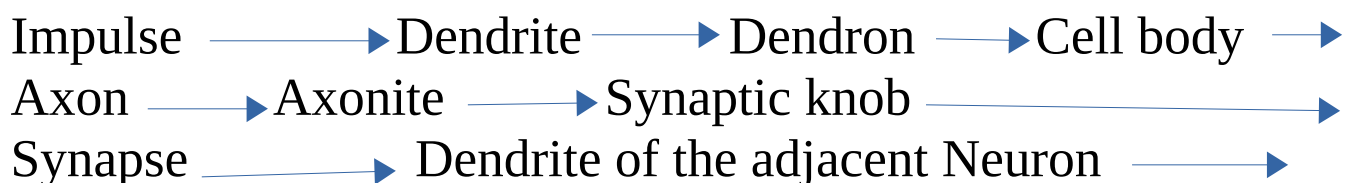
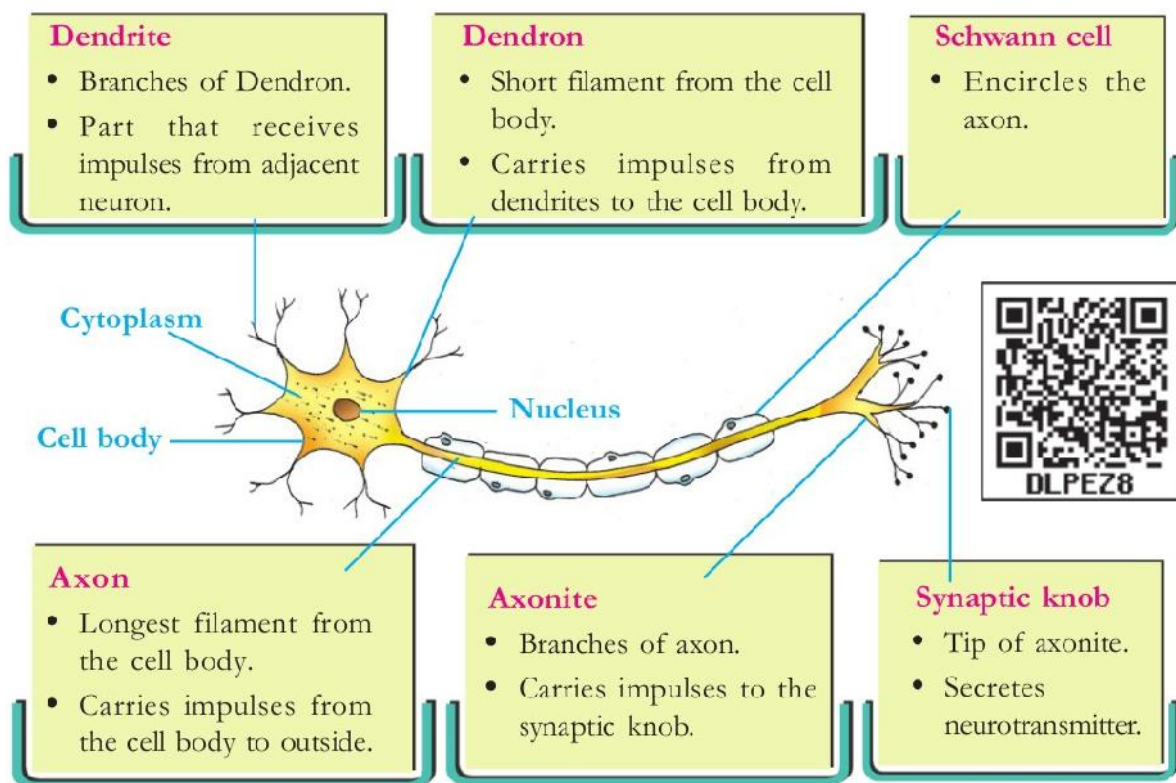
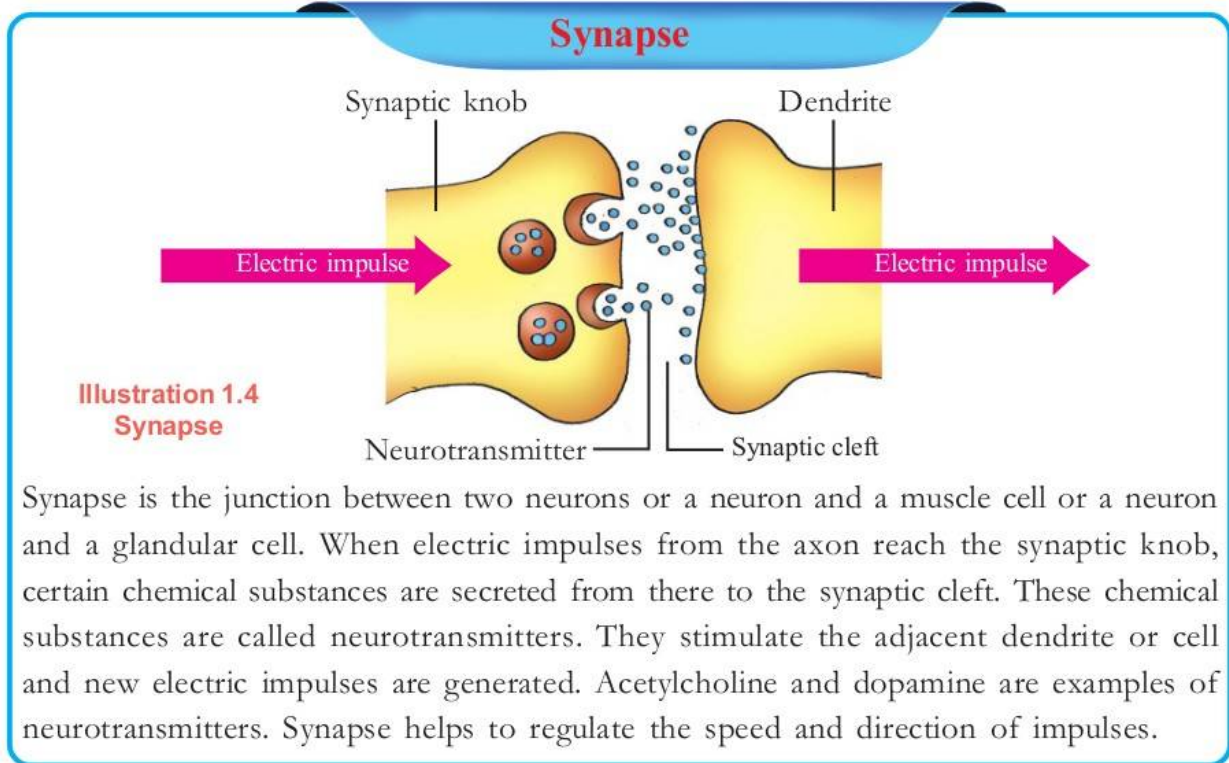


1 Sensations and Responses

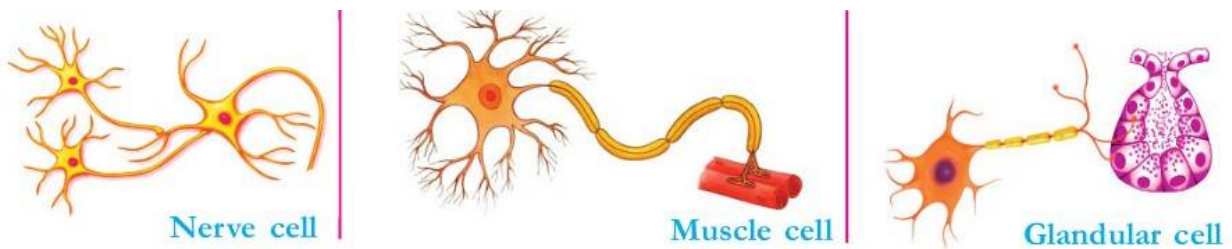


Neuron - Structure and function





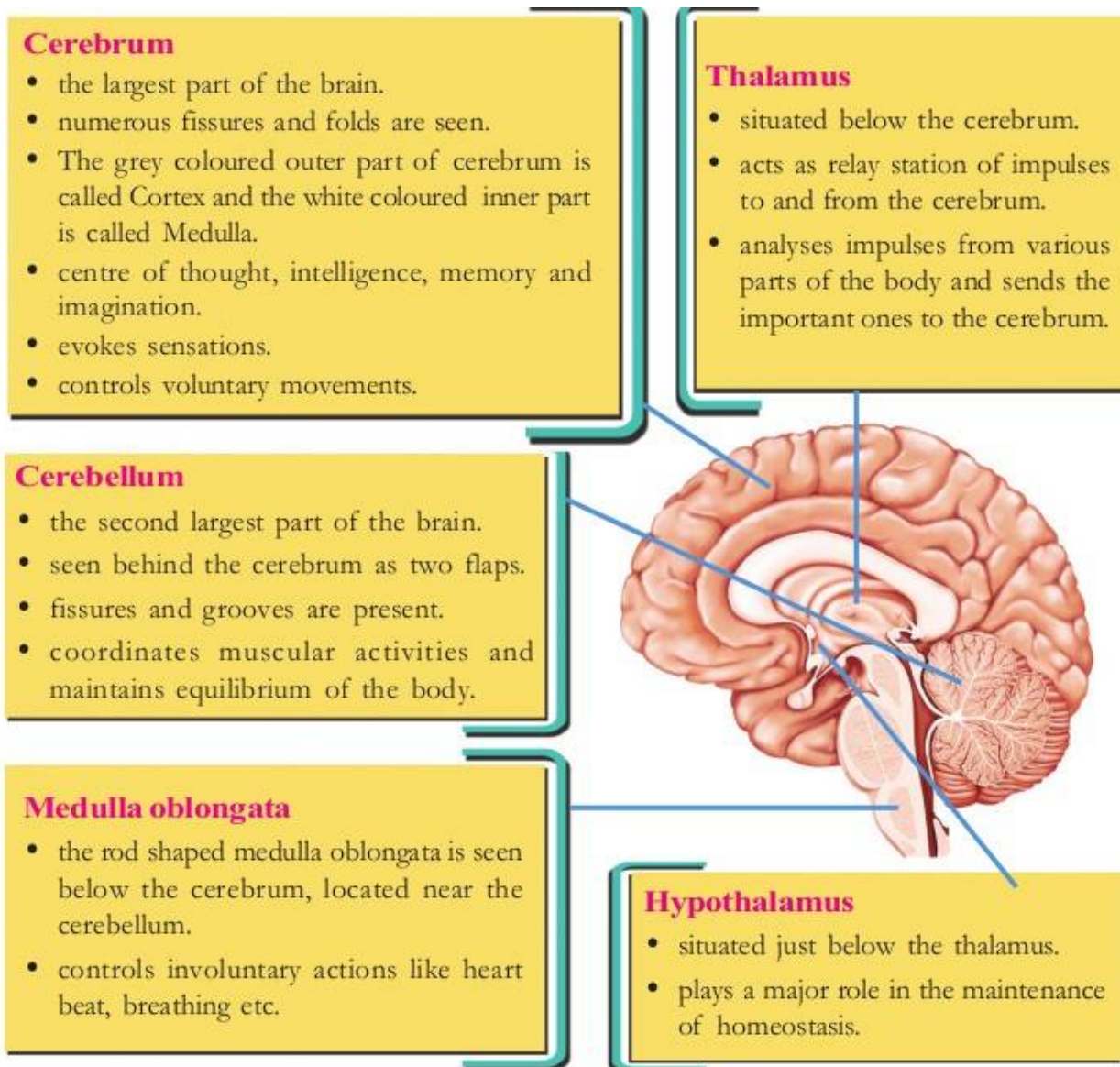
Different types of synapses



Nerves and their functions

Nerves and their peculiarities	Functions
Sensory nerve (formed of sensory nerve fibres)	carries impulses from various parts of the body to the brain and the spinal cord.
Motor nerve (formed of motor nerve fibres)	carries impulses from brain and spinal cord to various parts of the body.
Mixed nerve (formed of sensory nerve fibres and motor nerve fibres)	carries impulses to and from the brain and spinal cord.

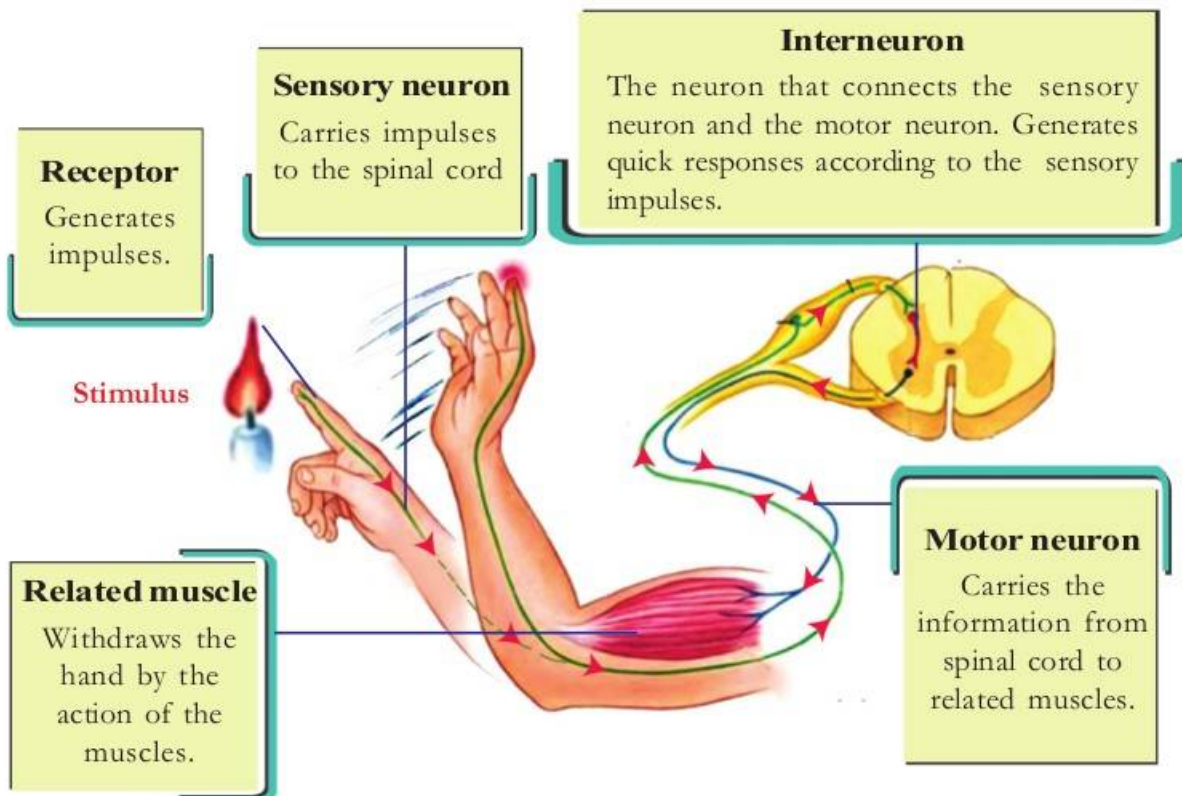
Structure and function of the brain



Reflex actions

The accidental and involuntary responses towards stimuli are called reflex actions. They do not happen consciously.

