reticulum. You will see the network of tubes extending throughout the cytoplasm. Some of these tubes open on the cell membrane, thus they appear to be continuous with the fluid surrounding the cell. Because of these connections it is believed that it plays an important part in the movement of materials throughout the cytoplasm.

1



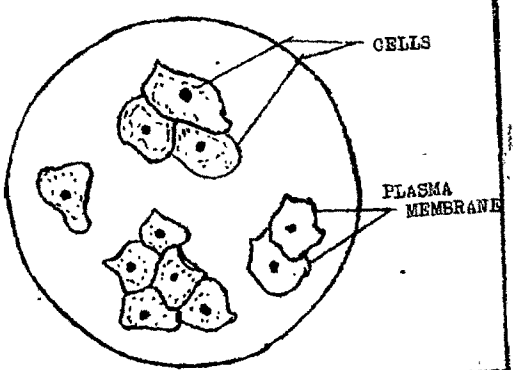
CELLS OF ONION PEEL

4

CELLS VARY IN THEIR

SHAPE

2



CELLS FROM THE INNER LINING OF CHE

5

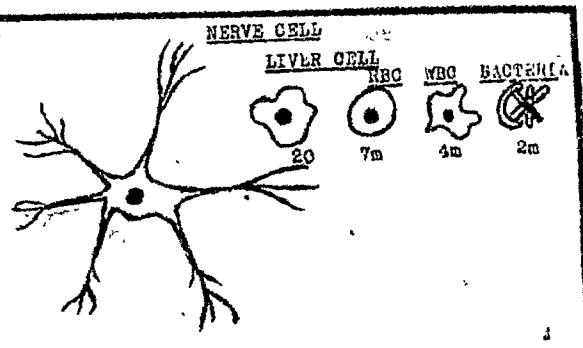
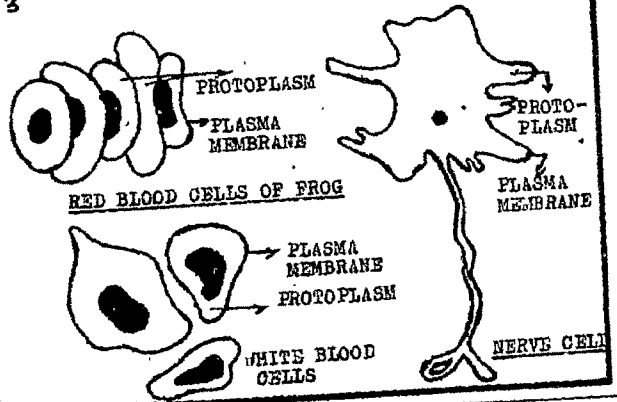


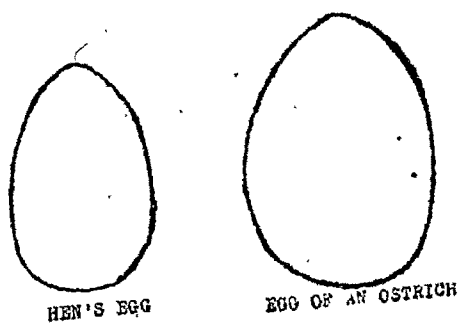
Diagram showing cells of different sizes

3



RED BLOOD CELLS OF FROG

6

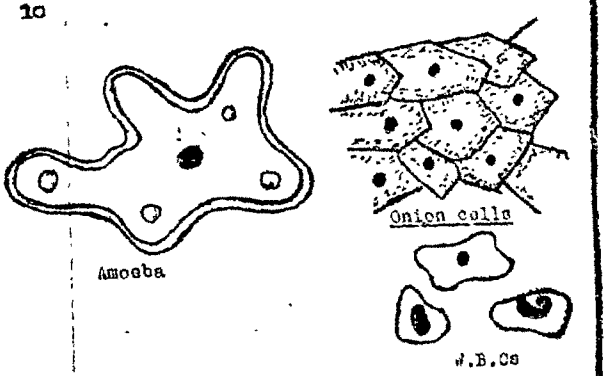


DIAGRAMATIC VIEWS

7

CELLS VARY IN THEIR SIZE

10



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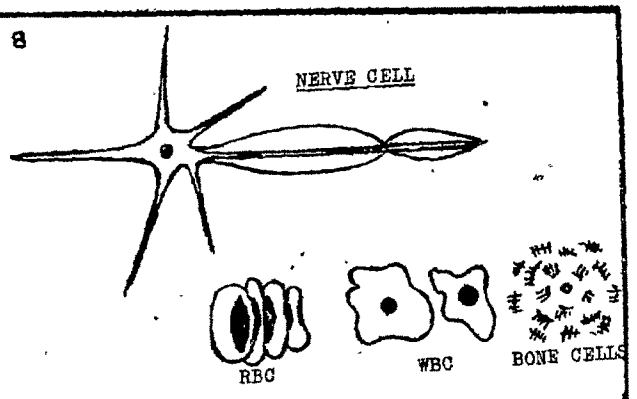

