10 EVOLUTION

Students Learning Outcomes

After studying this chapter, students will be able to:

- Explain the theory of evolution by natural selection with examples.
- Define species.
- Discuss briefly the observations Darwin made during his voyage on HMS Beagle.
- Describe sources of variation which can lead to speciation and evolution.
- Describe evidence of evolution with regards to the following:
  - Paleontology (fossil record)
  - Comparative anatomy (homologous structures, vestigial structures)
  - Selective breeding

Evolution is the change in heritable traits of population over the course of successive generations. It involves gradual changes in characteristics passed from one generation to the next. Such changes allow organisms to adapt to their

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environment. Over time, these changes accumulate, resulting in formation of new species. In 1850s, Charles Darwin explained the mechanism of evolution in a comprehensive way.

10.1 DARWIN'S OBSERVATIONS

English naturalist Charles Darwin (1809–1882) went on five-year trip around the world on a His Majesty's Ship (HMS) Beagle. During this voyage, Darwin made a lot of important observations that laid the foundations of his ***Theory of Evolution by Natural Selection***.

FIGURE 10.1: Charles Darwin and his voyage on HMS Beagle

The following are some important observations made by Darwin:

- **Unique species:** He observed a variety of unique plant and animal species in different regions. He observed that different islands and environments had their own distinct sets of species.
- **Variations in same species:** Darwin observed variations among same species living in different environments. He noticed that these were adaptations i.e., special variations in an organism's body or behaviour that help it survive in its environment. He was convinced on the role of adaptations in the

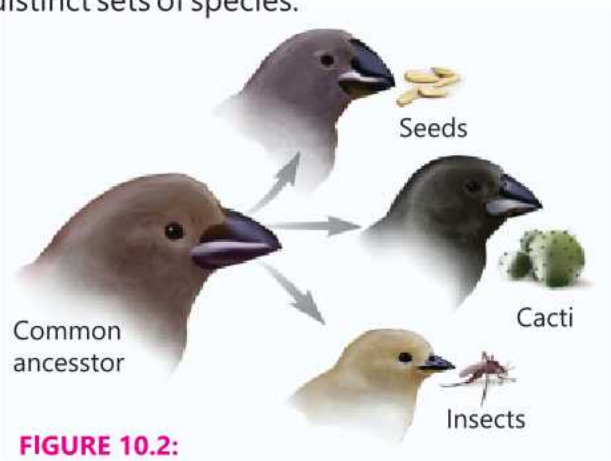

FIGURE 10.2: Finches with different beak sizes and shapes

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survival of species.

- **Beaks of finches:** On the Galapagos Islands, he noticed that different species of finches had different sizes and shapes of beaks in different islands. He noticed that different foods e.g., seeds, cacti and insects were available at different islands. The beaks of finches were suited according to the food sources available on specific island.
- **Fossils of extinct animals:** When he observed the fossils of extinct animals, he found their resemblance with modern species. This suggested that species could change over time.

Some whales have tiny leg bones buried deep inside their bodies! These bones no longer serve a purpose in swimming. These are powerful clues to the whale's evolutionary past. They're like fossils inside the body.

After returning from his voyage, Darwin analysed his observations and gathered more evidence to support his ideas. Eventually, in 1859, Darwin published his work in the form of a book, **"On the Origin of Species"**. In this book, he presented his *"theory of evolution by natural selection"*.

10.2 THEORY OF EVOLUTION BY NATURAL SELECTION

The theory of evolution by natural selection states that "living things change over time. Those with helpful characteristics (variations) survive, reproduce, and pass those characteristics to their young. Over many generations, these favourable characteristics become more common in the population. It leads to the evolution of new species.

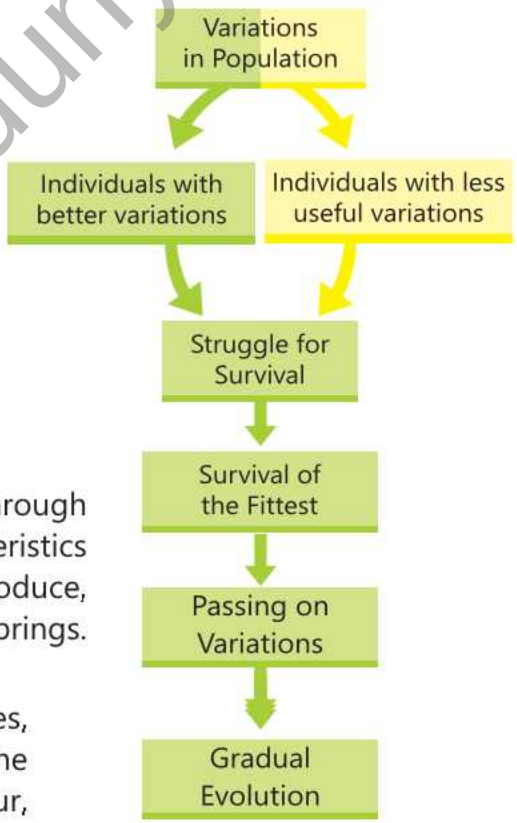

FIGURE 10.3: Mechanism of evolution

Natural Selection

Natural selection is the process through which the individuals with better characteristics (variations) are more likely to live, reproduce, and pass those variations to their offsprings. Natural selection works in three steps.