The pathway of impulses in a reflex action



Stimulus → Receptor → Sensory neuron →
Interneuron → Motor neuron → Related muscle

Types of Reflex Actions

- **Reflex arc** is the pathway of impulses in the reflex action.
- Mainly spinal cord acts as the centre of reflex action and such reflexes are called **Spinal reflexes**.
- But all reflexes are not under the control of the spinal cord. Don't we blink our eyes or when objects move towards them? This is also a reflex action. Such reflexes under the control of the cerebrum are called **Cerebral reflexes**.

Certain diseases affecting the nervous system

Disease	Causes	Symptoms
Alzheimer's	Accumulation of an insoluble protein in the neural tissues of the brain. Neurons get destroyed.	Loss of memory, inability to recognize friends and relatives, inability to do routine works.
Parkinsons	Destruction of specialised ganglions in the brain. Production of dopamine, a neurotransmitter in the brain gets reduced.	Loss of body balance, irregular movement of muscles, shivering of the body, profuse salivation.
Epilepsy	Continuous and irregular flow of electric charges in the brain.	Epilepsy due to continuous muscular contraction, frothy discharge from the mouth, clenching of the teeth following which the patient falls unconscious.

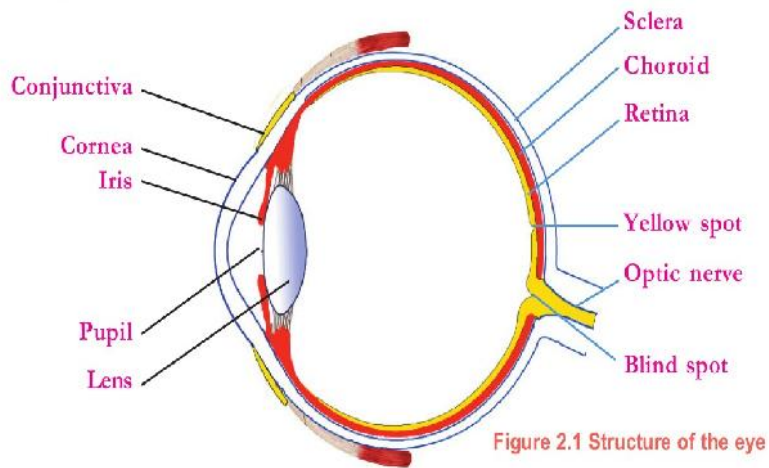
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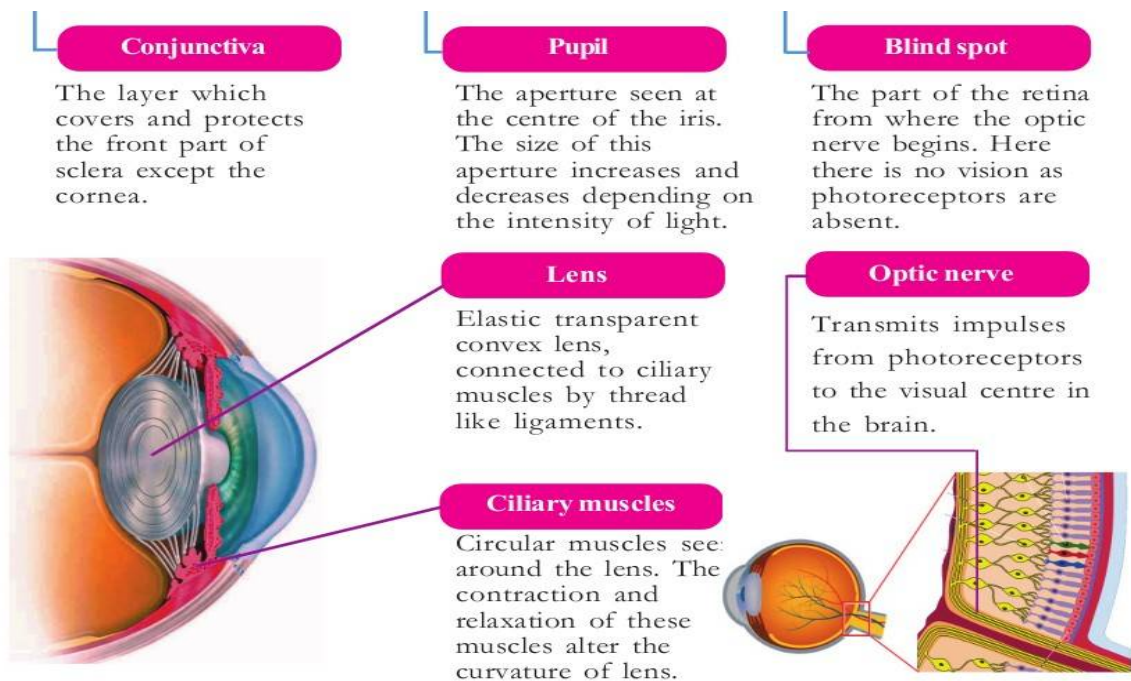
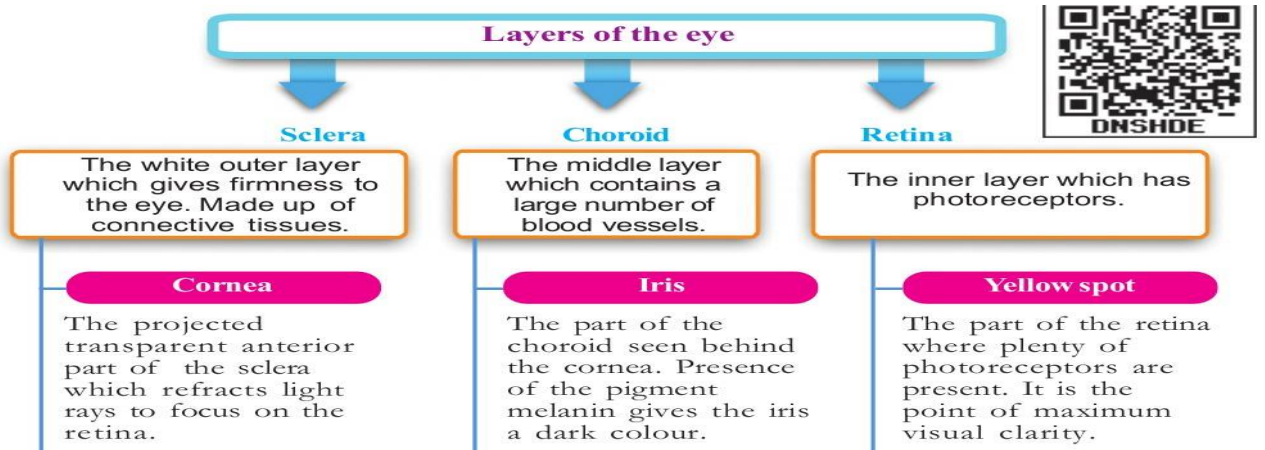
Windows of Knowledge



Structure of the eye

e diary.





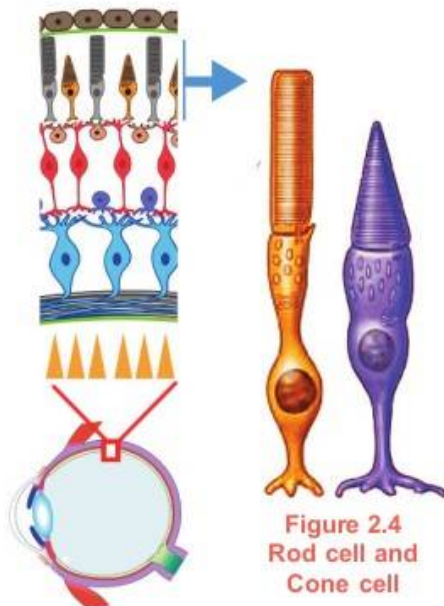
Retina and the Photoreceptors

Features	Rod Cell	Cone Cell
Pigment	Rhodopsin	Photopsin/ Iodopsin
Shape	Rod shape	Conical
Function	Vision in dim light	Vision in bright light, colour vision

Retina and the Photoreceptors

You might have understood that photoreceptors are present in the retina. Rod cells and cone cells are the photoreceptors in the retina. Rod cells are more in number than cone cells.

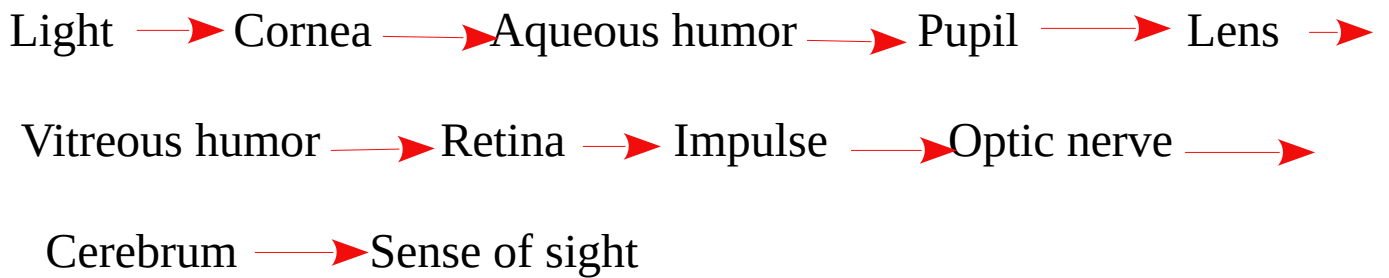
Observe figure 2.4 and relate the shape of photoreceptors with their names. Analyse the description and compare the photoreceptors and complete table 2.3.



Rod cells contain the visual pigment called rhodopsin. This pigment is formed from a protein named opsin and retinal which is a derivative of Vitamin A. Since they are activated even in dim light, we are able to see objects in dim light. These cells cannot detect colour.

Cone cells contain a pigment called photopsin. This is also called iodopsin. This pigment is also composed of opsin and retinal. There are three types of cone cells in our eyes, which help us to detect three primary colours of light – red, green and blue. This diversity is due to the difference in amino acids in the opsin molecule. So, cone cells provide us with colour vision.

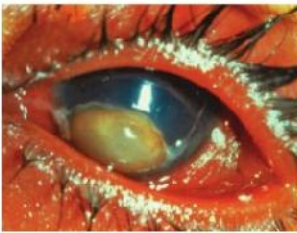
Sense of sight



Eye – Defects and Diseases

Night blindness

You have studied that the retinal, a part of the visual pigment, is derived from Vitamin A. The deficiency of Vitamin A results in the low production of retinal. This in turn prevents the resynthesis of rhodopsin. In this condition, objects cannot be seen clearly in dim light and this disease is called night blindness.



Xerophthalmia

Xerophthalmia

If there is a prolonged deficiency of Vitamin A, the conjunctiva and cornea become dry and opaque. This causes xerophthalmia and leads ultimately to blindness.

Colour Blindness

Observe figure 2.7.

Can you read the figure clearly?

You are aware that the retina contains cone cells which can detect red, green and blue colours. Some persons cannot distinguish green and red colours due to the defect of cone cells. This condition is called colour blindness. Can you guess why persons with colour blindness are not selected for military or for jobs like that of a driver, pilot etc? Discuss.

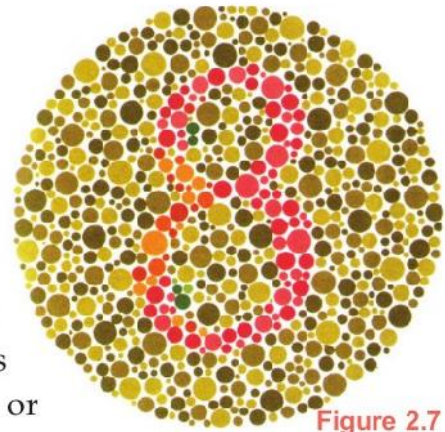
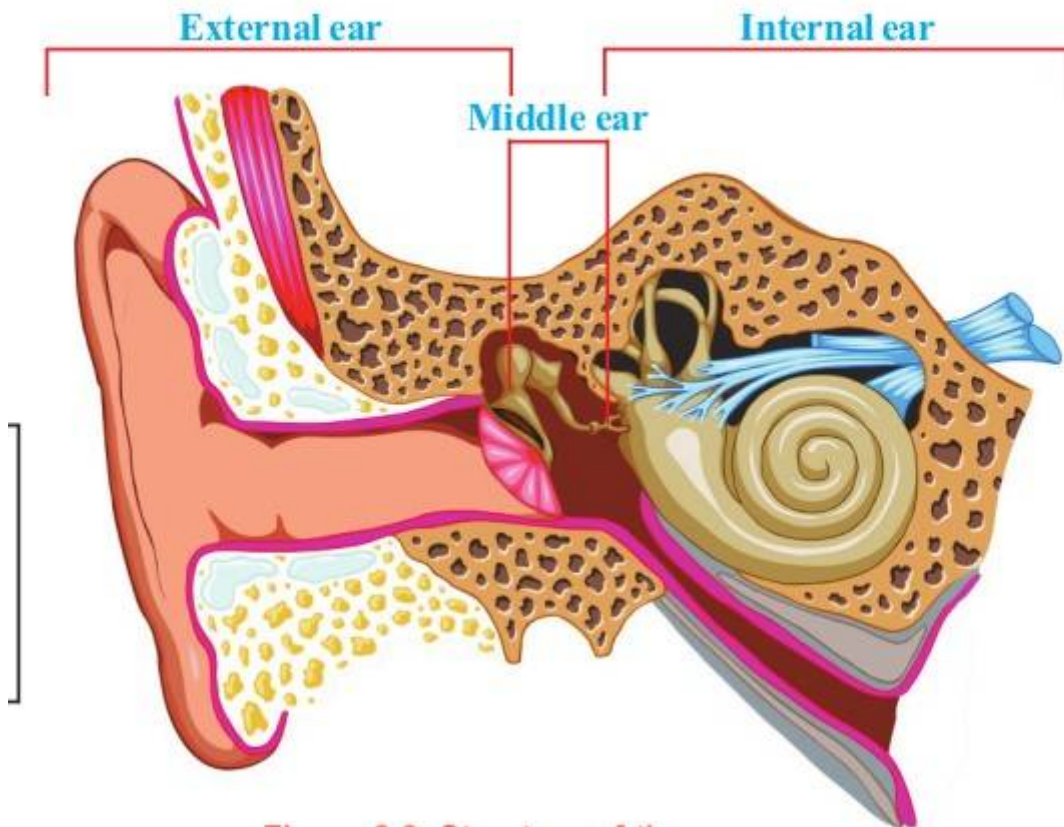


Figure 2.7

Ear

Auditory receptors are present in the ear. The ear not only helps us in hearing, but also in maintaining the balance of the body.