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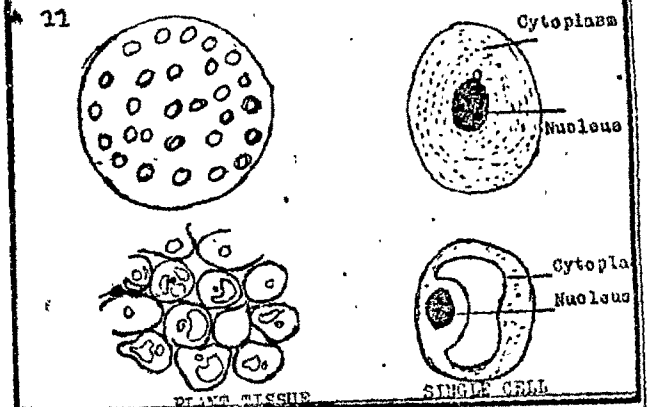


9

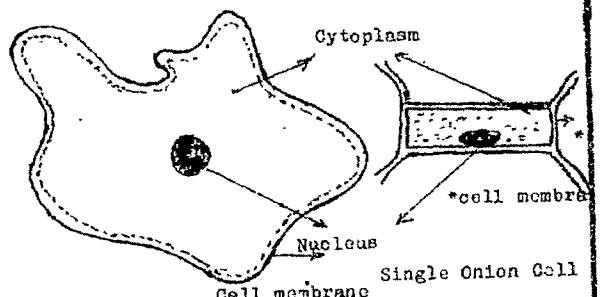
CELLS OF DIFFERENT TISSUES DIFFER IN THEIR FUNCTION ALSO.

12

THE TWO MAJOR AREAS OF PROTOPLASM ARE

1. CYTOPLASM
2. NUCLEUS

13



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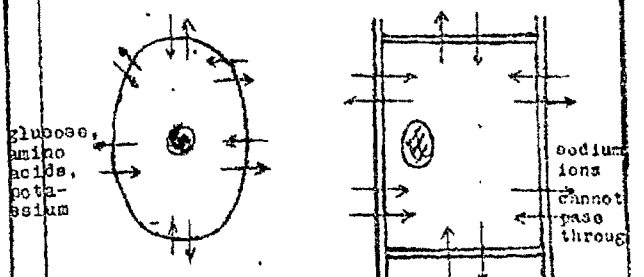

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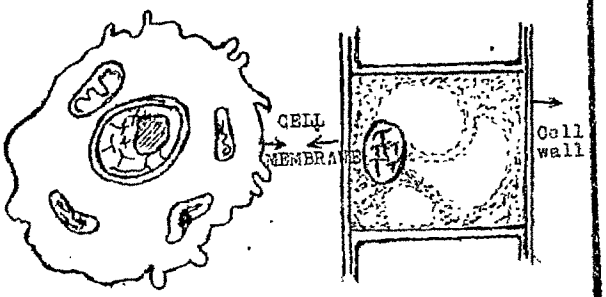


17

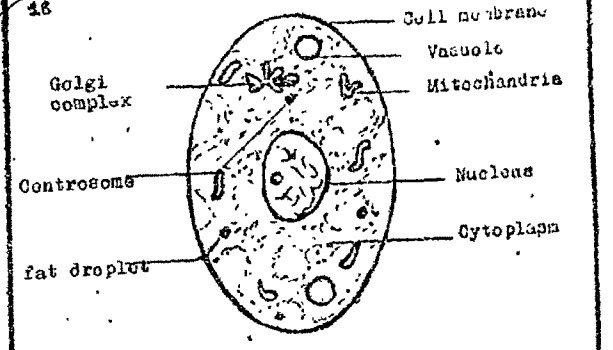
NOW YOU KNOW TWO THINGS

1. PLANT CELLS DIFFUR FROM ANIMAL CELLS BY HAVING CELL WALL.
2. THE CELL MEMBRANE PRESENT IN PLANT AND ANIMAL CELLS ALLOWS ONLY CERTAIN SUBSTANCES TO PASS INTO AND OUT OF THE CELL. HENCE, IT IS SELECTIVELY PERMEABLE IN NATURE.