1. **Variations:** In every species, individuals are slightly different from one another. These differences may be in colour, size, speed, strength, or ability to find food.

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For example: some beetles are green, and some are brown.

2. **Struggle for Survival:** Living things compete for limited resources such as food, water and space. Also, they face threats from predators, diseases, and harsh environments. For example: Birds eat beetles, so beetles must survive by hiding or blending in.

3. **Survival of the Fittest:** The individuals with better variations are more likely to live and reproduce. "Fittest" means best suited, not necessarily the strongest. For example: Brown beetles blend in with the soil better than green beetles. So, they will be difficult to be preyed upon by birds.

4. **Reproduction and Passing on Variations:** The surviving individuals reproduce and pass their useful variations to their offspring. Over time, these helpful variations become more common in the population. For example: More brown beetles are born because the green ones were eaten more often.

5. **Gradual Evolution Over Time:** After many generations, small changes build up. The species slowly changes. If the environment continues to favour certain variations, new species may eventually form. For example: If only brown beetles survive and reproduce over many generations, the whole beetle population may become brown.

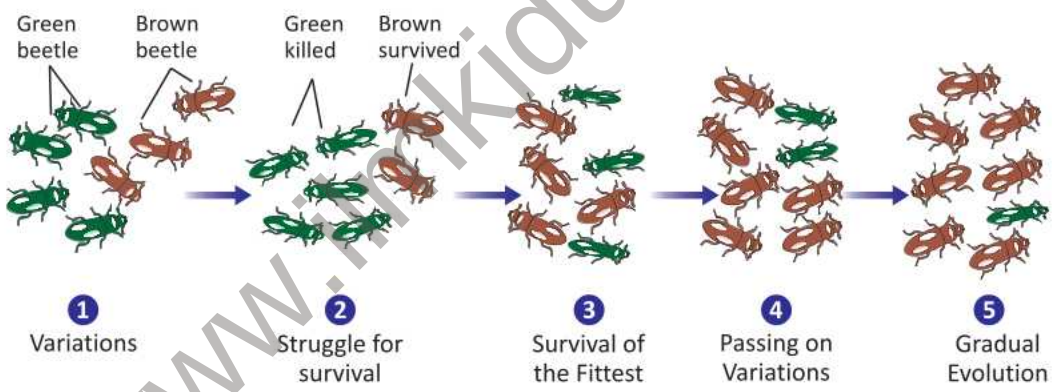

FIGURE 10.4: Process of natural selection

Examples of Natural Selection

1: Giraffe's Long Neck

i. **Variations:** Some giraffes had slightly longer necks than others.

ii. **Struggle for Survival:** Food (leaves on tall trees) was hard to reach, especially during dry seasons.

> Why do giraffes have such long necks?
>
> It's not just about reaching high leaves. Some scientists suggest long necks also helped male giraffes fight each other.

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iii. **Survival of the Fittest:** Giraffes with longer necks could eat leaves from taller trees and survived better during harsh conditions.

iv. **Reproduction and Passing on Traits:** These long-necked giraffes reproduced and passed the long-neck trait to their babies.

v. **Gradual Evolution Over Time:** Over many generations, most giraffes in the population had long necks.

2: Peppered Moth (During Industrial Revolution in England)

i. **Variations:** Some moths were light-coloured, and some were dark-coloured.

ii. **Struggle for Survival:** Birds hunted the moths during the day as they rested on tree bark.

iii. **Survival of the Fittest:** After pollution darkened the tree bark, dark-coloured moths blended in and survived better than light ones.

iv. **Reproduction and Passing on Variations:** Dark moths reproduced more and passed on the dark colour trait.

v. **Gradual Evolution Over Time:** Over time, the population had more dark-coloured moths than light ones.

10.3 SPECIES AND SPECIATION

Species

A species is a group of organisms that can interbreed and produce fertile offspring under natural conditions. Members of the same species are similar and are reproductively isolated from other species. For example, Lions (*Panthera leo*) and Tigers (*Panthera tigris*) are distinct species. They do not naturally interbreed with each other.

Speciation

Speciation is the process by which new species arise by evolution. There are two main types of speciation:

1. Allopatric Speciation: This speciation occurs when a population is geographically separated into two or more populations. The physical barrier (such as a mountain range, river, or ocean) prevents individuals from different groups from breeding. Over time, the isolated populations evolve differently and become distinct species. For example, in the case of the finches of Galapagos Islands, different islands provided unique environment. Over time, populations of finches adapted to each environment, eventually becoming separate species.

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2. Sympatric Speciation:

This speciation occurs when reproductive isolation happens within the same geographical area due to habitat preference or behaviour. For example, groups of fishes of same species live in the same lake. Buth the groups are reproductively isolated due to dietary preferences or mate selection. Over time, the groups remain reproductively isolated, resulting in the emergence of new species.