External Ear

Observe figure 2.9 and prepare a note on the basis of the indicators.

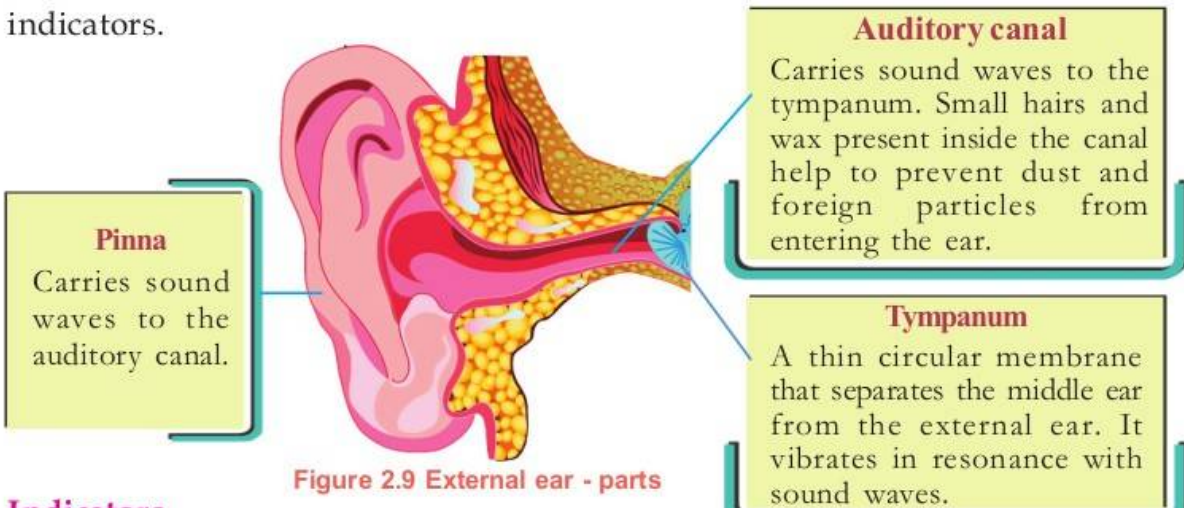
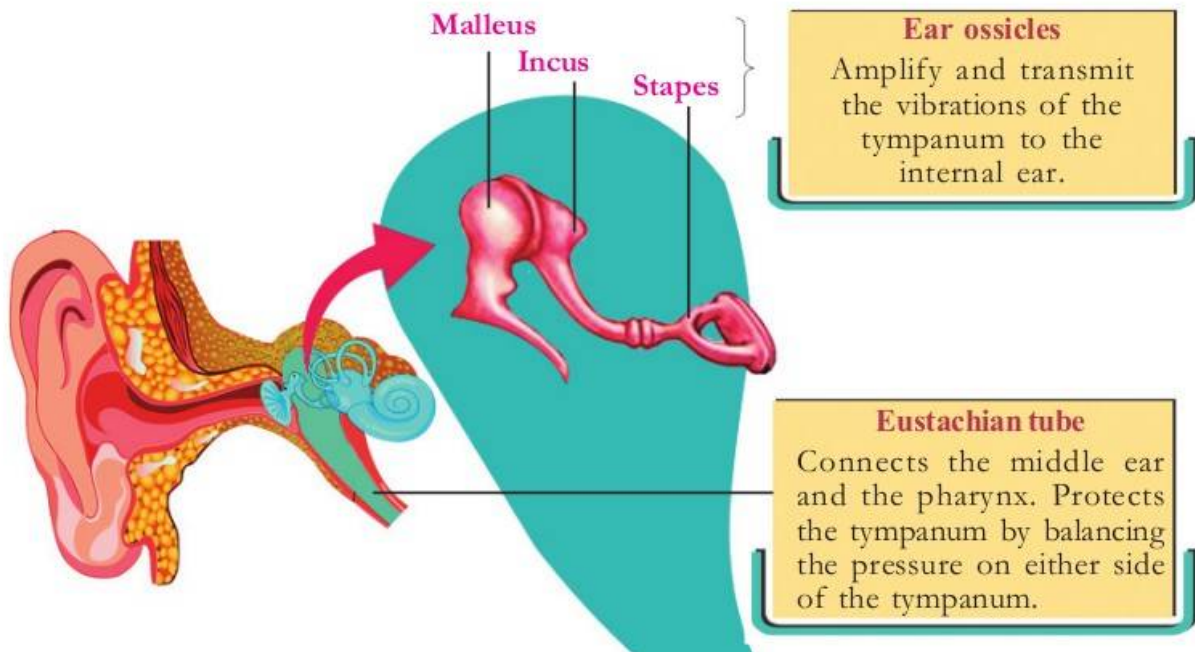


Figure 2.9 External ear - parts

Indicators

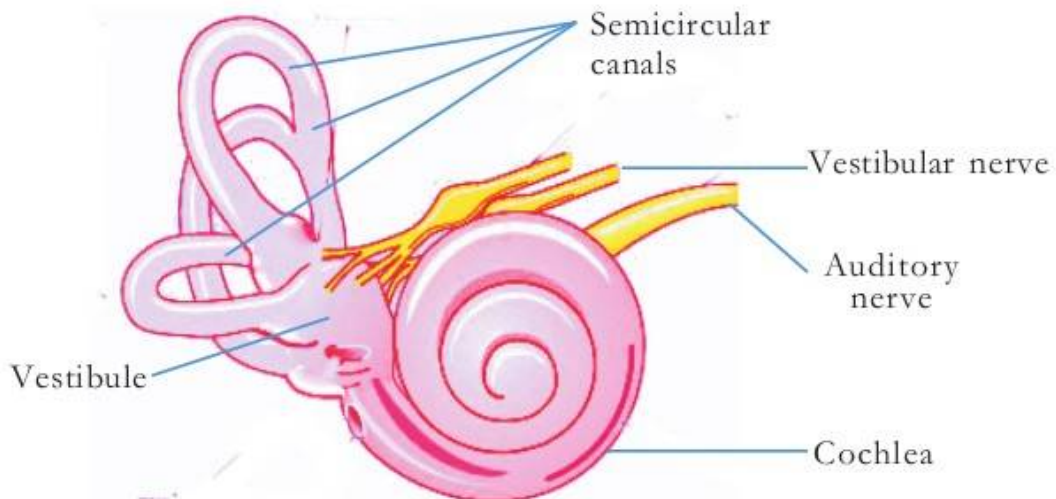
Middle Ear

Analyse figure 2.10 and prepare a table by including the parts of the middle ear and their functions.

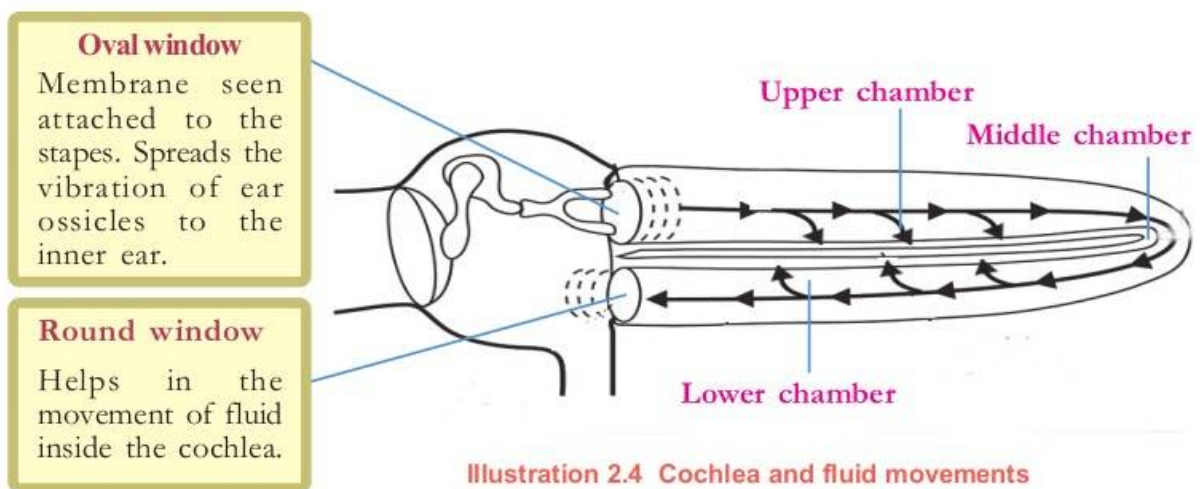


Internal Ear

Observe figure 2.11 and understand the parts of the internal ear.



The internal ear is situated inside a bony case in the skull called the bony labyrinth. In this bony case there are membranous labyrinths as well. The space inside the membranous labyrinth is filled with a fluid named endolymph. The space between the membranous and bony labyrinth is filled with a fluid called perilymph. Semicircular canals, vestibule and cochlea are the main parts of the internal ear. Semicircular canals and vestibule help in balancing the body whereas cochlea helps in hearing.



Cochlea is a coiled tube like a snail shell. It consists of three chambers. Specialized sensory hair cells which are present in the basilar membrane that separates the middle and lower chambers, function as auditory receptors. The basilar membrane and sensory hair cells together constitute the **Organ of Corti**.

To detect taste

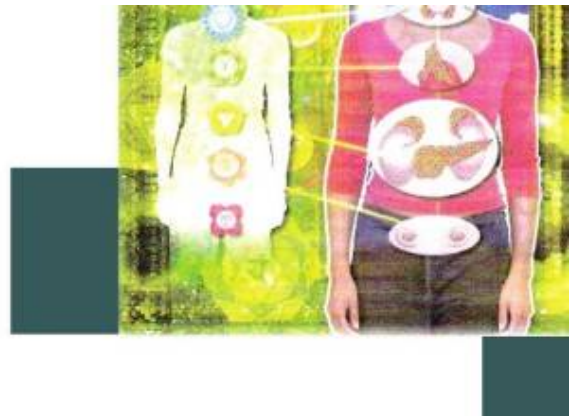
Each taste bud has chemoreceptors that help to detect different tastes. Substances responsible for taste dissolve in saliva, stimulate the chemoreceptors and generate impulses. These impulses reach the brain through the respective nerves and we experience taste.

To detect Smell

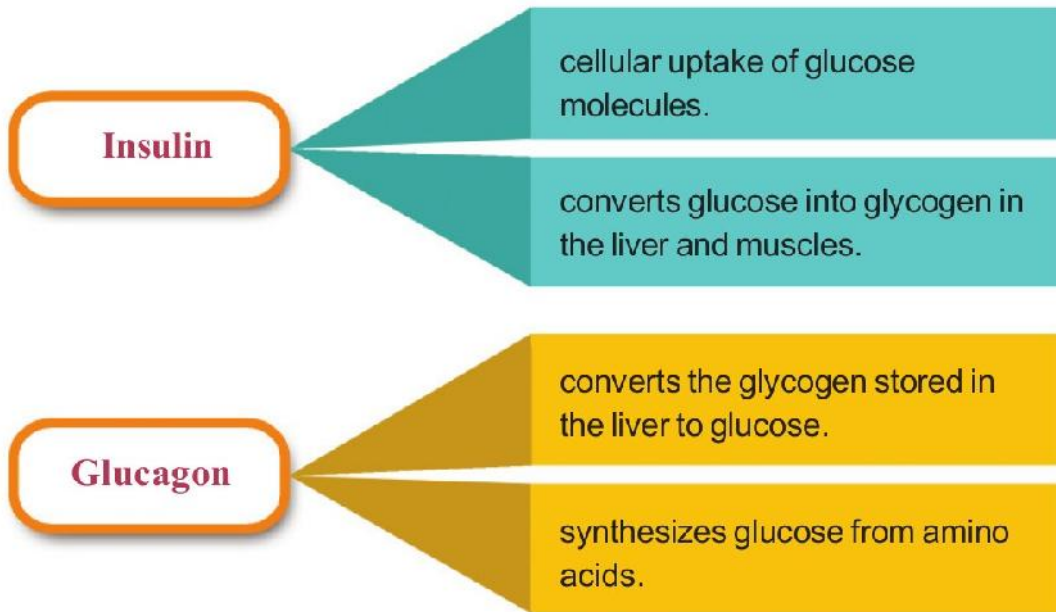
- Aromatic particles diffuse in the air and enter the nostrils.
- These aromatic particles dissolve in the mucus inside the nostrils and stimulate olfactory receptors
- Impulses are formed
- Impulses are transmitted to cerebrum through olfactory nerve
- Sense of smell

3

**Chemical Messages
for Homeostasis**



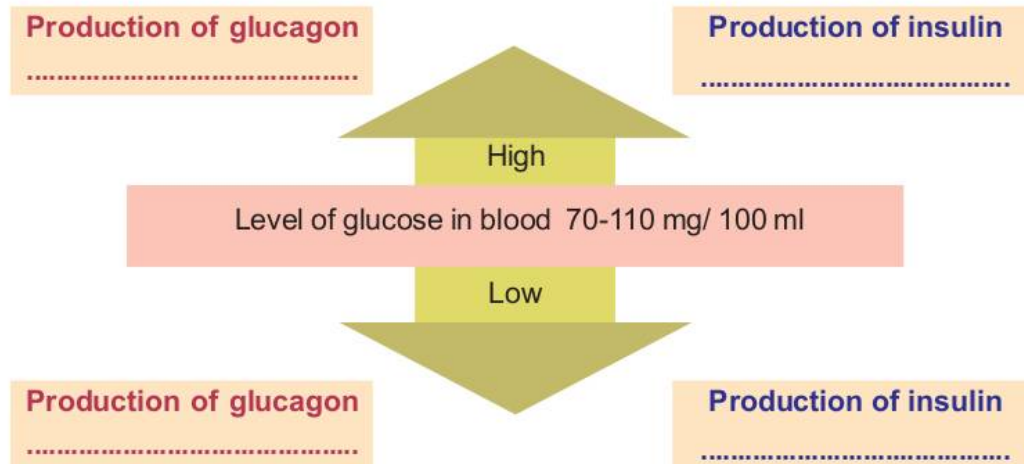
Action of insulin and glucagon





The normal level of glucose in blood is 70-110mg/100ml. The level of glucose in blood is maintained by the combined action of insulin and glucagon.

