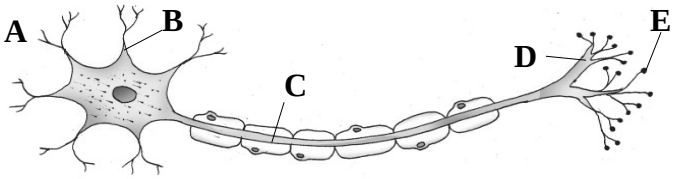
# UNIT 1- SENSATIONS AND RESPONSES

**Neuron**

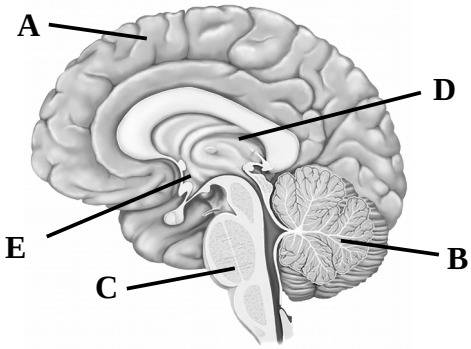



| Parts of neuron | Functions |
|---|---|
| A) Dendrite | Receives impulses from adjacent neuron. |
| B) Dendron | Carries impulses from dendrites to the cell body. |
| C) Axon | Carries impulses from the cell body to outside. |
| D) Axonite | Carries impulses to the synaptic knob. |
| E) Synaptic knob | Secretes neurotransmitter. |

**Different types of nerves**

| | |
|---|---|
| Sensory nerve | carries impulses from various parts of the body to brain and spinal cord. Parts ----> Brain |
| Motor nerve | carries impulses from brain and spinal cord to various parts of the body. Brain ----> Parts |
| Mixed nerve | carries impulses to and from the brain and spinal cord. Brain <-----> Parts |

**Brain**

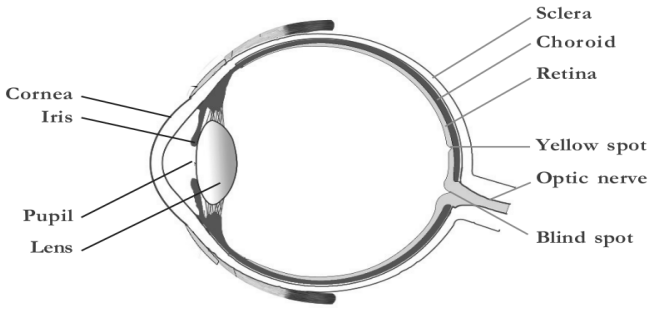



| | |
|---|---|
| A) Cerebrum | • centre of thought, intelligence, memory and imagination • evokes sensations, • controls voluntary movements. |
| B) Cerebellum | • coordinates muscular activities •maintains equilibrium of the body. |
| C) Medulla oblongata | • controls involuntary actions like heart beat, breathing etc. |
| d) Thalamus | • Acts as relay station of impulses to and from the cerebrum. |
| E) Hypothalamus | • Maintenance of homeostasis. |

**Diseases**

| 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, 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. |

# UNIT 2 - WINDOWS OF KNOWLEDGE

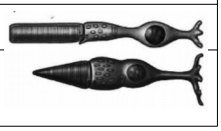



| Parts | Features | Functions |
|---|---|---|
| Cornea | The projected transparent anterior part of the sclera | Refracts light rays to focus on the retina. |
| Iris | The part of the choroid seen behind the cornea. | Presence of the pigment melanin gives the iris a dark colour. |
| Pupil | The aperture seen at the centre of the iris. | Regulate the amount of light falling on the eyes. |
| Lens | Elastic transparent convex lens, connected to ciliary muscles. | Focus light rays on the retina. |
| Retina | The inner layer which has photoreceptors. | Image is formed. |
| Yellow spot | The part of the retina where plenty of photo receptors are present. | Maximum visual clarity. |
| Optic Nerve | Begins from blind spot. Sensory nerve. | Transmits impulses from photoreceptors to the visual centre in the brain. |
| Blind spot | Here there is no vision as photoreceptors are absent. | The part of the retina from where the optic nerve begins. |

**Flowchart related to the sense of sight**

Light .... Cornea .... Aqueous humor.... Pupil .... Lens .... Vitreous humor ..... Retina ..... Impulse ..... Cerebrum.... Sense of sight.