15

1. PLANT CELLS DIFFER FROM ANIMAL CELLS BY HAVING CELL WALL
2. CELL WALL IS MADE UP OF AN ORGANIC SUBSTANCE CELLULOSE WHICH IS A CARBOHYDRATE

18



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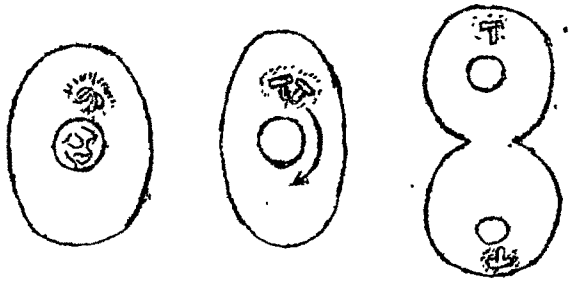


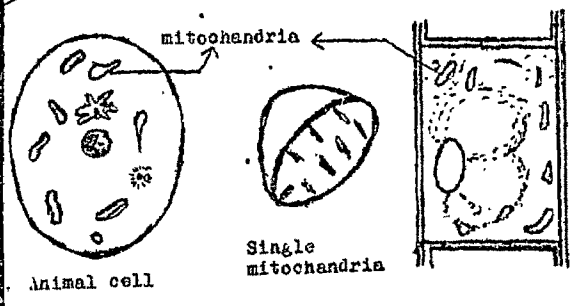
22

1. Golgi complex is a collection of plate like structures.
2. It is named after the person Golgi who identified it.
3. It is found near nucleus surrounding centrosome.
4. It is believed to be secretory in function.

20

1. Centrosome is a star shaped structure situated near nucleus.
2. It is absent in plant cells.
3. It functions during cell division.

23



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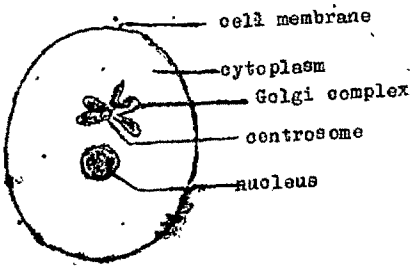

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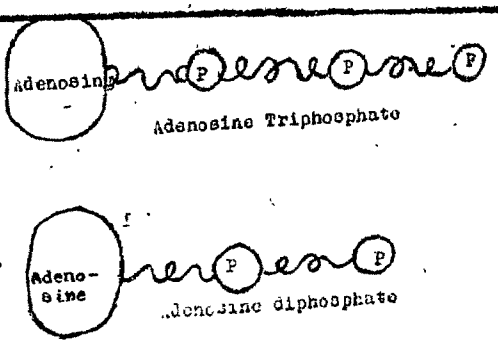
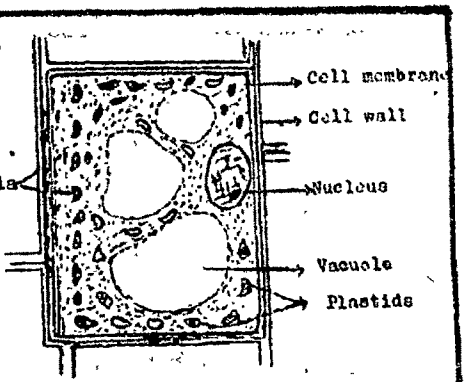


25

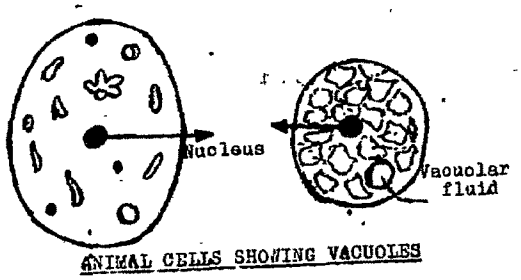
1. They are thread like granular structures.
2. They are dispersed in cytoplasm.
3. They are the "power houses of cell" since they are mainly responsible for the release of energy.

28



GENERALISED PLANT CELL

26



ANIMAL CELLS SHOWING VACUOLES

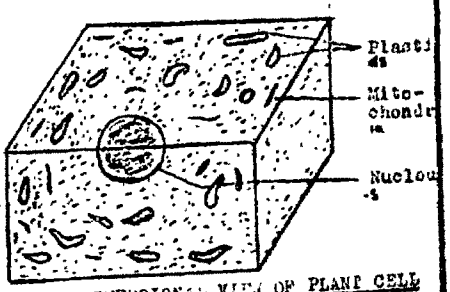
29

ANOTHER DIFFERENCE BETWEEN PLANT AND ANIMAL CELLS IS PLANT CELLS HAVE BIGGER VACUOLES

27

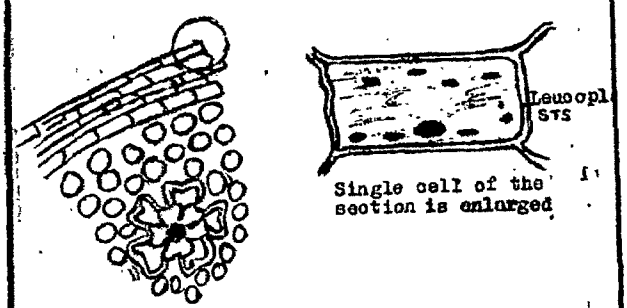
1.Centrosome	- helps in cell division.
2.Golgi complex	- secretory in function.
3.Mitochondria	- power house of cells
4.Vacuoles	- store house of food substances
5.Fat droplets	- store houses of fats.