Complete illustration 3.3 by including the production of hormones that regulate the level of glucose.



When insulin fails

How does the deficiency of insulin or the inability of cells to use insulin affect the body?

Discuss.

Based on the indicators, analyse the description given below and write notes in the Science diary.

Decreased production of insulin due to the destruction of beta cells or the inability of cells to utilize the insulin produced, raises the level of glucose in blood. Excess glucose in the blood is expelled through urine. Normally, there is no glucose in urine. Diabetes is clinically referred to as a condition when the level of glucose before breakfast is above 126mg/100ml of blood. Increased appetite and thirst and frequent urination are the major symptoms of diabetes.

The blood test that precisely determines the level of glucose in blood for three months plays a crucial role in the diagnosis of diabetes.

Regulation of level of calcium in blood

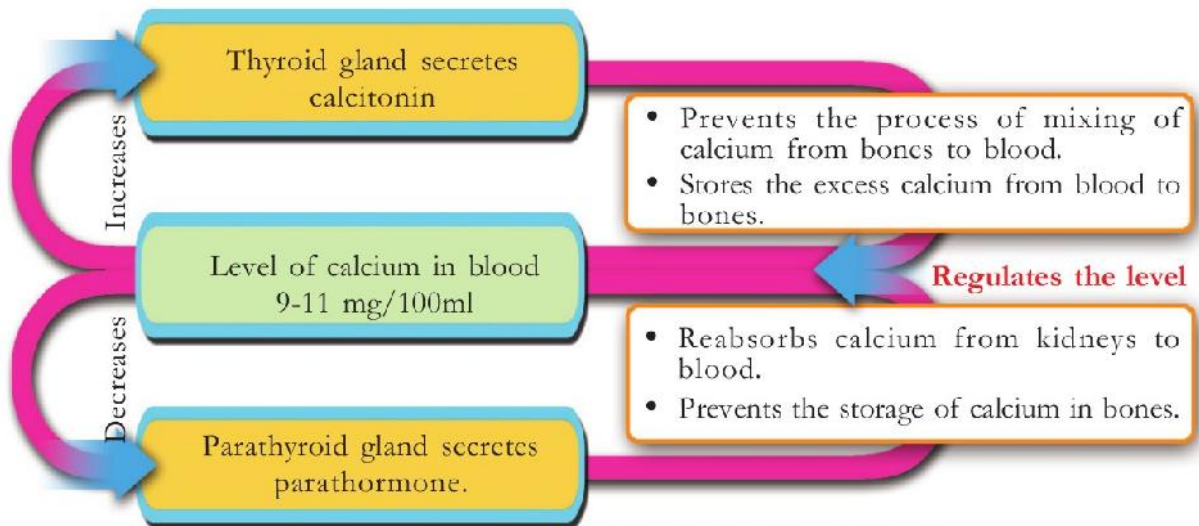


Illustration 3.4 Regulation of level of calcium in blood

If the production of somatotropin increases during the growth phase, it leads to the excessive growth of the body. This condition is called **Gigantism**. It leads to another stage called **Dwarfism** when its production decreases during the growth phase. **Acromegaly** is the condition caused by the excessive production of somatotropin after the growth phase. It is characterised by the growth of the bones on the face, jaws and fingers.

Chemical messages for communication

Haven't you noticed ants moving in a line along a particular trail? The reason behind this movement is the production of certain chemical substances.

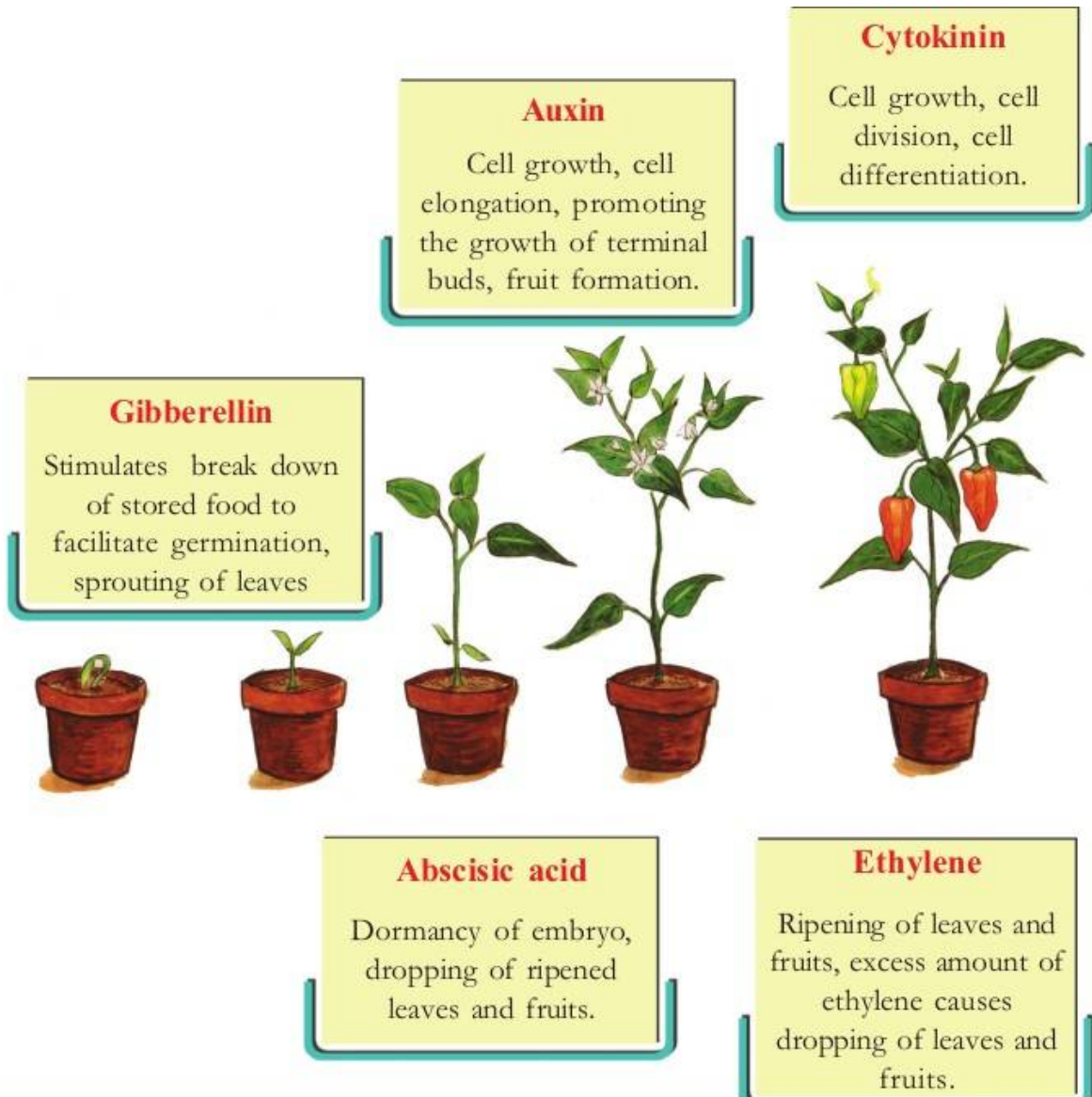
Such chemical substances that are secreted by certain animals to the surroundings to facilitate communication are called pheromones. Pheromones help in attracting mates, informing the availability of food, determining the path of travel, signalling dangers etc. The chemical messages of pheromones also help honey bees and termites to live in colonies.

The muscone in the musk deer, the civetone in the civet cat, bombykol in the female silk worm moth etc., are examples for pheromones.

Artificial pheromones are used for pest control in agricultural fields.



Plant hormones



4

Keeping Diseases Away



Tuberculosis

Tuberculosis was a dreadful disease earlier. Analyse the information given below and prepare a wall magazine on the main points relating to tuberculosis.

Pathogen	<i>Mycobacterium tuberculosis.</i>
Major Symptoms	Loss of body weight, fatigue, persistent cough
Transmission of Disease	When the patient speaks, coughs or sneezes, the pathogens spread into the air and thereby to others.
Organs/Body parts Affected	Tuberculosis mainly affects the lungs. But kidneys, bones, joints, brain etc. are also affected by this disease.
Treatment	By administering antibiotics
Vaccine	BCG is used as preventive vaccine against tuberculosis.

AIDS



Figure 4.3
HIV

AIDS (Acquired Immuno Deficiency Syndrome) is a dreadful disease that has gripped the world by fear. Lymphocytes play a major role in providing immunity to the body. HIV (Human Immuno deficiency Virus) enters the body and multiplies using the genetic mechanism of lymphocytes. Hence the number of lymphocytes decreases considerably and reduces the immunity of the body. Various other pathogens which enter the body in such a situation make the condition of AIDS even more fatal.



Through sexual contact with HIV infected person



From HIV infected mother to the foetus



By sharing needle and syringe contaminated with HIV components



Through the reception of blood and organs contaminated with HIV

Illustration 4.3 Mode of transmission of AIDS

AIDS does not spread...

- by touch, shaking hands, coughing, sneezing etc.
- through insects like mosquitoes, houseflies etc.
- by staying together and sharing food.
- by using the same toilet.
- by taking bath in the same pond.

Should we be scared of AIDS patients?

What should be our attitude towards them? Discuss.

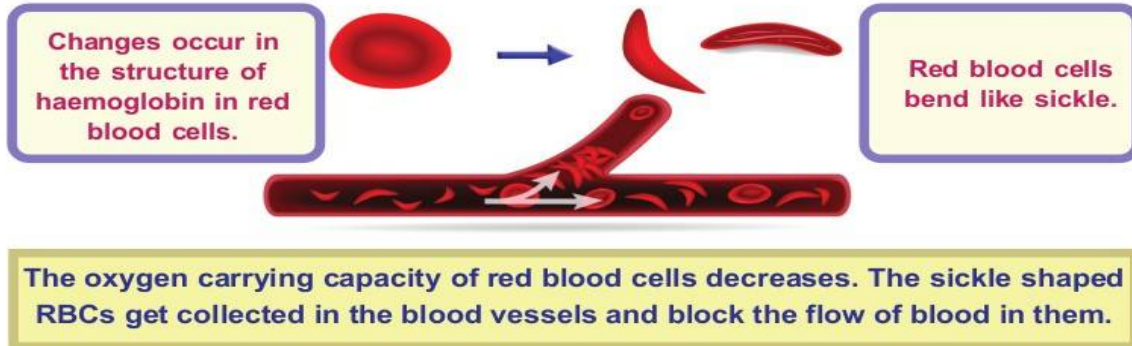


Illustration 4.4 Malarial infection

High fever with shivering and profuse sweating are the major symptoms of malaria. Other symptoms include headache, vomiting, diarrhoea, anaemia, etc.

Sickle cell anaemia

The defects in genes may also cause deformities in the sequencing of amino acids which are the building blocks of haemoglobin. As a result of this, the structure of haemoglobin changes and this in turn decreases its oxygen carrying capacity. Observe the changes that occur in the red blood cells of sickle cell anaemia patients given in illustration 4.6. Write your inferences in the Science diary based on the indicators given.



Cancer

Cancer is caused by the uncontrolled division of cells and their spread to other tissues. The normal cells get transformed into cancerous cells when the control system of cell division fails. This may be due to environmental factors, smoking, radiations, virus, hereditary factors, etc. The disease may become complicated with

Biology - X



the spread of cancer cells to other parts of the body through blood and lymph.

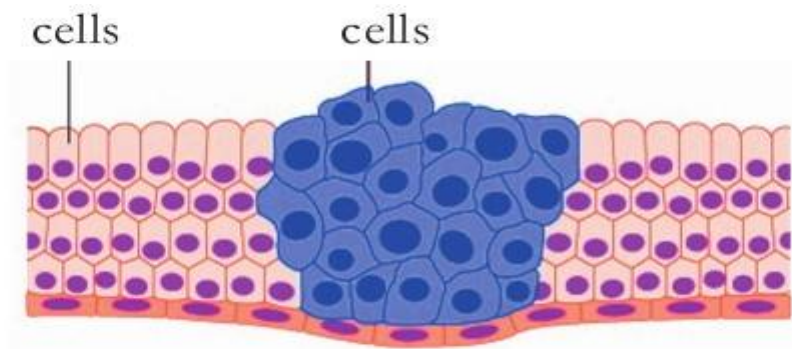


Illustration 4.7 Cancer cells

Surgery, chemotherapy, radiation therapy etc., are extensively used in the treatment of cancer. As recovery from the disease is difficult if the disease becomes severe, early diagnosis of the disease is crucial in the treatment of cancer.