**Photoreceptors**

| Cells | Pigment | Function | Shape |
|---|---|---|---|
| Rod cell | Rhodopsin | Dim light vision |  |
| Cone cell | Photopsin | Bright light vision, Colour vision | |

**Sense of taste – Chemoreceptors**

Substances responsible for taste dissolve in saliva ---- Enter in the taste bud -- stimulate the chemoreceptors --generate impulses ---- nerve --- impulses reach the brain ---experience taste.

**Significance saliva**

when the substances responsible for taste dissolve in saliva, it can enter the taste buds and stimulate the chemoreceptors to generate impulse.

**Sense of smell – Olfactory receptors**

Aromatic particles diffuse in the air and enter the nostrils ----- These aromatic particles dissolve in the mucus inside the nostrils ---- stimulate the olfactory receptors ---- generate impulses ---- olfactory nerve carries impulses ---- impulses reach the brain --- experience smell.

**Significance mucus**

Only when the aromatic particles responsible for smell dissolve in the mucus, it can stimulate the olfactory receptors to generate impulse.

**Eye disorders**

| Diseases | Reasons | Symptoms |
|---|---|---|
| Night blindness | The deficiency of Vitamin A results in the low production of retinal. This in turn prevents the resynthesis of rhodopsin. | Objects cannot be seen clearly in dim light. |
| Xerophthalmia | Prolonged deficiency of Vitamin A. | Conjunctiva and cornea become dry and opaque. |
| Colour blindness | The defect of cone cells. | Cannot distinguish green & red colours. |

# UNIT 3

## CHEMICAL MESSAGES FOR HOMEOSTASIS

**Pancreas**- Play an important role in blood glucose maintenance. Normal level of glucose in blood is **70-110mg/100ml**.

●Insulin (Beta cell) -- Cellular uptake of glucose molecules. Converts glucose into glycogen in the liver and muscles

●Glucagon (Alpha cell) --Synthesizes glucose from amino acids. Converts the glycogen stored in the liver to glucose.

**When blood glucose level increases:** Production of insulin increases. It lowers blood glucose by the following ways.
Cellular uptake of glucose molecules.
Converts glucose into glycogen in the liver and muscles

**When blood glucose level decreases:** Production of Glucagon increases. It rises blood glucose by the following ways.
Synthesizes glucose from amino acids.
Converts the glycogen stored in the liver to glucose.

**Diabetes**

| Clinical explanation | Cause | Symptoms |
|---|---|---|
| Diabetes is a condition when the level of glucose before breakfast is above **126mg/100ml** of blood | Decreased production of insulin due to the destruction of beta cells. or The inability of cells to utilize the insulin produced. | Increased appetite and thirst and frequent urination. |

**Blood calcium regulation**

Normal calcium level: 9-11mg/100ml

**When the calcium level increases**

Thyroid gland secretes calcitonin which regulate blood calcium by-

• Prevents the process of mixing of calcium from bones to blood.
• Stores the excess calcium from blood to bones.

**When the calcium level decreases**

Parathyroid gland secretes parathormon which regulate blood calcium by-

• Reabsorbs calcium from kidneys to blood.
• Prevents the storage of calcium in bones.