30



THREE DIMENSIONAL VIEW OF PLANT CELL

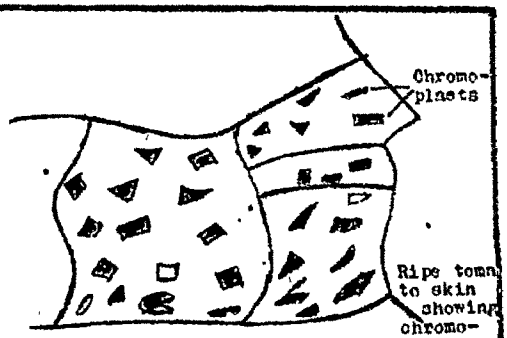
31



Single cell of the section is enlarged

Section of a root enlarged

34



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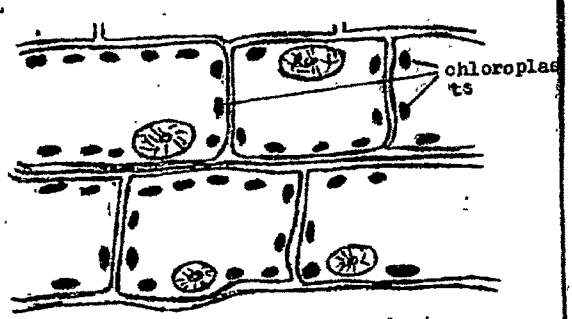
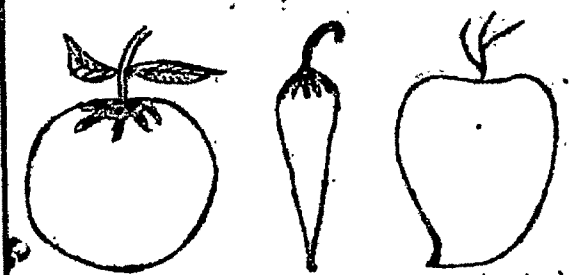


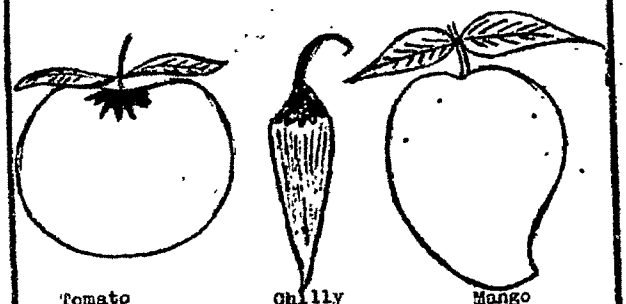
Cells of vallisnaria plant

35



Tomato(unripe) Chilly(unripe) Mango(unripe)

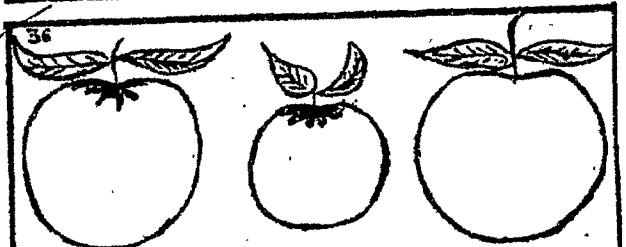
33



Tomato Chilly Mango

Unripe tomato, chilly, mango

36



Green tomato Young tomato (Pale white) Red tomato

37

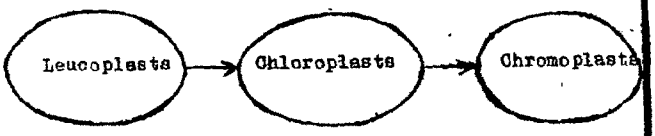


diagram showing the change of the form of plastids to another.