Discuss with cancer specialists about the life style and food habits that will help us to get rid of cancer. Also collect more information in this regard from other sources.


Lifestyle Diseases

Lifestyle diseases are caused by unhealthy living styles. The changes in food habits, lack of physical exercise, mental stress, bad habits like consumption of alcohol, drug abuse, smoking, etc. lead to various lifestyle diseases.


Analyse table 4.1 about certain lifestyle diseases and conduct a classroom presentation on healthy habits to be followed to avoid such diseases.

Disease	Cause
Diabetes	deficiency of insulin or its malfunctioning
Fatty Liver	deposition of excess fat in the liver
Stroke	rupture of blood vessels in the brain, block of blood flow
Hypertension	decrease in the diameter of arteries due to deposition of fat
Heart attack	block of blood flow due to deposition of fat in coronary arteries which carry blood to the heart.


Smoking and health hazards



- Stroke
- Addiction to nicotine



- Lung cancer
- Bronchitis
- Emphysema



- Hypertension
- Loss of elasticity of arteries
- Decrease in functional efficiency

Animal Diseases

Not only human beings, but animals are also affected by diseases. Observe table 4.2 about some animal diseases.

Disease	Pathogen
Anthrax, Inflammation of udder	Bacteria
Foot and mouth disease	Virus

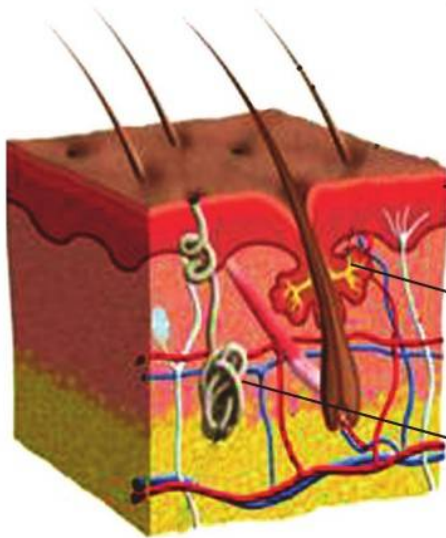
Plant Diseases

Plants are also affected by various diseases. Examine table 4.3 to identify some of the plant diseases caused by microorganisms like bacteria, virus and fungi.

Pathogen	Disease
Bacteria	Blight disease in paddy, Wilt disease in brinjal
Virus	Mosaic disease in peas and tapioca, Bunchy top of banana
Fungus	Quick wilt in pepper, Bud rot of coconut.

5

Soldiers of Defense



Epidermis : A protein called keratin present here prevents the entry of germs.

Sebaceous gland : Sebum produced by the gland makes the skin oily and water proof.

Sweat gland : The disinfectants present in the sweat produced by this gland destroys the germs.

Figure 5.1 The skin and its defense mechanism

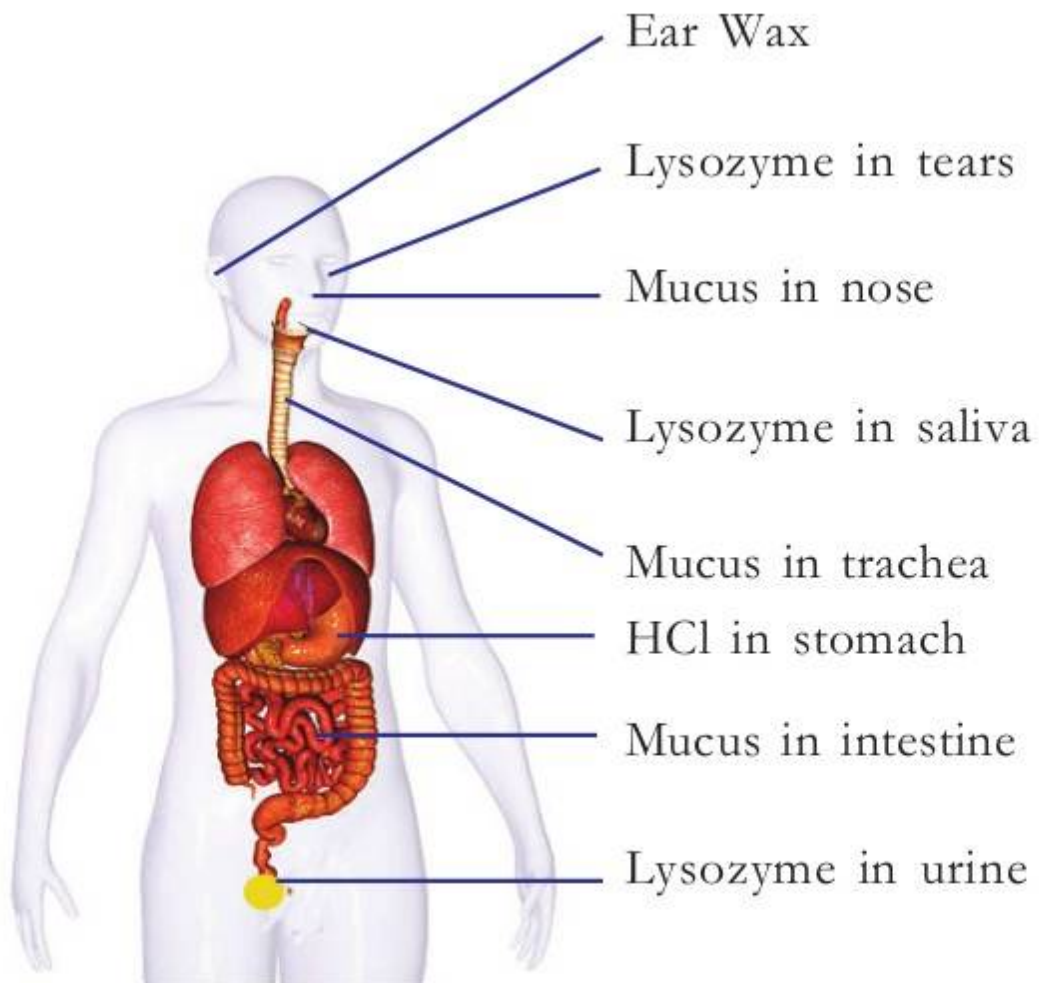


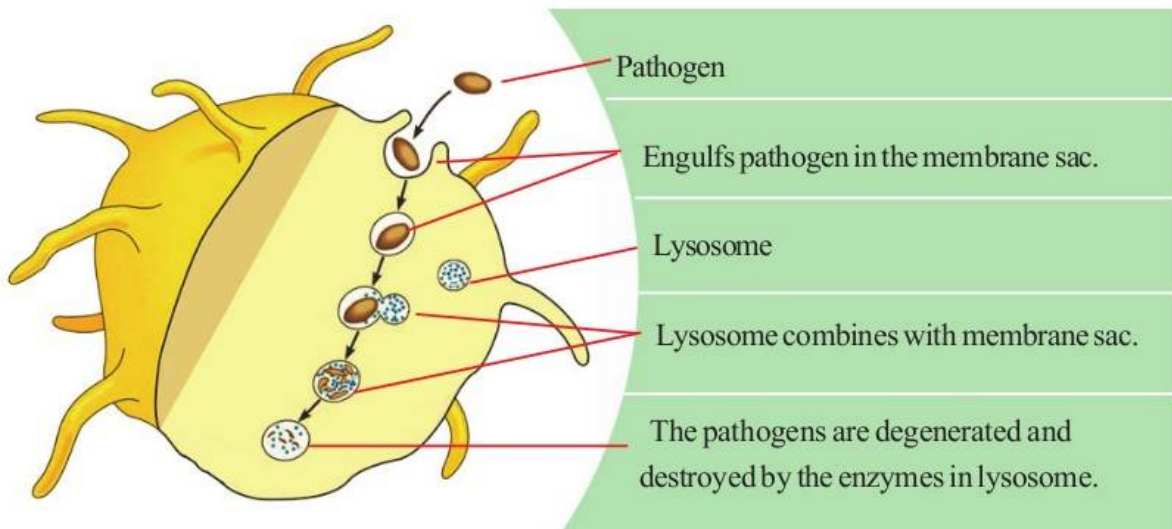
Illustration 5.2 Body secretions and Defense mechanisms

Phagocytosis



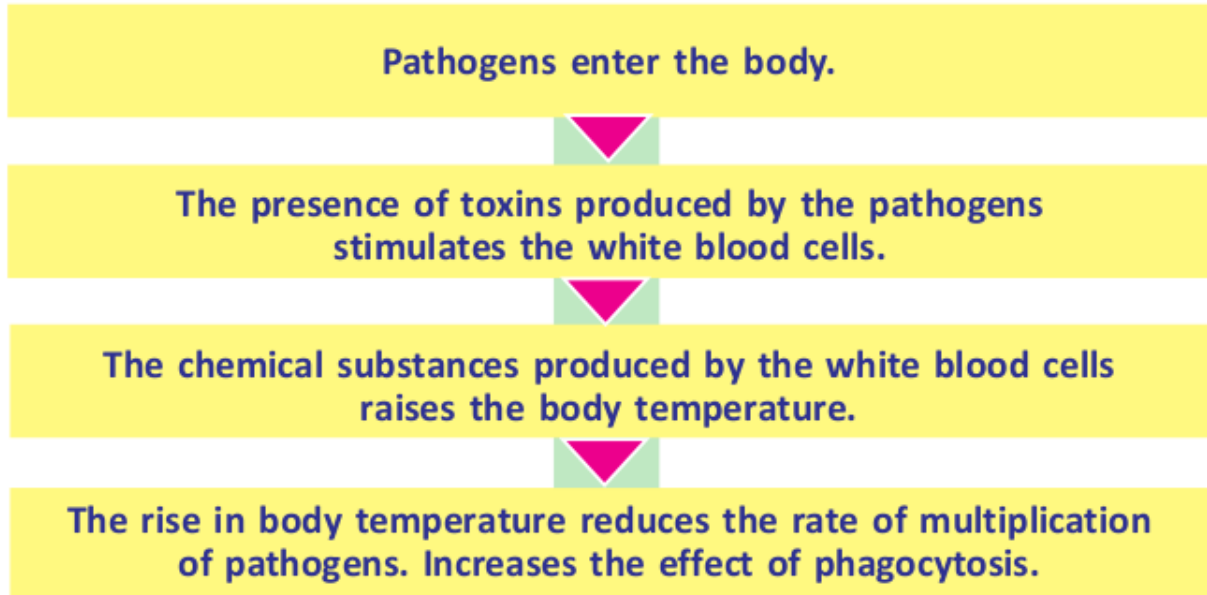
Phagocytosis is the process of engulfing and destroying of germs. The cells that are engaged in this process are called phagocytes. (phago- to engulf, cyte-cell). The white blood cells, namely monocytes and neutrophils are phagocytes.

Analyse illustration (5.5) and write notes on the stages of phagocytosis in the Science diary.

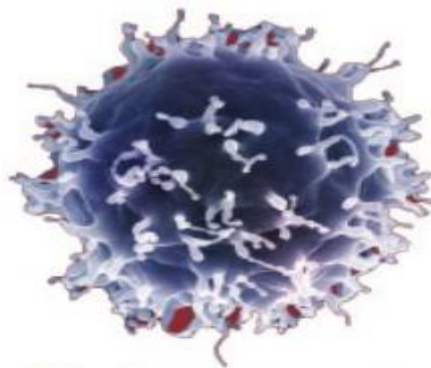


Fever, a Defense Mechanism

The normal body temperature is 37⁰ C (98.6⁰F). Fever is a condition when the body temperature rises above the normal level. Is it a disease or a symptom? Analyse the flow chart given and write your inferences in the Science diary.



B & T Lymphocytes



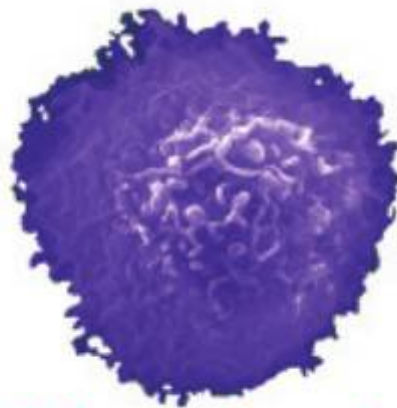
B- Lymphocyte

B - Lymphocytes

B- Lymphocytes produce certain proteins that act against antigens. These are called antibodies.

Antibodies destroy the pathogens in three different ways.

1. Destroy the bacteria by disintegrating their cell membrane.
2. Neutralise the toxin of the antigens.
3. Destroy the pathogens by stimulating other white blood cells.



T- Lymphocyte

T-Lymphocytes

- Stimulate other defense cells of the body.
- Destroy the cells affected by virus.
- Destroy cancer cells.

Immunization



Edward Jenner

Edward Jenner, an English doctor started immunization in 1778. He observed that people affected by cowpox escaped from the attack of smallpox. He injected the pus taken from a cowpox patient into the body of an 8 year old boy. The boy was affected by cowpox and recovered. After two months the pus taken from a smallpox patient was injected into the boy. He was not affected by smallpox. The immunization programmes got the name vaccination from the Latin word 'vacca' meaning cow, in memory of the cowpox experiments of Jenner.

Note the doubt of the child who observes the poster. What is vaccination? Analyse the description given below and prepare notes in the Science diary.

Defense mechanisms become slow when germs enter the body. This causes the spread and multiplication of germs. Immunization is the artificial method to make the defense cells alert against the attack of pathogens.

Vaccines are the substances used for artificial immunization. Any one of the components from alive or dead or neutralised germs, neutralised toxins or cellular parts of the pathogens will be the component of each vaccine. These act as antigens that stimulate the defense mechanism of the body. Antibodies are formed in the body against them. These antibodies are retained in the body which in future protects the body from the pathogen responsible for the same disease.