**Growth disorders due to variations in somatotropin**

| | | |
|---|---|---|
| Gigantism | Production of Somatotropin increases during the growth phase | Excessive growth of the body. |
| Dwarfism | Production of Somatotropin decreases during the growth phase. | Stunted growth. |
| Acromegaly | The excessive production of somatotropin after the growth phase. | Growth of the bones on the face, jaws and fingers. |

| Pheromones | Uses | Example |
|---|---|---|
| Chemical substances that are secreted by certain animals to the surroundings to facilitate communication. | Attracting mates, informing the availability of food, determining the path of travel, signalling dangers. | The muscone in the musk deer, Civeton in the civet cat, Bombykol in the female silk worm moth |

**Plant hormones**

| | |
|---|---|
| Gibberellin | Stimulates break down of stored food to facilitate germination, Sprouting of leaves |
| Auxin | Cell growth, cell elongation, promoting the growth of terminal buds, fruit formation. |
| Ethylene | Ripening of leaves and fruits, excess amount of ethylene causes **dropping of leaves and fruits.** |
| Abscisic acid | Dormancy of embryo, **dropping of ripened leaves and fruits.** |

# UNIT 4 - KEEPING DISEASES AWAY

**Tuberculosis (Bacterial disease)**
**Pathogen :**Mycobacterium tuberculosis.
**Symptoms :** Loss of body weight, fatigue, persistent cough.
**Transmission:** When the patient speaks, coughs or sneezes, the pathogens spread into the air and thereby to others.
**Body parts Affected:** Lungs.,kidneys, bones,joints, brain etc.
**Treatment:** Antibiotics
**Vaccine :** BCG

**AIDS (Viral disease)**
**Pathogen :** HIV
**Multiplication :** multiplies using the genetic mechanism of lymphocytes
**Mainly Affected:** Lymphocytes, there by reduce immunity.
**Transmission:** Through sexual contact with HIV infected person, From HIV infected mother to the foetus, By sharing needle and syringe contaminated with HIV, Through the reception of blood and organs contaminated with HIV.
**AIDS does not spread:**
• by touch, shaking hands, coughing, sneezing etc.
• through insects like mosquitoes, houseflies etc.
• by staying together and sharing food.

**Malaria (Protozoa disease)**
**Pathogen :**Plasmodium
**Transmission: Through f**emale Anopheles mosquito.
**Symptoms** : High fever with shivering and profuse sweating.

**Haemophilia (Genetic disease)**
**Cause :** Genes that control the synthesis blood clotting protein become defective.
**Symptoms:** Excess blood is lost even through minor wound.
**Temporary relief :** By identifying and injecting the deficient protein. **Cure:** Gene therapy.

**Cancer**
Uncontrolled division of cells and their spread to other tissues.
**Factors causing cancer :** Environmental factors, smoking, radiations, virus, hereditary factors.
**Complication :** The spread of cancer cells to other parts of the body through blood and lymph.
**Significance of early diagnosis :** Recovery from the disease is difficult if the disease becomes severe.
**Treatment :** Surgery, chemotherapy, radiation therapy etc.

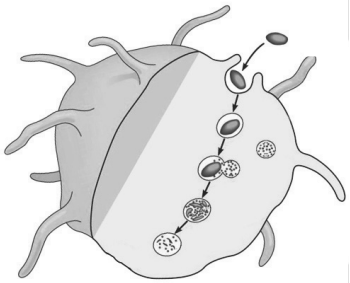
## UNIT 5 - SOLDIERS OF DEFENSE

**Defense mechanisms in skin**
**keratin** :The outer epidermis of the skin have a protein called keratin, prevents germs from entering it.
**Sebum:** It is produced by the **sebaceous glands** makes skin oily and water proof.
**Sweat :** It is produced by the **sweat glands** .The disinfectants in it destroy germs.

**Body secretions and defense**

| | |
|---|---|
| Lysozyme | Tears in eye, Saliva in mouth,Urine in urinary tract |
| Mucus | Trachea, Intestine |
| HCl | Stomach |
| Ear wax | Ear |

**Identify the process--- Phagocytosis (Neutrophils,Monocytes)**



Phagocyte reach near pathogen.
↓
Engulfs pathogen in the membrane sac.
↓
Lysosome combines with membrane sac.
↓
The pathogens are degenerated and destroyed by the enzymes in lysosome.