38

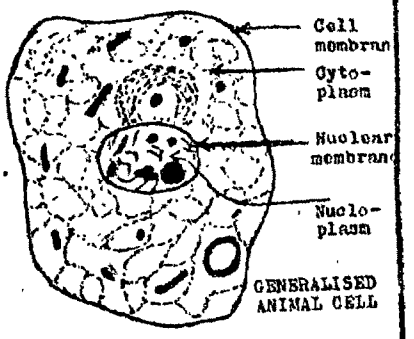
Type of plastid	Colour	Seen in which parts	Function
Leuco-plasts	Colourless	roots and parts which are not exposed to sunlight	Storage of starch
Chloro-plasts	Green	leaf, stem etc (parts which are exposed to sunlight)	Manufacture of food
Chromo-plasts	Coloured (red, yellow, etc)	fruits, petals, etc. (parts which have been exposed to sunlight for long time	Gives attractive colour

Table 1

39

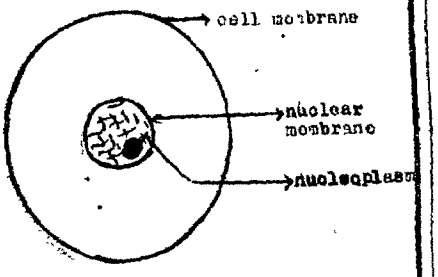
ANOTHER DIFFERENCE BETWEEN PLANT AND ANIMAL CELLS IS, PLANT CELLS HAVE PLASTIDS WHEREAS ANIMAL CELLS DO NOT HAVE PLASTIDS IN THEM.

40



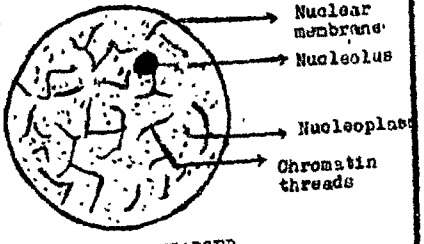
GENERALISED ANIMAL CELL

41



ANIMAL CELL

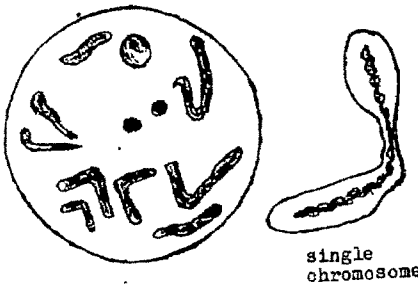
42



NUCLEUS ENLARGED

43

Fig.1 Fig.2



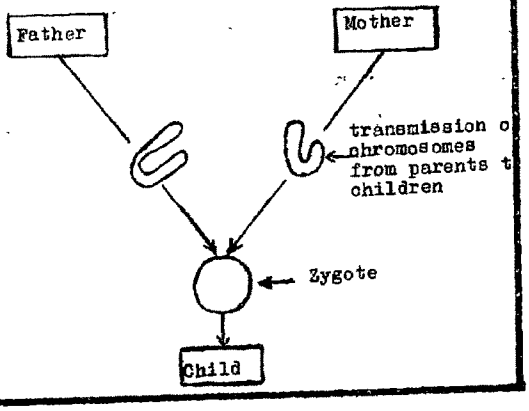
NUCLEUS AT CELL DIVISION

46

We shall review what we have studied about nucleus.

1. Nucleus is surrounded by nuclear membrane
2. Inside nuclear membrane there is nucleoplasm.
3. The substance constituting nucleus is chromatin matrix which are made up of chromosomes.
4. Chromosomes have genes in them which carry the hereditary characters.

44



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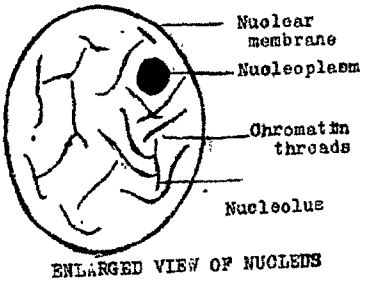
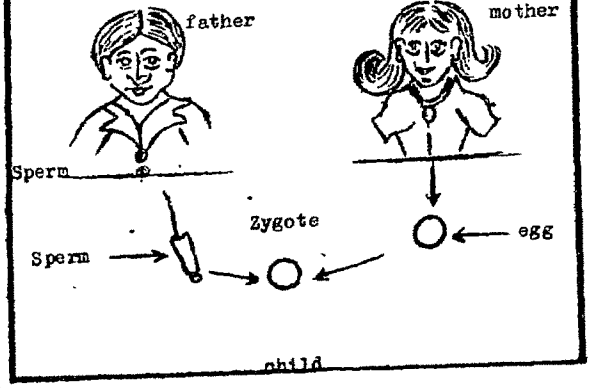


ENLARGED VIEW OF NUCLEUS

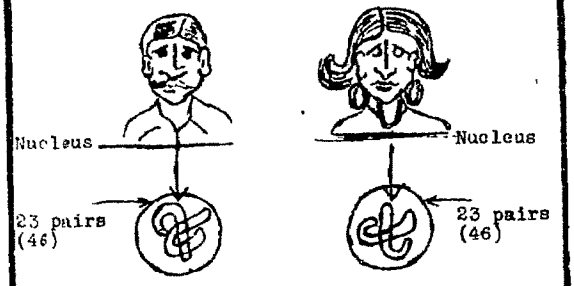
45



48

1. Nuclear membrane
2. Nucleoplasm
3. Chromosomes
4. Nucleolus

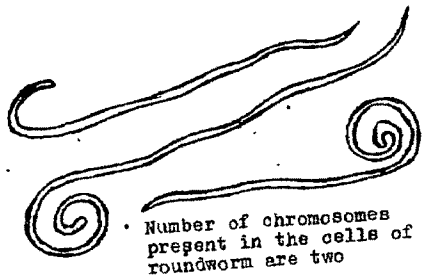
49



52.