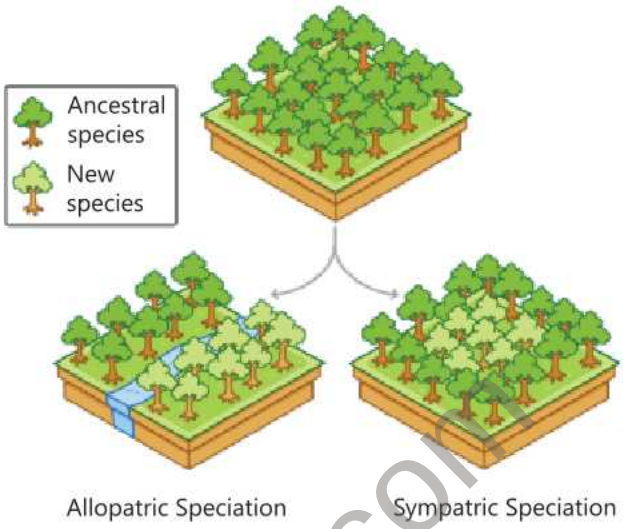

Figure 10.5: Main types of speciation

10.4 SOURCES OF VARIATION

Variations are the inheritable differences among individuals in a population on which natural selection can act. The following are the main sources of variations.

1- Mutations

Mutation is a permanent change in the DNA of an organism that can pass on to the offspring. Mutations can occur spontaneously or by environmental factors such as radiations or chemicals. Mutations result in new characteristics (variations) in organism. Most mutations are neutral or harmful. Some mutations can be beneficial and provide better variations to the organism.

You probably look similar to your parents and siblings. However, you don't look exactly the same, and this is due to **variations.**

Example: In a population of bacteria, a mutation may produce antibiotic resistance in some individuals. These resistant bacteria have more chances to survive and reproduce in the presence of antibiotics. They can pass on this variation to future generations.

2- Genetic Recombination

In sexually reproducing organisms, genetic recombination occurs during the formation of gametes through meiosis. The mixing of genetic material from two parents produces offspring with new combinations of genes.

Bananas have numerous mutations!

Many bananas are triploid, meaning they have three sets of chromosomes. It makes them sterile. They can't reproduce normally. So, every banana is a clone i.e., grown from a cutting of another plant.

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This results in variation by creating new combinations of characteristics.

Example: Human siblings have different combinations of characteristics (e.g., hair colour, eye colour) because of the genetic recombination that occurs during the formation of gametes in parents.

3- Gene Flow (Migration)

Gene flow occurs when individuals from one population migrate to another and introduce new genes in that population. This can introduce new variations within a population. If these new variations prove better in the new population, they can spread through the population.

Example: When plants from one area cross-pollinate with plants from a different region, they introduce new characteristics into the population, such as improved drought resistance varieties.

4- Random Pairing of Gametes

During sexual reproduction, the pairing (fusion) of egg and sperm is random. It means that any sperm can fertilize any egg. It increases variation by producing offspring with unique combinations of genes inherited from both parents.

Example: In humans, the random pairing of an egg and one sperm from millions of possibilities leads to children in the same family having different characteristics, even though they share the same parents.

10.5 EVIDENCES OF EVOLUTION

There exists many evidences that species have changed and continue to change over time. The following are important evidences of evolution:

Recalling

Fossils are the remains, impressions or traces of organisms that lived in the past. Most fossils are found in sedimentary rocks.

1. Palaeontology (Fossil Record)

Fossils provide a visual record of evolution. Palaeontologists study fossils to observe sequence of evolutionary changes among organisms. For example, the fossils of vertebrate classes showed that fishes are the earliest vertebrates, following amphibians, reptiles, and then birds and mammals.

Fossils of organisms show characteristics of ancestors and their new generations. These fossils bridge the gaps in the evolutionary history of various species and provide evidence of gradual

FIGURE 10.6: Archaeopteryx

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change over time. For example, fossils of *Archaeopteryx* (a bird-like dinosaur) provides evidence that birds evolved from a tetrapod dinosaur (a reptile).

2. Comparative Anatomy

Comparative anatomy involves the similarities and differences in the structures of different organisms.

Homologous Structures

The similar structures in different species that perform different functions are called homologous structures. For example, the forelimbs of mammals (arms of human, legs of cat, flippers of whale, and wings of bat) all have the same structure but different functions. The basic similarity of structure of these forelimbs is the evidence that they evolve from a common ancestor.

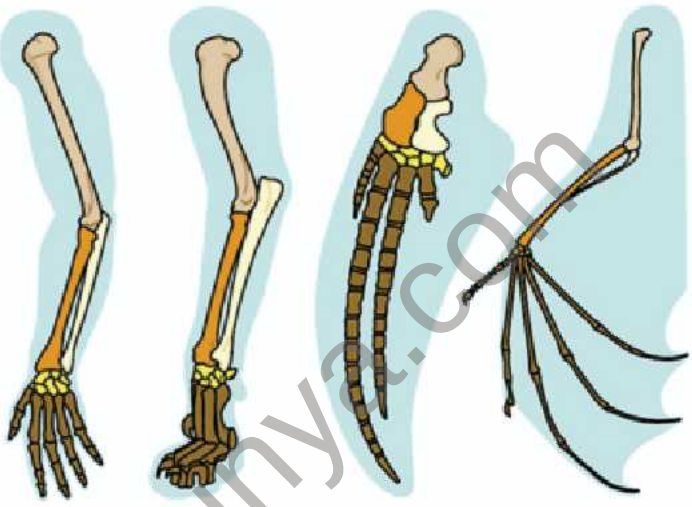

FIGURE 10.7: Homologous structures

Vestigial Structures

Vestigial organs are body parts that have no apparent function but were fully functional in an organism's ancestors. It is believed that through evolution vestigial organs lost their original function over time. For example:

Homologous organs are structurally same but functionally different. **Analogous organs** are functionally same but structurally different e.g. wings of bat, birds and insects etc.

- **Human appendix:** It is a small, tube-like structure attached to the cecum. In humans, it is a vestigial structure. It might have played a more important role in the digestive system of ancestors.
- **Ear muscles in humans:** In many animals, such as cats and dogs, ear muscles move their ears to detect sounds from different directions. However, in humans, these ear muscles are largely non-functional. So, these are vestigial structures in humans.
- **Pelvic bones in whales:** Modern whales have small, non-functional pelvic bones even though they do not have legs.
- **Wings in flightless birds:** Birds like ostriches have wings, but they do not

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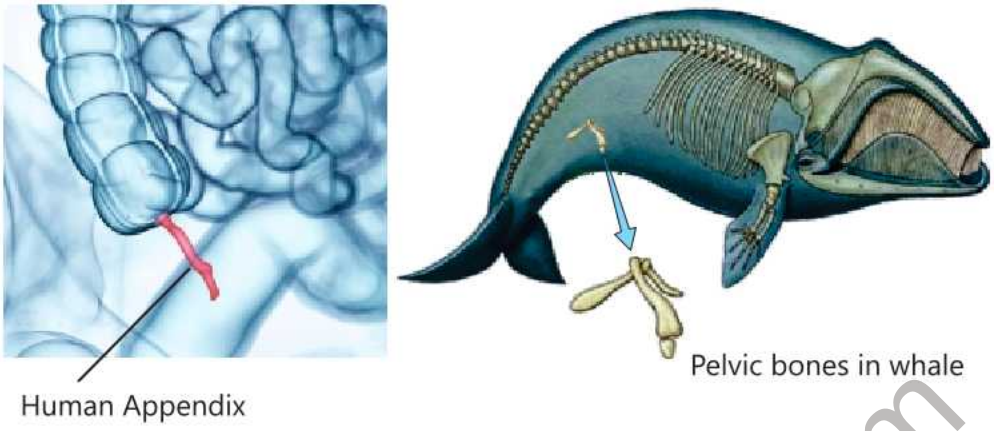

FIGURE 10.8: Vestigial organs

use them for flight.

3. Selective Breeding

Selective breeding means the process in which humans select varieties of plants or animals and breed them to produce offspring with required characteristics. In this way, they can improve characteristics in plants such as grain production or disease resistance. Similarly, they can improve growth rate or milk production in animals.

The varieties of animals which are selectively bred are called **breeds**. The varieties of plants which are selectively bred are known as **varieties** or **cultivars**. Many breeds of sheep, goat, cow, hen etc. have been produced by selective breeding to increase the production of meat, milk, eggs, wool etc.

FIGURE 10.9: Different breeds of hen

Similarly, many plant varieties (cultivars) have been produced for better quantity and quality of food. This process has proved very successful for the improvement of yields in economically important plants like wheat, rice, potato, and apple etc.

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FIGURE 10.10: Varieties (cultivars) of potato and apple

Selective breeding provides evidence of the naturally occurring variations among species and their natural selection (evolution).

EXERCISE

A. Select the correct answers for the following questions.

1. The survival and reproduction of individuals with advantageous traits is called:
   a) Mutations b) Gene flow
   c) Natural selection d) Asexual reproduction
2. A population is split by a river. After many generations, both population evolve into different species. What type of speciation may occur?
   a) Sympatric b) Genetic drift c) Mutation d) llopatric
3. Which characteristics in whales supports that their ancestors lived on land?
   a) Big body b) Fins c) Pelvic bones d) Stream-lined body
4. Farmers choose best cows to breed. It is an example of:
   a) Natural selection b) Selective breeding
   c) Adaptation d) Genetic mutation
5. Darwin's observation of finches proved that:
   a) Climate was same on all islands
   b) All finches were identical
   c) They adapted to different foods on different islands
   d) Finches never migrated
6. A new variation appears suddenly and helps survival. What happens next?
   a) It disappears b) It spreads through population
   c) It causes disease d) It's removed by natural selection

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7. Which of these is a vestigial structure?

a) Human ear muscles b) Wings of Sparrow

c) Beak of duck d) Tail of cat

8. Which pair are homologous structures?

a) Bird wings and butterfly wings b) Dolphin fins and shark fins

c) Human arms and dolphin fins d) bat wings and bird wings

9. Human appendix is a vestigial organ because it:

a) Has a major digestive function b) Is part of the immune system

c) Is no longer useful for digestion d) Helps in absorbing nutrients

10. Artificial selection is similar to natural selection because;

a) Environmental conditions play role in both

b) Both occur over millions of years

c) Both are carried out by humans

d) Both depend upon variations among individuals

B. Write short answers.

1. Write a short note on selective breeding.
2. What are the two types of speciation?
3. Provide examples of homologous structures.
4. List the steps in the process of natural selection.