**Significance of lysosome -** The pathogens are degenerated and destroyed by the enzymes in lysosome.

**Stages involved in fever – Normal temp - 37 $^0$ C / 98.6 $^0$ F.**
Pathogens enter the body.
↓
The presence of toxins produced by the pathogens stimulates the white blood cells.
↓
The chemical substances produced by the white blood cells raises the body temperature.
↓
The rise in body temperature reduces the rate of multiplication of pathogens. Increases the effect of phagocytosis.

**Fever is a defence mechanism ? Why?**
Fever prevents the rapid multiplication of bacteria and also increases the effect of phagocytosis.

**Vaccines**
Vaccines are the substances used for artificial immunization.
**Components of vaccines** -Any one of the components from Alive or dead or neutralised germs,neutralised toxins or cellular parts of the pathogens.
**Actions of Vaccines**- Components of vaccines act as antigens . They 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.

**Common vaccines**

| Vaccine | Against which Disease |
|---|---|
| BCG | Tuberculosis |
| OPV | Polio |
| TT | Tetanus |
| MMR | Mumps, Measles, Rubella |
| Pentavalent | Diphtheria, Pertussis, Tetanus, Hepatitis-b, Hib |

**Antibiotics - Alexander Fleming**
Medicines that are extracted from microorganisms like bacteria, fungi, etc. and **used to destroy bacteria** are called antibiotics.

Is it advisable to use antibiotics without the recommendation by a doctor?
No, Their regular use creates many side effects
Side effects:
• regular use develops immunity in pathogens against antibiotics.
• destroys useful bacteria in the body.
• reduces the quantity of some vitamins in the body.

**Things should be taken care of while transfusing blood.**
People in the age 18-60 can donate blood.
Blood donation can be done once in three months.
Pregnant and breast feeding women as well as person with communicable disease should not donate blood.
Everyone cannot receive blood from all blood groups.
Prior to blood transfusion, blood group testing is mandatory.

| Blood Group | Antigen present | Antibody | Whom can receive |
|---|---|---|---|
| A | A | b | A, AB |
| B | B | a | B, AB |
| AB | A and B | Nil | AB |
| O | Nil | a and b | A, B, AB, O |

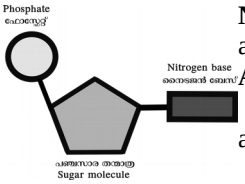
**Positive group -** Those blood with Rh factor (antigen D).
**Negative group -**Those blood with out Rh factor (antigen D).

**Everyone cannot receive blood from all blood groups.Why**?
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.

## UNIT6 UNRAVELLING GENETIC MYSTERIES

**Compare DNA and RNA**

| Type of nucleic acids | Number of strands | Type of sugar | Nitrogen bases |
|---|---|---|---|
| DNA | Two (Double helical) | Deoxyribose | Adenine, **Thymine**, Cytosine, Guanine |
| RNA | One | Ribose | Adenine, **Uracil**, Cytosine, Guanine |




**Nucleotide- T**he basic units of nucleic acids (DNA,RNA)
**A nucleotide is made up of:** a sugar molecule, a phosphate group and a nitrogen base.

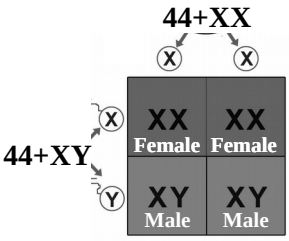
**Pairing of nitrogen bases in DNA** – Adenine : Thymine
Cytosine : Guanine

Nitrogen base seen only in DNA : Thymine
Nitrogen base seen only in RNA : Uracil

**The stages of protein synthesis (The action of genes)**
mRNA forms from DNA ----> mRNA reaches outside the nucleus ----> mRNA reaches ribosome ----> tRNA brings different kinds of amino acids to ribosome ----> Based on the information in mRNA, Protein is synthesized by adding amino acids.
Cell organelle where protein synthesis takes place - **Ribosome**
**Different types of RNAs involved in protein synthesis.**
**mRNA** (messenger RNA) - Carries information from DNA reaches ribosome and controls protein synthesis.
**tRNA** (transfer RNA) - Carry amino acids to the ribosomes.
**rRNA** (ribosomal RNA) - Seen associated with ribosomes.