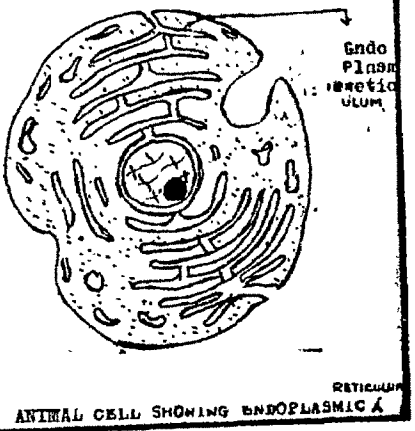
EVERY ORGANISM HAS A FIXED NUMBER OF CHROMOSOMES

50



Number of chromosomes present in the cells of roundworm are two

54



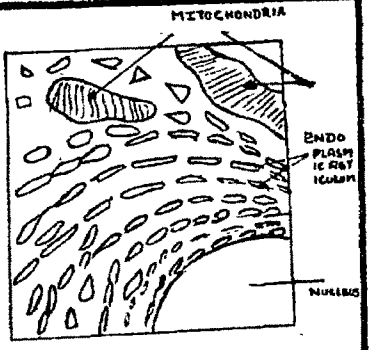
ANIMAL CELL SHOWING ENDOPLASMIC RETICULUM

51

42 chromosomes are present in the cells of wheat plant

Wheat Plant

55



A PART OF ANIMAL CELL ENLARGED TO SHOW ENDOPLASMIC RETICULUM.

WORK BOOKLET

(A)

1. a) The cells which comprises the body of living organisms are all similar in shape and size (T/F).

   b) All the cells of a living organism perform the same function (T/F).

2. Cell is nothing but a bit of _____ surrounded by _____ membrane.

3. The two major areas of protoplasms are _____ and _____.

4. Cytoplasm is that part of protoplasm which lies outside nucleus but within _____.

5. The cell membrane or plasma membrane allows only certain substances to pass into and out of the cell. In other words it is a _____ membrane.

6. In addition to cell membrane plant cells have _____ _____. This is one of the differences between plant cells and animal cells.

(B)

1. The different organelles or parts present in cytoplasm are:

   1) 4)

   2) 5)

   3)

2. Centrosome which is a star shaped structure functions only during _____ _____ and is usually absent in _____ cell.

3. The Gologi complex which is named after a biologist namely golgi is believed to be _____ in function.

4. Mitochandria mainly help in _____ energy from food. (consuming/releasing)

5. Vacuoles are called " store houses" of cells, because they store _____ and _____ substances.

(C)

1. The three types of plastids are (1) _____
   (2) _____ and (3) _____

2. a) Leucoplasts are _____ plastids.
   b) Chloroplasts are _____ plastids.
   c) Chromoplasts are _____ plastids.

   (coloured, colourless, green)

3. One interesting feature of plastids is they can change from one form of plastids to another (T/F)

4. The difference between plant and animal cells with regard to plastids is _____ cells donot plastids in them.

5. Vacuoles that are present in _____ cells are quite bigger in size when compared with vacuoles of _____ cells. This is another difference between plant and animal cells.