Examples For Vaccines : BCG,OPV,MMR ,TT ,Pentavalent

Antibiotics

Medicines that are extracted from microorganisms like bacteria, fungi, etc. and used to destroy bacteria are called antibiotics. They can be used externally and internally.



It was Alexander Fleming who first discovered antibiotics in 1928. He accidentally discovered that the fungus *Penicillium notatum* has the ability to destroy bacteria. But it took several years to extract medicine from it.

Kerala becomes a model again

KARSAP (Kerala Antimicrobial Resistance Strategic Action Plan) submitted on October 2018, is another example for the Kerala model. This action plan aims to fight against the

rise in the incidence of microbes towards medicines. Kerala is the first in the South East nations to launch this plan. In 2016, a form of tuberculosis, resistant to medicines affected five lakh people all over the world. WHO has

Though antibiotics are effective medicines, their regular use creates many side effects. Some important side effects are listed below:

- regular use develops immunity in pathogens against antibiotics.
- destroys useful bacteria in the body.
- reduces the quantity of some vitamins in the body.

Antifungal medicines, are used

Blood Grouping

Blood group	Antigens	Antibodies
A	A	b
B	B	a
AB	A and B	Nil
O	Nil	a and b

Table 5.5 Different types of blood groups



The basis of blood grouping is the presence of antigen A and antigen B in red blood cells. The blood group of a person is named according to the antigen present in that person's blood. In blood transfusion, certain antibodies present in the blood plasma are of special importance. In blood group A, antibody **b** and in group B, antibody **a** are present. In addition to antigens A and B, another antigen called D or Rh factor is present in the cell membrane of red blood cells of certain persons. The blood groups in which Rh factor is present are known as positive blood groups and those without Rh factor are called negative blood groups.

When a foreign antigen reaches one's blood, it stimulates the defense mechanism. On receiving unmatching blood, the antigen present in the donor's blood and the antibody present in the recipient's blood will react with each other and form a blood clot. Hence, everyone cannot receive blood from all blood groups.

Notice Board

- **People in the age group 18-60 can donate blood.**
- **Blood donation can be done once in three months.**
- **Blood donation causes no problem to the donor's health.**
- **Pregnant women and breast feeding mothers should not donate blood.**
- **Persons with communicable diseases (transmitted through blood) should not donate blood.**

Defence Mechanisms in Plants

mechanisms in plants.



Wax covering, cuticle

Prevents the entry of germs through leaves.

Bark

Protects the inner cells from direct contact of pathogens.

Cell Wall

Well equipped resistant coat. Chemical substances such as lignin, cutin, suberin, etc. provide rigidity to the cell wall. The germs that have crossed the cell wall are prevented from entering through the cell membrane by callose, a polysaccharide formed in the cell wall.

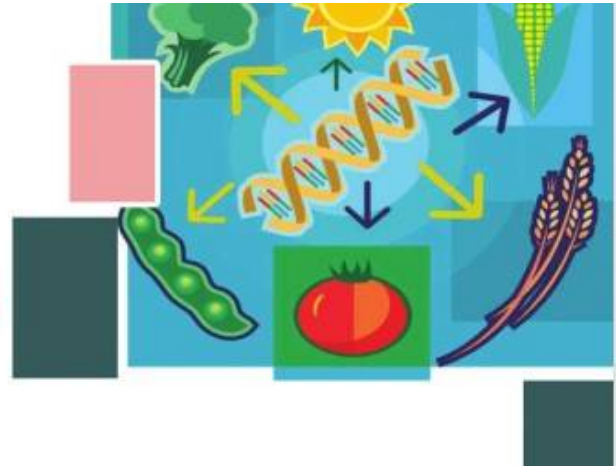
Illustration 5.9
Defence Mechanisms in Plants

4 Types of Defence Mechanisms in Plants

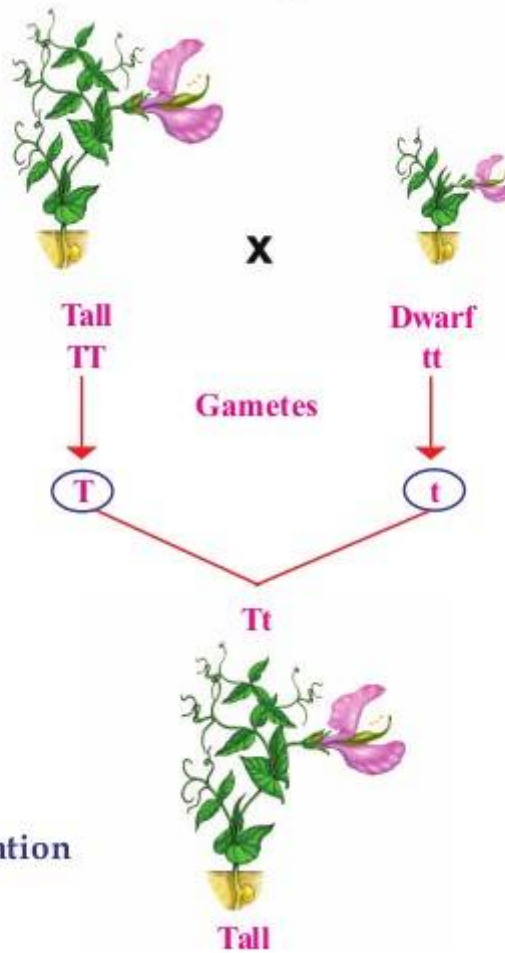
- 1. Cuticle:** A wax covering, prevents the entry of germs through leaves.
- 2. Bark :** Protects the inner cells of stem and root from direct contact of pathogens.
- 3. Cell Wall :** Well equipped resistant coat. Chemical substances such as lignin, cutin, suberin, etc. provide rigidity to the cell wall.
- 4. Callose :** The germs that have crossed the cell wall are prevented from entering through the cell membrane by callose, a polysaccharide formed in the cell wall

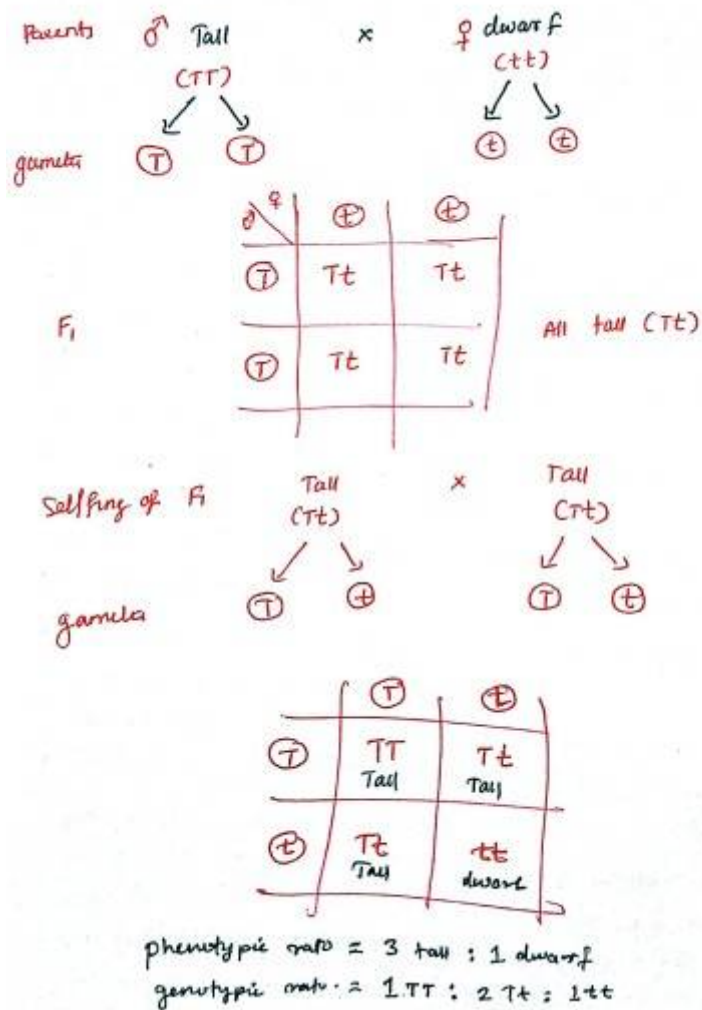
6

Unravelling Genetic Mysteries



Parental plants





- A character is controlled by the combination of two factors.
- One trait is expressed (dominant trait) and the other trait remains hidden (recessive trait) in the offsprings of the first generation.
- The traits that remain hidden in the first generation appear in the second generation.
- The ratio of the dominant and the recessive traits in the second generation is 3 : 1.

DNA

Gregor Mendel described those which are responsible for the inheritance of characters as factors. The real structure and peculiarities of these factors were not identified till the early 20th century. It was through further studies that the significance of DNA (Deoxyribo Nucleic Acid) molecule in the inheritance of characters was made clear. It was also found that the carriers of heredity which Mendel described as 'factors' were the genes present in DNA. Findings about the structure of DNA in chromosomes became a great achievement in later genetic researches. Molecular genetics is a fast developing area in the field of scientific research.

DNA (Deoxyribonucleic Acid)

Two scientists, James Watson and Francis Crick, presented the double helical model of DNA in 1953. This model fetched wide acceptance in the scientific world, and they were awarded the Nobel Prize in 1962.

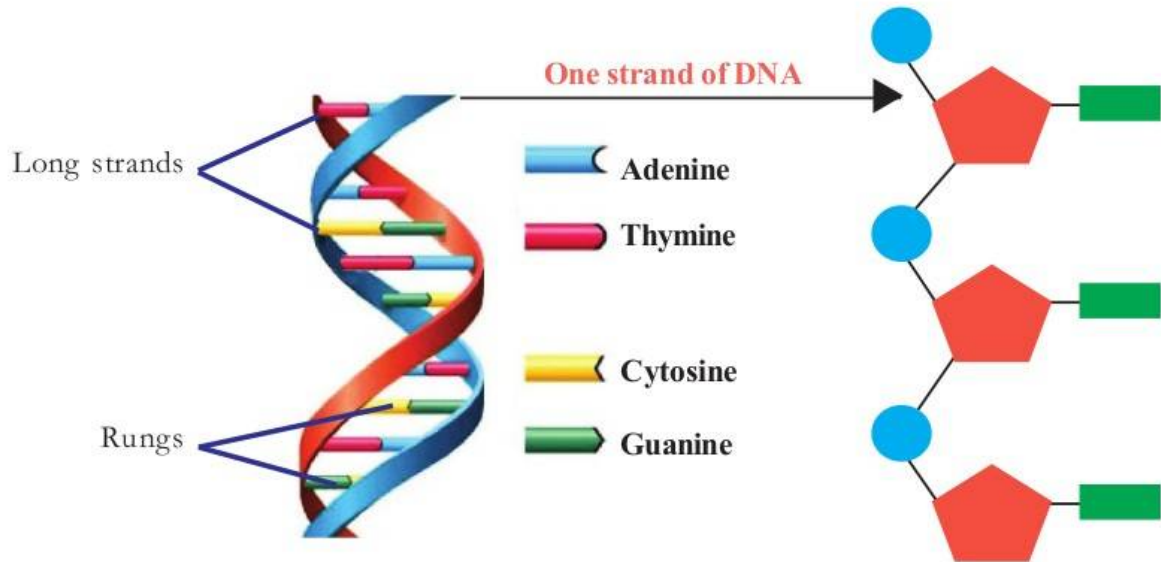


Figure 6.2
Watson and Crick



As per the double helical model, DNA molecule contains two strands. A structure with two long strands made up of sugar and phosphate, and rungs with nitrogen bases, was suggested.

Based on the indicators, analyse illustration 6.4 and 6.5 and the description given below. Prepare a note on the structure of DNA.



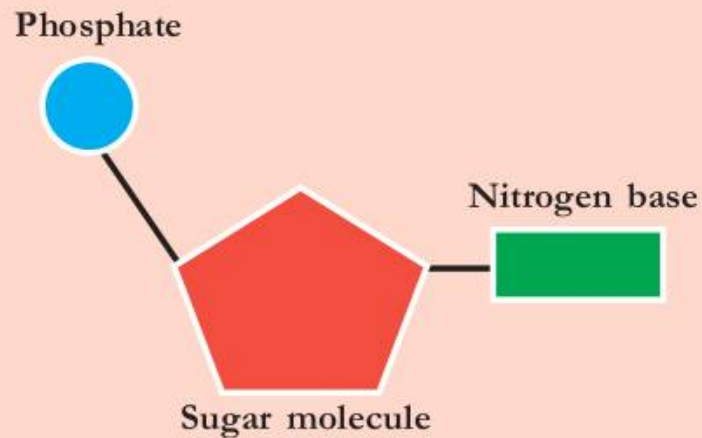


Illustration 6.5 Nucleotide

DNA molecule is made up of units called nucleotides. A nucleotide contains a sugar molecule, a phosphate molecule and a nitrogen base.

DNA contains deoxyribose sugar. Nitrogen bases are molecules that contain nitrogen and are alkaline in nature. Since DNA has four kinds of nitrogen bases, namely adenine, thymine, guanine and cytosine, DNA has four kinds of nucleotides too. Nitrogen bases, the building components of DNA, are molecules with great specificity. In DNA, the base adenine pairs only with thymine and guanine pairs only with cytosine.

RNA (Ribonucleic acid)

RNA is another nucleic acid like DNA. RNA is also formed of nucleotides. Ribose sugar is present in RNA. In RNA, the nitrogen base uracil is seen instead of thymine. Majority of RNAs have only a single strand.