**Genetic makeup (Total chromosomes 46)**
Female - 44 + XX, Male is 44 + XY
44 Somatic chromosomes and 2 sex chromosomes (X,Y)

**Sex determination**




Child with XX sex chromosomes is **female** and one with XY sex chromosomes is **male**.
**The possibility for the birth of a male or a female child is equal.**
Because the chance of fusion of sperm with X chromosome or sperm with Y chromosome to ovum are equal.

**The XY chromosomes of the father determine whether the child is male or female.**
If the sperm with X chromosome fuses with ovum, the child is female and if the sperm with Y chromosome fuses with ovum the child is male.

## UNIT 7 GENETICS OF THE FUTURE

**Production of insulin through genetic engineering**

- Cut insulin gene from human DNA.
- Plasmid (circular DNA) is isolated from a bacterium.
- Joining insulin gene with isolated plasmid.
- Plasmid with ligated insulin gene is inserted in to bacterial cell.
- This bacterium is allowed to multiply in a culture medium.
- Bacteria produce inactive insulin.
- Active insulin is produced from this.

**Enzymes used in this process**
Cut insulin gene from human DNA – Restriction endonuclease
Joining insulin gene with isolated plasmid – Ligase
**Vector in this process** – Plasmid

**Restriction endonuclease - Genetic scissors.**
**Ligase - Genetic glue.**

**DNA profiling** / DNA fingerprinting
The technology of testing the arrangement of nucleotides.
**Basis of DNA testing / DNA fingerprinting**
The arrangement of nucleotides in each person also differs, just like the difference in the fingerprint of each person.
**Scope of DNA fingerprinting**

- To identify real parents in cases of parental dispute.
- To identify persons found after long periods of missing due to natural calamities or wars.
- To find out hereditary characteristics.
- The real culprit can be identified from among the suspected persons.

**The real culprit can be identified from among the suspected persons. How?**
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. Analyse the arrangement of nucleotide sequence.
**Gene mapping** – The technology used to identify the **location of a gene in the DNA** responsible for a particular trait.
**Gene therapy** - Gene responsible for diseases are removed and normal functional genes are inserted in their place.

## UNIT 8 - THE PATHS TRAVERSED BY LIFE

**Theory of chemical evolution (A.I.Oparin, J.B.S.Haldane)**
**Formation atmosphere of primitive earth**
(Hydrogen, nitrogen, carbon dioxide, methane, ammonia, water vapour, hydrogen sulphide etc.) No free oxygen
↓
**Formation of primitive ocean**
↓
**Formation Simple organic molecules**
(eg:- monosaccharides, amino acids, fatty acids, nitrogen bases)
↓
**Formation of complex organic molecules**
(eg:- polysaccharides, proteins, nucleotides, lipids)
↓
**Nucleic acids, lipid layer**
↓
**Primitive cell**

**Sources of energy for chemical evolution**
Thunder and lightning, Ultra violet radiations,volcanic eruptions

**Theory of natural selection (Charles Darwin)**

Over production
↓
Struggle for existence
↓
Organisms with favourable variations undergo Natural selection. → Survive
Organisms with no favourable variations Destroyed.
↓
Favourable variations are transferred to the next generation.
↓
Accumulation of variations inherited through generations.
↓
Origin of new species

**Circumstance that leads to severe competition among organisms.**
when the number of organisms is more and the availability of resources is less.

**Significance of variations in natural selection**
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.

Theory of Natural selection – Charles Darwin
Mutation Theory - Hugo deVries,
Inheritance of acquired characters - Lamark

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