C. Write answers in detail.

1. Explain the theory of evolution by natural selection.
2. Write a note on the observations Darwin made during his voyage.
3. Describe the sources of variation.
4. Justify how fossil record provides an evidence of evolution.
5. Write a note on homologous structures as an evidence of evolution.
6. What are vestigial structures? Explain how they provide evidence of evolution.

D. Inquisitive questions

1- Why is variation among individuals important for evolution?

2- How do fossils help scientists understand the history of life on Earth?

3- Why can isolation lead to the formation of new species?

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GLOSSARY

A

Acquired Immunity: Immunity developed during a person's life due to exposure to diseases or vaccination.

Adrenal gland: A gland above each kidney that produces hormones like adrenaline and cortisol.

Adreno-cortico-tropic hormone: A hormone from the pituitary gland that signals adrenal glands to release cortisol.

Agranulocytes: White blood cells without granules in their cytoplasm, e.g., lymphocytes and monocytes.

Aldosterone: A hormone that helps control blood pressure by managing salt and water in the body.

Alimentary canal: The continuous muscular tube of the digestive system extending from the mouth to the anus.

Alleles: Different forms of a gene found at the same location on chromosomes.

Allergens: Substances that cause allergic reactions.

Allergies: Immune responses to harmless substances like pollen, dust, or certain foods.

Allopatric speciation: Formation of new species due to geographic isolation.

Alveoli: Tiny air sacs in the lungs where oxygen and carbon dioxide are exchanged between air and blood.

Amylase: An enzyme that breaks down starch into maltose.

Androgens: Male hormones responsible for male features and reproductive functions.

Antibodies: Proteins produced by the immune system to fight specific antigens.

Antidiuretic hormone: A hormone that reduces urine production to save water in the body.

Antigens: Foreign substances, like pathogens, that trigger an immune response in the body.

Arteriosclerosis: Hardening and thickening of arterial walls.

Atrium (Atria): The upper chamber(s) of the heart that receive blood from veins.

Autonomic nervous system: The part of the nervous system that controls involuntary actions like heartbeat and digestion.

B

Bacteriophages: Viruses that infect and reproduce inside bacteria.

Bile: A digestive fluid produced by the liver that helps break down fats.

Bioremediation: Using living organisms to clean up environmental pollution.

Biotechnology: The use of living organisms or biological systems for practical purposes.

Blood plasma: The liquid part of blood that carries cells, nutrients, and waste products.

Bronchi: The two main branches of the trachea that carry air into each lung.

Bronchitis: Inflammation of the bronchi, often due to infection or irritation.

C

Calcitonin: A hormone that helps lower calcium levels in the blood.

Capillaries: The smallest blood vessels where exchange of gases, nutrients, and waste takes place.

Cardiac arrest: A sudden loss of heart function.

Cardiovascular system: The body system consisting of the heart, blood, and blood vessels.

Centromere: The region where two chromatids are joined together in a chromosome.

Chromatid: One half of a duplicated chromosome.

Chromatin: A mix of DNA and proteins in the nucleus, forming chromosomes.

Chromosome: A thread-like structure made of DNA that carries genetic information.

Coordination: The control and regulation of body functions through the nervous and endocrine systems.

Cortisol: A hormone that helps the body respond to stress and regulates metabolism.

D

Deamination: The removal of an amino group from amino acids in the liver.

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Diabetes: A disease caused by insufficient insulin production or use, leading to high blood sugar levels.

Dialysis: A medical treatment that removes waste products from the blood when kidneys fail.

Digestion: The breakdown of complex food substances into simpler, absorbable forms.

Dihybrid cross: A genetic cross involving two traits.

DNA (Deoxyribonucleic Acid): A molecule that carries genetic instructions in cells.

Dominant allele: An allele that shows its effect even if only one copy is present.

E

Endocrine system: The system of glands that release hormones to control body activities.

Enzyme: A protein that speeds up chemical reactions in living organisms.

Epiglottis: A flap of tissue that prevents food from entering the windpipe.

Epinephrine: Also called adrenaline, a hormone for emergency responses (fight or flight).

Evolution: The process through which populations and species change over time.

Excretion: The removal of metabolic waste products from the body.

F

Fallopian tube: A tube where the egg travels from the ovary to the uterus.

Fermentation (in biotechnology): The process where microbes break down substances to produce useful products.

Fertilization: The fusion of a male and a female gamete to form a zygote.

First polar body: A small cell formed alongside the secondary oocyte, non-functional.

Follicle: A structure in the ovary where an egg develops.

G

Gametogenesis: The process of forming male or female sex cells (gametes).

Gene cloning: Making many copies of a specific gene.

Gene editing: A technique to change specific DNA sequences in genes.