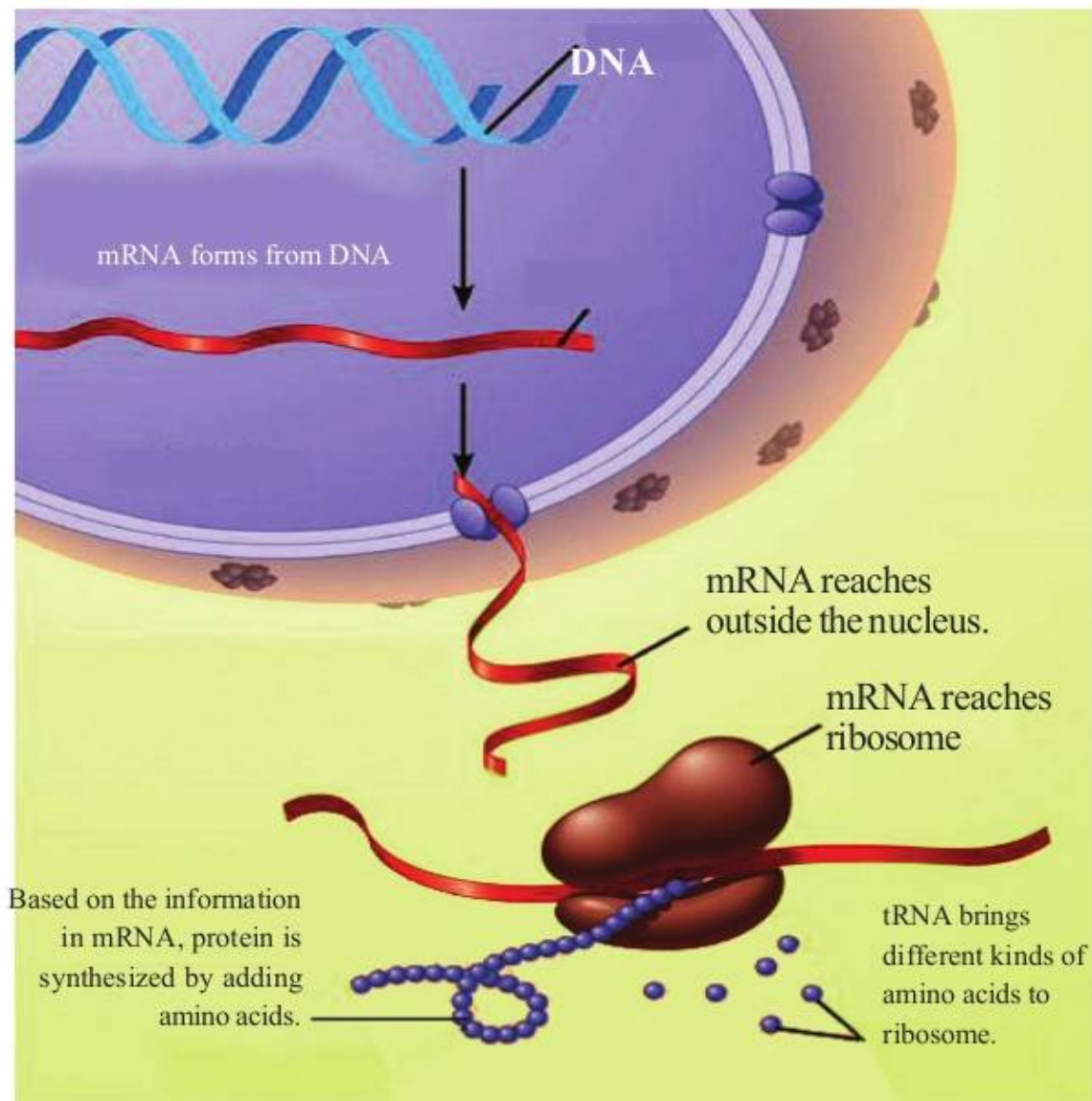
Compare the structure of DNA and RNA and complete table (6.2) suitably.

	Number of strands	Type of sugar	Nitrogen bases
DNA			
RNA			

Table 6.2

	Number of Strands	Type of Sugar	Nitrogen Bases
DNA	2	Deoxyribose	Adenine, Thymine, Guanine, Cytosine
RNA	1	Ribose	Adenine, Uracil, Guanine, Cytosine

Protein synthesis / Gene Action



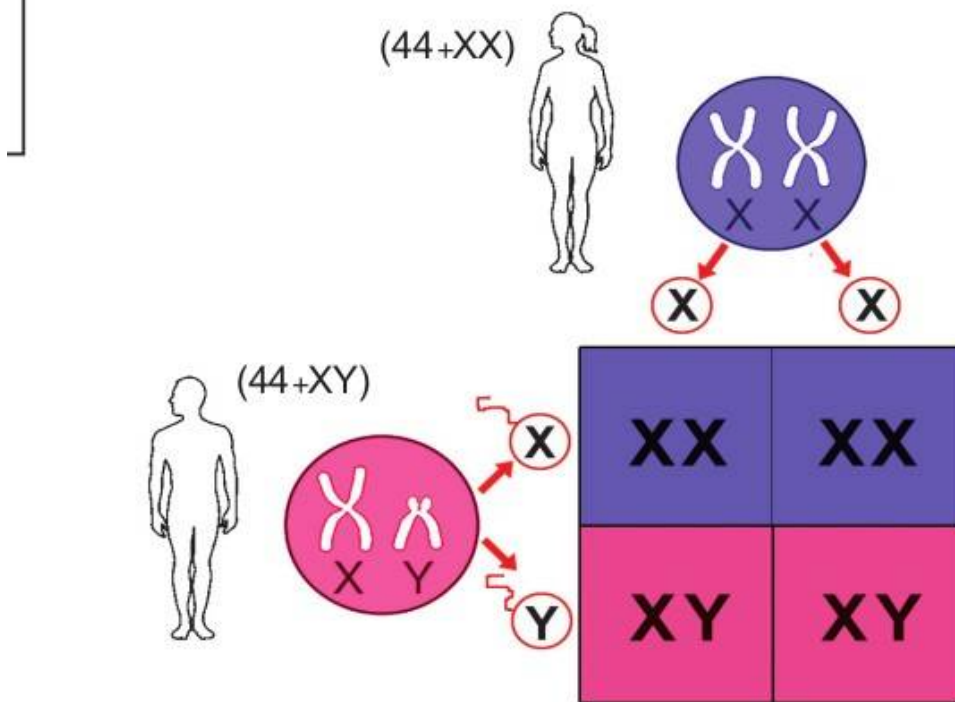
Steps of Protein Synthesis

1. mRNA forms from DNA
2. mRNA reaches outside the nucleus.
3. mRNA reaches ribosome
4. tRNA brings different kinds of amino acids to ribosome.
5. Protein molecule is synthesized

Is the child male or female?

What is the genetic mechanism that determines whether a child is male or female?

Observe illustration 6.10. Discuss with the help of indicators and write down inferences in the Science diary.



The XY chromosomes of the father determine whether the child is male or female. Child with XX sex chromosomes is female and one with XY sex chromosomes is male.

7

Genetics of the Future

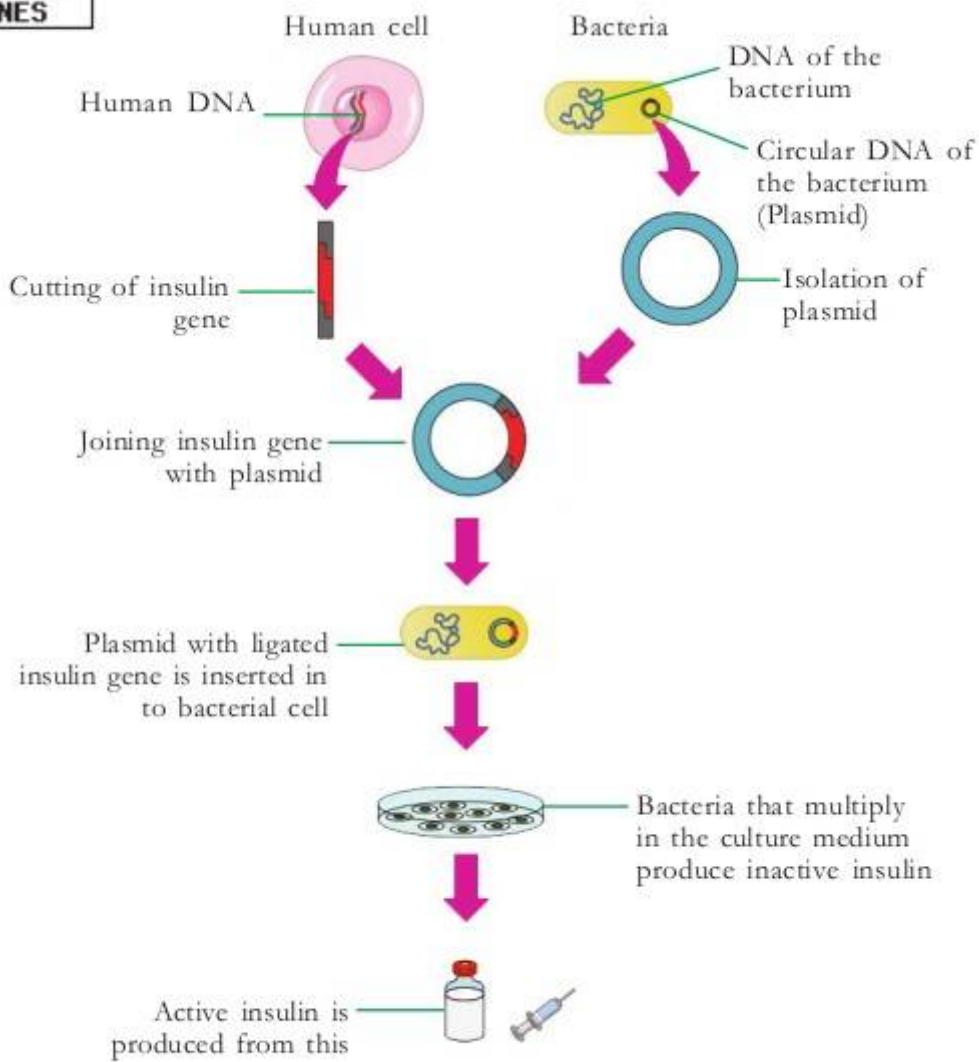


Illustration 7.1 Production of insulin through genetic engineering

Enzymes are used to cut and join genes. The enzyme restriction endonuclease is used to cut genes. This enzyme is known as 'genetic scissors'. The enzyme ligase is used for joining. This enzyme is called 'genetic glue'.



How was the insulin producing gene of humans transferred into bacteria? A gene from one cell is transferred to another cell by using suitable vectors. Vectors which contain ligated genes enter target cells. Plasmids in bacteria are generally used as vectors. In this way, the new genes become a part of the genetic constitution of target cells.

Gene therapy

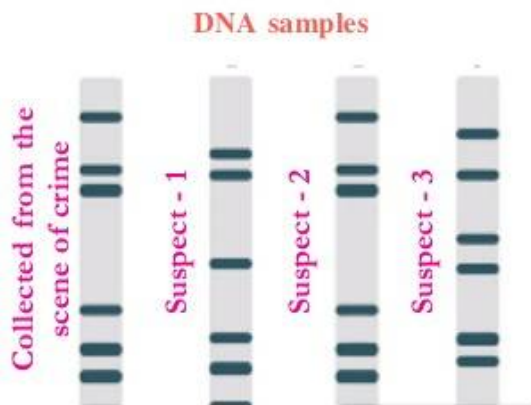
Genetic engineering has made a great leap in the treatment of genetic diseases. Gene therapy is a method of treatment in which the genes that are responsible for diseases are removed and normal functional genes are inserted in their place. This has triggered great hope in the control of genetic diseases.

DNA Finger printing



Alec Jeffreys

The technology of testing the arrangement of nucleotides is DNA profiling. Certain experiments conducted by a scientist named Alec Jeffreys in 1984 paved the way for DNA testing. Just like the difference in the fingerprint of each person, the arrangement of nucleotides in each person also differs. This discovery became the basis of DNA testing. Hence this technology is also called DNA finger printing.



The arrangement of nucleotides among close relatives has many similarities. Hence, DNA finger printing is helpful to find out hereditary characteristics, to identify real parents in cases of parental dispute and to identify persons found after long periods of missing due to natural calamities or wars. DNA of the skin, hair, nail, blood and other body fluids obtained from the place of

murder, robbery etc., is compared with the DNA of suspected persons. Thus, the real culprit can be identified from among the suspected persons through this method.

8

The Paths Traversed by Life



A.I. Oparin



J.B.S. Haldane

The Panspermia argues that life originated in some other planet in the universe and accidentally reached the earth. The organic substances obtained from the meteors that fell on earth support this.

The hypothesis that evolved into the theory of chemical evolution is that life originated as a result of the changes that occurred in the chemical substances in seawater, under specific conditions in primitive earth. This theory is generally accepted by the scientific world due to its experimental evidences. The Russian scientist A.I. Oparin (1924) and the British scientist J.B.S. Haldane (1929) are the proponents of this theory.

Analyse illustration 8.1 and prepare a note on the theory of Chemical evolution in your Science diary.