(D) NUCLEUS

1. The parts of nucleus are :
   a)
   b)
   c)
   d)

2. The part of protoplasm present within the _____ membrane is called as NUCLEOPLASM.

3. In the nucleoplasm are present _____ and _____.

4. The structures responsible for transmission of hereditary characteristics are _____ which are present in _____.

5. The number of chromosomes for all living organisms is _____ (fixed/not fixed)

6. The structure which forms a sort of skeleton to the cell is _____.

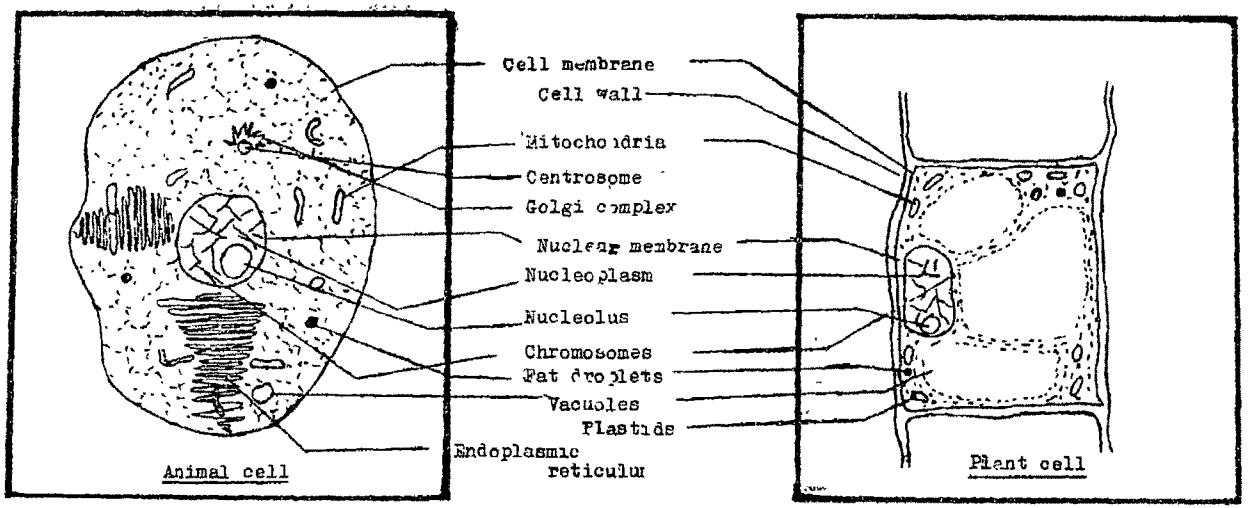
UNIT - II

S U M M A R Y

(The Organelles of a Cell)

This is the summary of all those points which you have learnt through slides and teacher's explanation. You know that all living organisms whether plants or animals are composed of one or more than one cell, and each cell is nothing but a bit of protoplasm surrounded by cell membrane or plasma membrane. This cell membrane is present in both plant as well as animal cells. Inside this cell membrane is the protoplasm, where, two major areas, namely, nucleus and cytoplasm could could be distinguished. Cytoplasm is that part of protoplasm lying outside the nucleus but within the cell membrane. In plant cells, in addition to cell membrane, there is cell wall which is made up of cellulose, a carbohydrate. Regarding cell membrane, you learnt that it allows only certain substances for e.g., amino acids, glucose etc., to pass into and out of cell. In other words, it is selectively permeable in nature.

Next, we studied about different organelles, namely, Centrosome, Golgi complex, Mitochondria, Vacuoles, Fat droplets, and Plastids that are present in cytoplasm. Table - 1 (See page) tells you what all we have studied about these organelles.



PARTS OF A PLANT AND AN ANIMAL CELL

While studying about these organelles we noted the difference between animal cell and plant cell with regard to these structures. The differences are given hereunder:

	Animal cell	Plant Cell
1.	Cell wall is absent	Cell wall is present
2.	Centrosome is present	Centrosomes is absent
3.	Vacuoles are smaller	Vacuoles are bigger
4.	Plastids are absent	Plastids are present

Coming to second major area of protoplasm, namely, nucleus, we studied that it is a dense sperical structure situated in the centre of the cell, and it controls all the activities of the cell. In plant cells it is pushed towards one side due to the presence of bigger vacuoles. Nucleus is composed of:

1. Nuclear membrane
2. Nucleoplasm
3. Chromatin matrix
4. Nucleolus

Nuclear membrane is thin and surrounds the nucleoplasm. It separates nucleoplasm from cytoplasm. Nucleoplasm is that part of protoplasm which is inside nuclear membrane. It is composed of proteins, DNA, RNA, Phosphorous, etc., which you know already.

In the nucleoplasm are seen two structures, namely, chromatin matrix and nucleolus. This chromatin matrix is made up of thread like structures which are known as chromatin threads or chromosomes. These chromosomes are responsible for the transmission of hereditary characters from parents to children. The number of chromosomes in the cells is fixed for all organisms, e.g. for man the number is 23 pairs, for wheat plant it is 21 pairs.

In addition to these, some more structures have been identified recently under electron microscope. One of them is endoplasmic reticulum. It is in the form of a network and is spread all over the cell (see the diagram). It serves as a sort of skeleton to the cell.

So far, we have tried to understand certain major things about cell. Below are given names of articles which will give you additional information about cell. To make your reference easy, even page numbers are given. Read these articles carefully and try to make notes for yourself.

1. "Inside the Living Cell" by Butlet, J.A.V. 1959, George Allen and Unwin Ltd., London.

2. "Can Man Create Life"? by Shivanand Karkal. Mirror Magazine, April 1978, Page No. 38 to 42.