Gene flow (migration): Movement of genes between populations due to migration.

Gene: A unit of heredity that determines the characteristics of an organism.

Genetic engineering: The direct manipulation of an organism's genes using biotechnology.

Genetic recombination: Mixing of genes during reproduction to create variation.

Genetically modified organism: An organism whose DNA has been changed using biotechnology.

Genotype: The genetic makeup of an organism.

Glomerulus: A cluster of capillaries in the kidney involved in blood filtration.

Glucagon: A hormone that raises blood sugar by telling the liver to release stored glucose.

Growth hormone: A hormone that helps in body growth and development.

H

Haemodialysis: A type of dialysis that uses a machine to clean the blood.

Haemoglobin: A red protein in red blood cells that carries oxygen.

Heterozygous: Having two different alleles for a gene.

Histone: Proteins that DNA wraps around to form chromatin.

Homozygous: Having two identical alleles for a gene.

Hormone: A chemical messenger produced by glands that regulates body functions.

I

Immunity: The body's ability to resist disease.

Infectious diseases: Illnesses caused by pathogens like bacteria or viruses.

Inheritance (heredity): Passing of traits/characteristics from parents to offspring.

Innate Immunity: The natural defence you are born with.

Insulin: A hormone that helps cells absorb glucose from the blood.

L

Large intestine: The part of the digestive system where water is absorbed from waste.

Leucocytes: White blood cells involved in defending the body against infection.

Liver: A large organ that performs many vital functions including detoxification and bile production.

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Locus (loci): The specific location of a gene on a chromosome.

Luteinizing hormone: A hormone that helps in egg release in females and testosterone production in males.

Lymph: A fluid that carries white blood cells and drains into the bloodstream.

Lymphocyte: A type of white blood cell involved in specific immune responses.

M

Meiosis: A type of cell division that produces cells with half the number of chromosomes.

Mendel's Laws: Rules describing how traits are inherited from parents to offspring.

Menstruation: Monthly shedding of the uterine lining in females.

Monohybrid cross: A genetic cross involving one trait.

Mutation: A change in the DNA sequence of a gene.

N

Nasal cavity: The inside of the nose, where air is filtered, warmed, and moistened.

Natural selection: The process where organisms with favourable traits survive and reproduce.

Nephron: The functional unit of the kidney that filters blood and forms urine.

Neuron: A nerve cell that carries messages as electrical signals.

Non-Infectious disease: Diseases not spread from person to person, like diabetes.

Nor-epinephrine: A hormone that increases heart rate and blood pressure during stress.

Nutrient: A substance that provides nourishment essential for growth and health.

O

Oesophagus: The muscular tube that carries food from the mouth to the stomach.

Oestrogen: A hormone that controls female reproductive development and functions.

Oogenesis: The process of egg cell formation in females.

Ovary: A female reproductive organ that produces eggs and hormones.

Ovulation: The release of an egg from the ovary.

Oxytocin: A hormone that causes uterine contractions during childbirth and milk release during breastfeeding.

P

Pancreas: An organ that makes hormones (like insulin) and digestive enzymes.

Parathormone: A hormone that increases calcium levels in the blood.

Pathogen: A microorganism that causes disease.

Peristalsis: Rhythmic muscle contractions that move food along the digestive tract.

Phenotype: The observable traits or characteristics of an organism.

Phloem: Tissue in plants that transports food.

Placenta: An organ that connects the developing foetus to the uterus and provides nutrients.

Plasmid: A small DNA ring found in bacteria, used in genetic engineering.

Platelets: Cell fragments in blood that help with clotting.

Pollution: The presence of harmful substances in the environment.

Primary oocyte: An immature egg cell in its first stage of development.

Primary spermatocyte: A diploid cell that begins the process of sperm formation.

Progesterone: A hormone that prepares the uterus for pregnancy.

Prostate gland: A gland that adds more fluid to semen.

Protein synthesis: The process of making proteins using DNA and RNA.

Puberty: The stage of development when a person becomes sexually mature.

R

Recessive allele: An allele that shows its effect only when two copies are present.

Recombinant DNA: DNA formed by combining genes from different sources.

Red blood cells: Blood cells that carry oxygen using haemoglobin.

Reflex action: A quick, automatic response to a stimulus.

Reflex arc: The nerve pathway through which a quick, automatic response (reflex) travels from a sense organ to a muscle or gland, without involving the brain.

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RNA (Ribonucleic Acid): A molecule that helps in protein synthesis and gene expression.

S

Salivary glands: Glands in the mouth that secrete saliva to help digest food.

Second polar body: Another small cell formed during egg development, usually non-functional.

Secondary oocyte: An egg cell formed after the first division into genesis.

Secondary spermatocyte: A haploid cell formed after the first division in spermatogenesis.

Semen: The fluid containing sperm and secretions from male glands.

Seminal vesicle: A gland that adds fluid to sperm to form semen.

Sexual reproduction: Reproduction involving the fusion of male and female gametes.

Speciation: The formation of new species through evolution.

Sperm: The male gamete (reproductive cell).

Spermatid: An immature sperm cell that develops into a sperm.