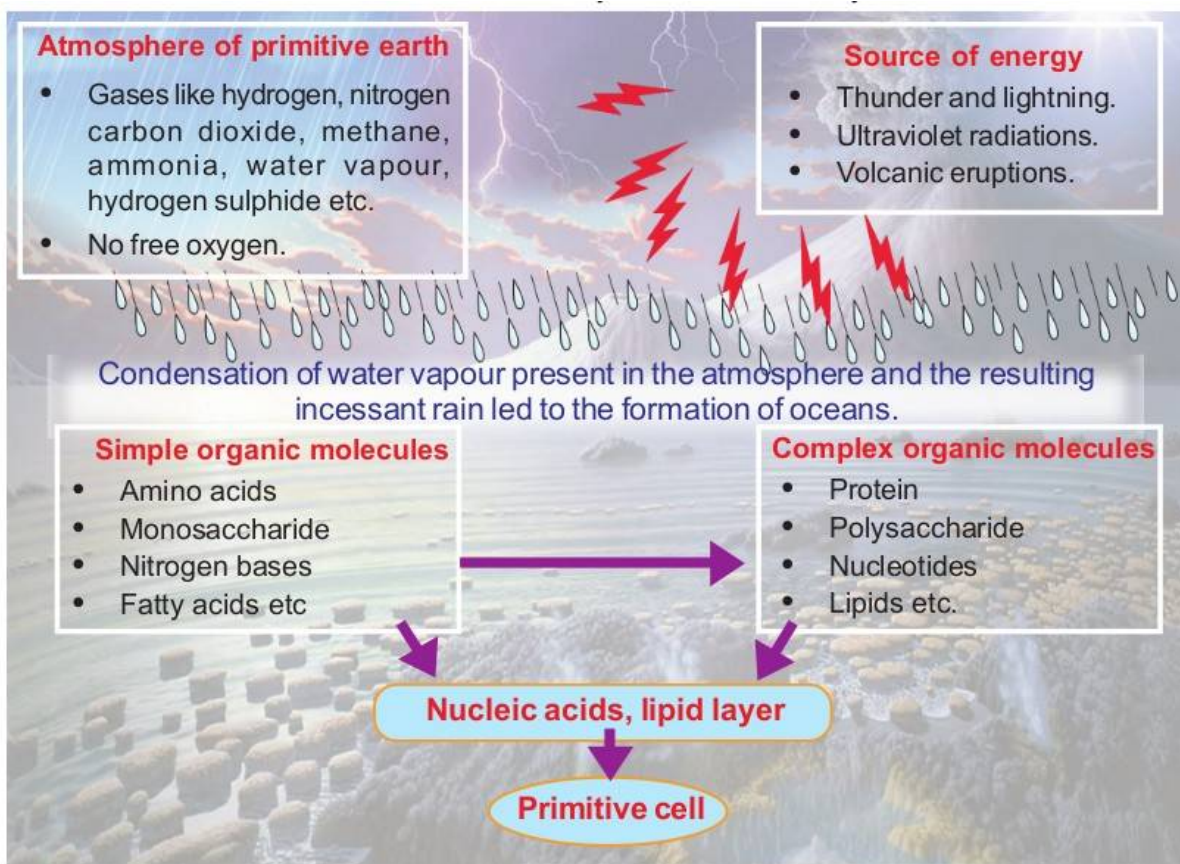
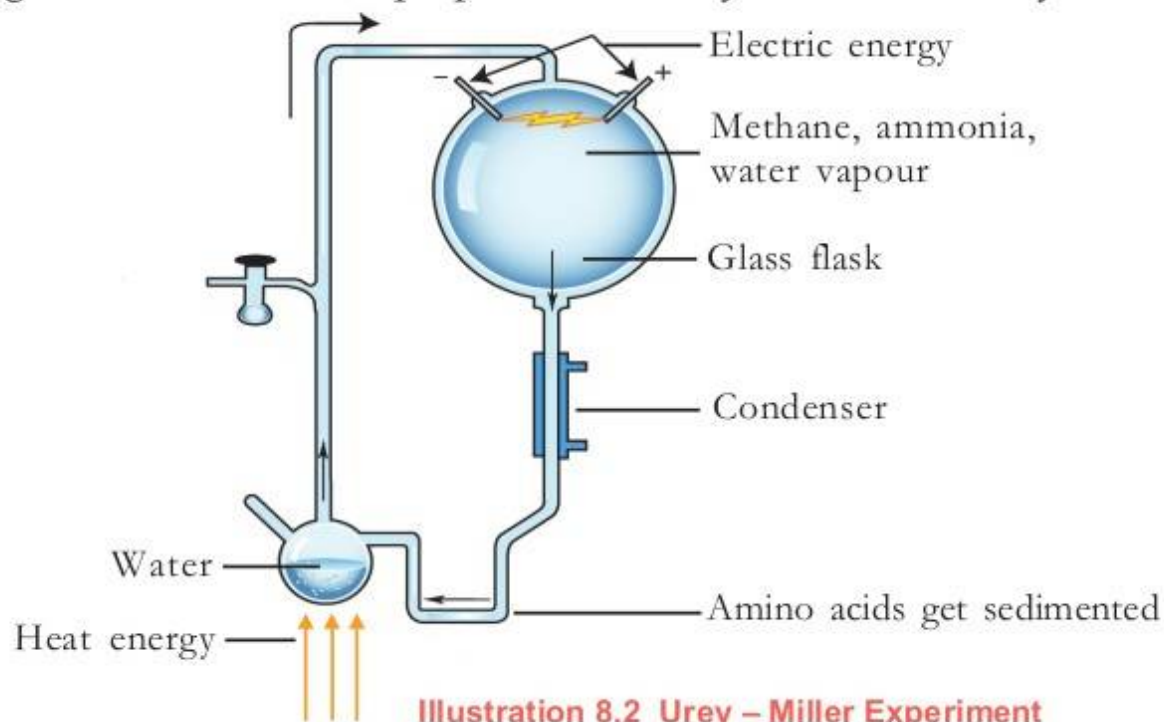


Illustration 81. Chemical evolution

Urey – Miller Experiment

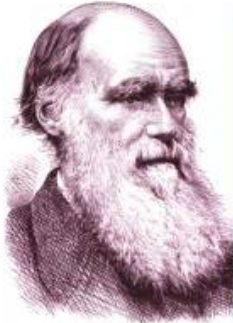
Urey and Miller conducted their experiment by artificially recreating the atmosphere of primitive earth that contained methane, ammonia, hydrogen and water vapour.

Analyse illustration 8.2 and the description, on the basis of the given indicators and prepare a note in your Science diary.



In the place of natural energy sources like thunder and lightning in the atmosphere of primitive earth, high voltage electricity was passed through the gaseous mixture in the glass flask. Then, this gaseous mixture was cooled with the help of a condenser. The sediment substances were separated and when observed, organic molecules such as amino acids, were found. Later many scientists designed similar experiments and more organic compounds were synthesized. This finally gave more acceptance to the Oparin – Haldane Hypothesis.

A logical scientific theory on evolution was first put forward by Charles Robert Darwin, an English naturalist. Darwin adopted a scientific method for formulating inferences through observation and data analysis. This scientific credibility paved way for the larger acceptance of Darwin's theory of evolution.



Charles Darwin

Darwin's Voyage

Darwin's voyage to the Galapagos Islands in the ship HMS Beagle was a turning point both in his life and in the history of the theory of evolution. Charles Darwin formulated his theory of evolution on the basis of the studies conducted on organisms in Galapagos Islands.

Darwin was only 22 years old when he joined a group appointed by the British government to construct maps of coastal areas. By the time he returned to Britain after 7 years, he had collected necessary evidences for his theory of evolution. After further follow up enquiries, observations and studies, he presented his theory in the renowned text *Origin of Species by Means of Natural Selection*, at the age of fifty. This theory that broke off many existing beliefs got great acceptance in the scientific world.

Finches were one among the organisms observed and closely studied by Darwin in the Galapagos Islands. The differences in the beaks of these finches attracted Darwin.

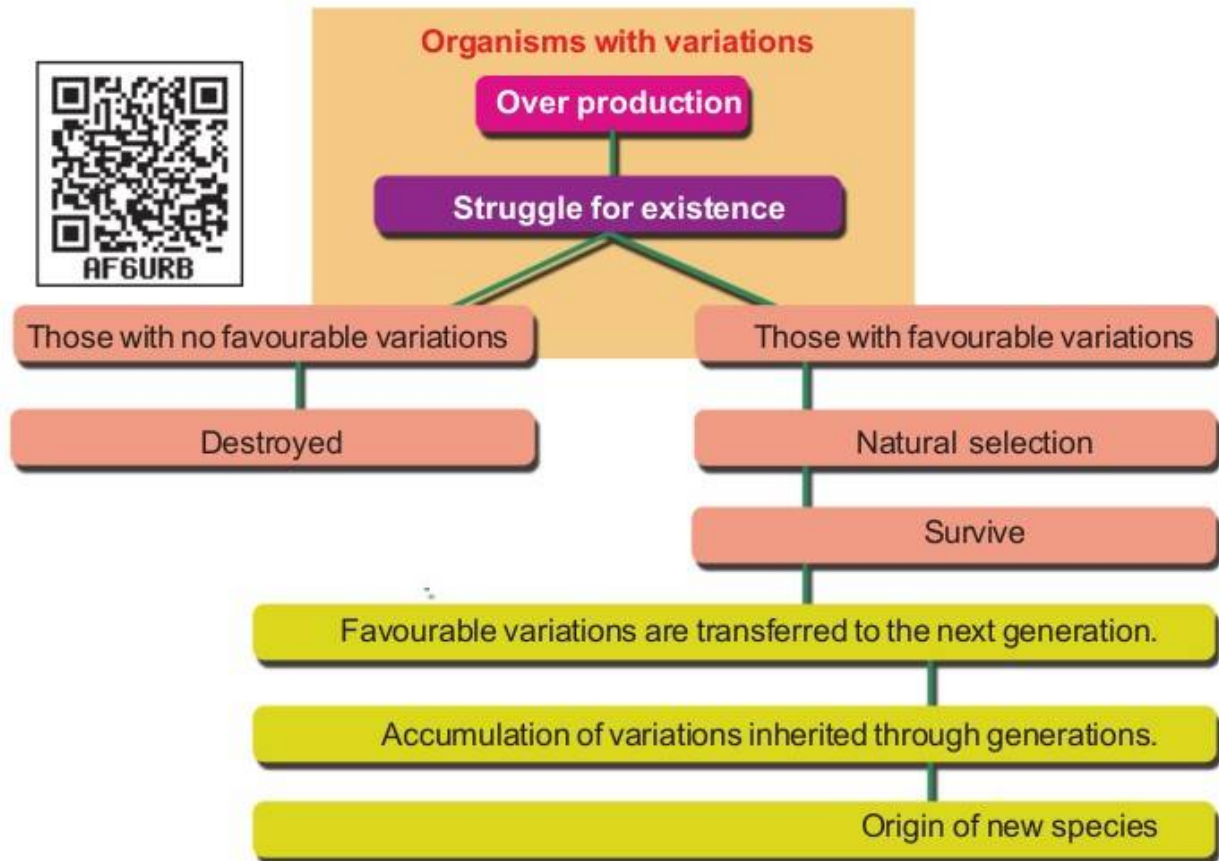


Illustration 8.5 Theory of Natural Selection

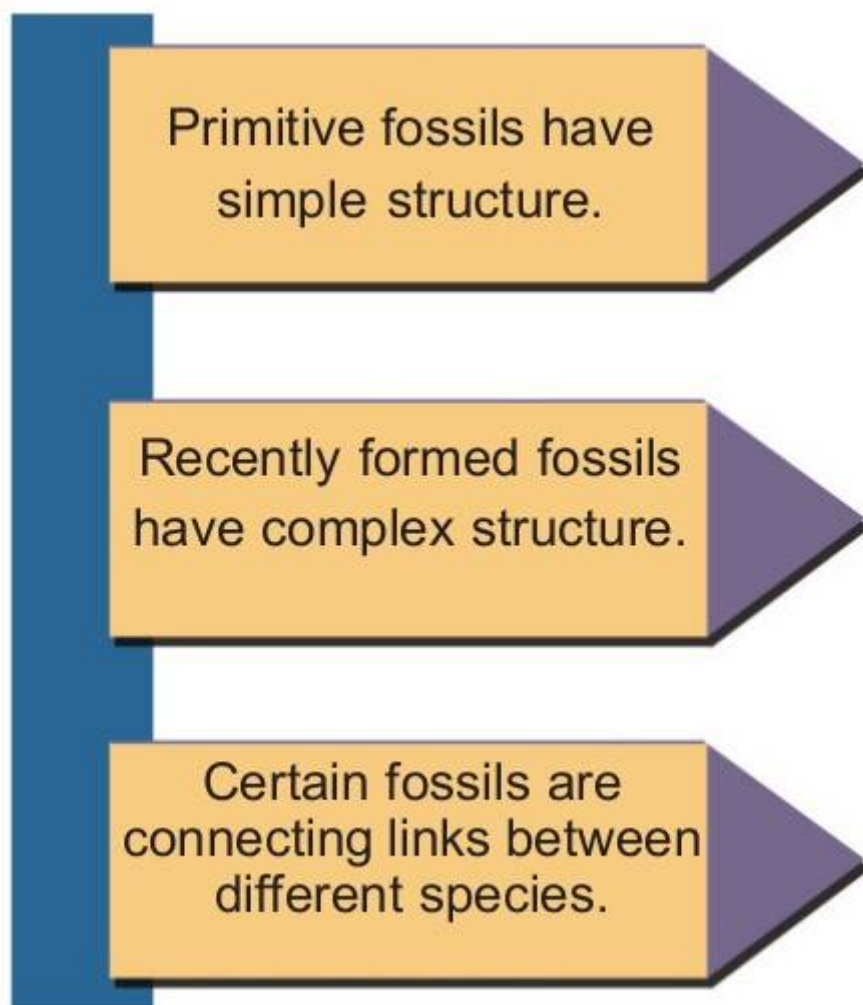
The Theory of Natural Selection

Every species produces more number of offsprings than that can survive on earth. They compete with one another for food, space and mates. The competition becomes hard when the number of organisms is more and the availability of resources is less. Many variations are visible in organisms. These variations may be favourable or unfavourable. Those with favourable variations survive in the struggle for existence. Others are eliminated. Variations that are inherited through generations and repeated differently help to form species that are different from their ancestors. This type of selection, done by nature, leads to the diversity of species that we see around us. This is the explanation of Darwin's theory which is known as the Theory of Natural Selection.

Fossils – Evidence of evolution

Fossils are the remnants of primitive organisms. They are evidences that explain the history of life on earth.

Fossils may be the body, body parts or imprints of organisms. The age of fossils can be calculated scientifically. They are categorised on the basis of geological time scale and their peculiarities are studied. The oldest known fossils dating from about 3.5 billion years ago are of prokaryotes. Fossils from different layers of rocks indicate the evolution of eukaryotes from prokaryotes. Cell Biology and Molecular Biology make fossil evidences more scientific. What are the inferences you can arrive at from such studies?



Comparative Morphological Studies

Observe illustration 8.7 and compare the structure of forelimbs in lizard, bat, whale etc.



Illustration 8.7 Comparative morphological studies

The forelimbs of these organisms differ in their external appearance. Are they different in their anatomy too?

These forelimbs are made up of blood vessels, nerves, muscles and bones. Differences in their external appearances are their adaptations to live in their own habitats. Organs that are similar in structure and perform different functions are called homologous organs.

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