3. "Genes - Yesterday, Today and Tommorrow", by Subhash S. Arora. Science Reporter, September 1978, Page No. 589.

UNIT TEST II

Name: _____

I. Fill up the Blanks:

1. A cell is nothing but a bit of protoplasm surrounded by _____ _____. K

2. The process used by biologists to study the parts of a cell by colouring them is called as _____. K

3. Carbohydrates are substances which are made up of _____, _____ and _____ elements and the ratio of _____ and _____ is always 2:1. K

4. Fats differ from carbohydrates by having greater number of _____ and _____ atoms. K

5. Proteins include _____ and _____ in addition to carbon, hydrogen and oxygen. K

6. De-oxyribose nucleic acid helps in:
   (a) _____
   (b) _____ K

7. Name three sources of sugar:
   (1) _____ (2) _____
   (3) _____ C

8. Name three sources of proteins:
   (1) _____ (2) _____
   (3) _____ C

9. Name three sources of fats:
   (1) _____ (2) _____
   (3) _____ C

10. Proteins are built out of small units known as:
    _____ _____

11. (1) The two major areas of protoplasm are _____ and _____. K

(2) The nucleic acid present in nucleoplasm is _____. K

(3) The portion of the protoplasm that lies within the cell membrane, but outside the nucleus is called as _____. K

(4) During the process of energy formation, Adenosine _____ phosphate is converted into Adenosine _____phosphate which loses one molecule of _____ and becomes again Adenosine _____ phosphate, thereby releasing energy. K

(5) Genes are located in _____

(1) Cytoplasm (3) Chromosome
(2) Centrosome (4) Nucleolus K

12. Here are given parts of both animal as well as plant cells. Write one function of each of them in the space provided:

(a) Mitochondria _____
(b) Nucleolus _____
(c) Centrosome _____
(d) Golgi bodies _____
(e) Chromoplasts _____
(f) Vacuoles _____
(g) Chloroplasts _____
(h) Chromosomes _____
(i) Endoplasmic reticulum _____
(j) Leucoplasts _____

II. Instructions:

Here are given a few incomplete statements. Under each incomplete statement you will find 3 or 4 alternatives with which you can complete that statement. You have to choose that alternative which is most appropriate and which completes the statement. Put a '✓' mark against the serial number of the alternative you have selected:

1. The biologists who formulated the cell theory were

   (a) Grew and Malphighi (c) Watson and Crick
   (b) Schleiden and Schwann (d) Robert hook and Huxley K

2. Amino acids are called as building blocks of proteins because:

   (a) the structure of proteins depends upon the structure and sequence of amino acids.

   (b) Since proteins are made up of amino acids.

   (c) since amino acids combine together and form proteins. K

3. Nucleotides are the smaller units of:

   (a) Carbohydrates (c) Proteins
   (b) Nucleic acids (d) Fats C

4. The nucleic acid D.N.A. contains:

   (a) Ribose sugar
   (b) Both Ribose and De-oxyribose sugars
   (c) De-oxyribose sugar K

5. Here are given parts of an animal cell. Write 'c' if it is present in Cytoplasm and 'N' if it is present in nucleus, in the brackets provided against each of them:

   (a) Centrosome ( ) (d) Nucleolus ( )
   (b) Nuclear membrane ( ) (e) Golgi complex ( )
   (c) Mitochondria ( ) (f) Chromosomes ( )

6. The following are the chemical substances present in protoplasm. Write 'I' in the bracket if it is inorganic substance and "O" if it is organic C

   (a) Carbohydrates ( ) (e) Proteins ( )
   (b) Potassium salts ( ) (f) Nucleic acids ( )
   (c) Fats ( ) (g) Sodium chloride ( )
   (d) Sulphur ( ) (h) Water ( )

III. (1) Write in 3 to 4 sentences as to why water is needed by all living organisms: K

(2) Write in 2 to 3 sentences the physical nature of protoplasm. K

(3) Write the components of cell theory: K

(4) List out all the differences between an animal cell and a plant cell: C

IV. Give your Reasons:

1. Reason out as to why green plants need not be provided with ready source of food materials: A

2. Reason out as to why children always resemble their parents in many respects: A

3. There are two similar dogs, viz., dog 'A' and dog 'B'. Dog 'A' is given only solid food, whereas dog 'B' is given both solid and liquid food. Reason out as to which dog will live longer and why? A

V. Match 'A' with 'B': K

'A'	'B'
1. Robert Hooke	(a) formulated the cell theory.
2. Schleiden and Schwann	(b) first person to call protoplasm as physical basis of life.
3. Prof. Huxley	(c) first person to identify cells in cork.

VI. Draw a neat diagram of an animal cell and label all its parts: C