Spermatogenesis: The formation of sperm cells in males.

Spinal cord: A bundle of nerves extending from the brain that controls reflexes and sends messages.

Struggle for survival: Competition among organisms for limited resources.

Survival of the fittest: Organisms best adapted to the environment survive and reproduce.

Sympatric speciation: Formation of new species without geographic separation.

Synapse: The gap between two neurons where nerve impulses are transmitted.

T

Testes: Male reproductive organs that produce sperm and testosterone.

Testosterone: The main male hormone responsible for male features and reproduction.

Thyroid-stimulating hormone: A hormone that controls the thyroid gland and its hormone production.

Thyroxin: A hormone from the thyroid gland that controls the body's metabolism.

Trachea: The windpipe; a tube that carries air to and from the lungs.

Transcription of DNA: The process of making RNA from DNA.

Translation (in genetics): The process of making proteins from RNA.

Transpiration: Loss of water vapor from the surface of plant leaves.

True-breeding: Organisms that produce offspring with the same traits over generations.

U

Ureter: The tube that carries urine from the kidney to the bladder.

Urethra: The tube through which urine exits the body.

Urinary bladder: A muscular sac that stores urine before excretion.

Uterus: A muscular organ where a baby develops during pregnancy.

V

Vaccine: A substance that stimulates the immune system to protect against disease.

Valve: A structure in the heart and veins that prevents the backflow of blood.

Variations (in genetics): Differences in traits among individuals of a species.

Vas deferens: A tube that carries sperm from the testes to the urethra.

Vector-Borne Diseases: Diseases spread by carriers like mosquitoes or ticks.

Vectors (in genetic engineering): Carriers used to transfer genes into organisms.

Ventricle: The lower chamber of the heart that pumps blood out of the heart.

Villi: Small finger-like projections in the small intestine that increase surface area for absorption.

Z

Zoonotic diseases: Diseases that spread from animals to humans.

Zygote: The first cell formed when a sperm fertilizes an egg.

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Pairing Scheme / Instructions for Preparation of Exam Paper of Biology for Class-10

The paper of Biology (General) for class 10 will consist of 60 marks. Timing of the paper will be two hours. The paper will be made as per following details:

Part-I: Objective:

Q-1: 12 Multiple Choice Questions. The detail is as follows: 1 × 12 = 12

Chapter	1	2	3	4	5	6	7	8	9	10
MCQs	1	1	1	2	1	1	1	1	1	2

Part-II: Subjective:

Q-2: 5 short answer questions have to be answered out of 8. The detail is as follows: 2 × 5 = 10

Chapter	1	2	5
No. of Short Questions	2	4	2

Q-3: 5 short answer questions have to be answered out of 8. The detail is as follows: 2 × 5 = 10

Chapter	3	4	6	7
No. of Short Questions	2	3	1	2

Q-4: 5 short answer questions have to be answered out of 8. The detail is as follows: 2 × 5 = 10

Chapter	8	9	10
No. of Short Questions	2	2	4

Part-III: Subjective:

This section will contain three detailed questions bifurcated in two-part **a & b** (carrying 5 & 4 marks each) and students have to attempt 2 questions The detail is as follows: 2 × 9 = 18

Q-5:

Chapter	1	3
Part	a	b

Q-6:

Chapter	6	5
Part	a	b

Q-7:

Chapter	9	8
Part	a	b

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MODEL PAPER OF BIOLOGY FOR CLASS-10

Objective Type

Time allowed: 15 Min. **Max. Marks: 12**

نوٹ: ہر سوال کے چار ممکنہ جوابات A، B، C اور D دیے گئے ہیں۔ جو انتخاب آپ کے خیال میں درست ہے، اس سوال کے سامنے والے دائرے کو مارکر یا پین کی سیاہی سے بھریں۔ دو یا دو سے زیادہ دائروں کو کاٹنے یا بھرنے کی صورت میں جواب غلط تصور ہو گا۔

Note: Four possible answers A, B, C and D to each question are given. The choice which you think is correct, fill that circle with marker or pen ink in the answer-book. Cutting or filling two or more circles will result in zero mark in that question.

(i) خوراک کی نالی کے فوراً بعد معدے کا حصہ کہلاتا ہے۔

(i) The part of the stomach just after the oesophagus is called:

(a) Fundus فنڈس (b) Pyloric end پائلورک حصہ
(c) Cardiac end کارڈیک حصہ (d) Body جسم

(ii) ان میں سے کون سا ترتیب اس راستے کو درست طور پر ظاہر کرتا ہے جس سے ہوا سانس لینے (Inhalation) کے دوران گزرتی ہے؟

(ii) Which of these correctly orders the structures through which air passes during inhalation?

(a) Pharynx → trachea → larynx → bronchi فیرنکس ← ٹریکیا ← لیرنکس ← برونکائی
(b) Pharynx → larynx → trachea → bronchi فیرنکس ← لیرنکس ← ٹریکیا ← برونکائی
(c) Larynx → pharynx → bronchi → trachea لیرنکس ← فیرنکس ← برونکائی ← ٹریکیا
(d) Larynx → pharynx → trachea → bronchi لیرنکس ← فیرنکس ← ٹریکیا ← برونکائی

(iii) ٹانگوں سے ڈی آکسی جنیٹڈ (deoxygenated) خون کے دل تک واپس آنے کا درست راستہ بتائیں:

(iii) Trace the correct pathway for deoxygenated blood from legs back to the heart:

(a) Femoral veins → Inferior vena cava → Right atrium فیمورل وریدیں ← انفیریئر وینا کیوا ← دایاں ایٹریئم
(b) Femoral arteries → Inferior vena cava → Right atrium فیمورل شریانیں ← انفیریئر وینا کیوا ← دایاں ایٹریئم
(c) Femoral veins → Superior vena cava → Right atrium فیمورل وریدیں ← سپیریئر وینا کیوا ← دایاں ایٹریئم
(d) Femoral arteries → Superior vena cava → Right atrium فیمورل شریانیں ← سپیریئر وینا کیوا ← دایاں ایٹریئم

(iv) یوریٹر گردے سے کس راستے کے ذریعے نکلتا ہے؟

(iv) Ureter leaves the kidney through:

(a) pelvis پیلوس (b) hilus ہائلس
(c) papillary duct پیپی لیری ڈکٹ (d) collecting duct کلیکٹنگ ڈکٹ

(v) ٹیوبولر سیکریشن کس قسم کا عمل ہے؟

(v) Tubular secretion is a/an:

(a) active transport ایکٹو ٹرانسپورٹ (b) diffusion ڈفیوژن
(c) osmosis اوسموسس (d) passive transport پیسو ٹرانسپورٹ

(vi) گلوکاگون کا کام ہے:

(vi) The function of glucagon is to:

(a) accelerates protein synthesis within cells خلیوں کے اندر پروٹین کی ترکیب کو تیز کرنا
(b) stimulates release of glucose from liver جگر سے گلوکوز کے اخراج کو بڑھانا
(c) decrease release of glucose from liver جگر سے گلوکوز کے اخراج کو کم کرنا
(d) slow down glucose formation from lactic acid لیکٹک ایسڈ سے گلوکوز کی تشکیل کو سست کرنا

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(vii) Fertilization usually occurs in the: (vii) عام طور پر فرٹیلائزیشن کہاں ہوتی ہے؟

(a) uterus یوٹرس (b) vagina ویجائنا

(c) fallopian tube فیلوپین ٹیوب (d) cervix سروکس

(viii) If transcription is blocked, what will NOT form? (viii) اگر ٹرانسکرپشن رک جائے تو کون سی چیز تشکیل نہیں پائے گی؟

(a) mRNA ایم آر این اے (b) Amino acids امینو ایسڈز

(c) Proteins پروٹینز (d) Ribosome رائبوسوم

(ix) If a gene from bacteria is transferred into corn, the advantage is: (ix) اگر بیکٹیریا کا جین مکئی میں منتقل کیا جائے تو فائدہ کیا ہوگا؟

(a) larger corn size مکئی کے سائز میں اضافہ (b) production of natural toxin قدرتی زہر (ٹاکسن) کی پیداوار

(c) more vitamins زیادہ وٹامنز (d) faster growth تیزی سے نشوونما

(x) Arrange the following in correct order: (x) درج ذیل کو درست ترتیب میں لگائیں:

1. Thrombin converts fibrinogen — 1۔ تھرومبن فائبرونجن کو تبدیل کرتا ہے
2. Platelets form a temporary plug — 2۔ پلیٹ لیٹس عارضی پلگ بناتے ہیں
3. Clotting factors convert prothrombin — 3۔ کلوٹنگ فیکٹرز پروتھرومبن کو تبدیل کرتے ہیں
4. Platelets contract to reduce wound size — 4۔ پلیٹ لیٹس زخم کے سائز کو کم کرنے کے لیے سکڑتے ہیں

(a) 2 → 3 → 1 → 4 (b) 1 → 2 → 3 → 4

(c) 3 → 2 → 4 → 1 (d) 4 → 3 → 2 → 1

(xi) What does "fittest" mean in evolution? (xi) ارتقا میں "فٹسٹ" سے کیا مراد ہے؟

(a) Strongest سب سے زیادہ طاقتور (b) Largest سب سے بڑا

(c) Best suited سب سے زیادہ موزوں (d) Fastest سب سے تیز

(xii) In allopatric speciation, the main factor preventing gene flow is: (xii) ایلوپیٹرک اسپیسی شی ایشن میں جین فلو کو روکنے والا بنیادی عنصر کون سا ہے؟

(a) climate آب و ہوا (b) predation پریڈیشن

(c) physical barrier جسمانی رکاوٹ (d) competition مقابلہ

Subjective Type (Part I)

Time allowed: 1.45 Hrs. **Max. Marks: 48**

Q. 2: Write short answers to any five (05) questions: کوئی سے پانچ (5) سوالات کے مختصر جوابات لکھیے: (4)

(i) State two functions of the liver other than digestion. (i) ہاضمے کے علاوہ جگر کے دو افعال بیان کریں۔

(ii) Differentiate between bolus and chyme. (ii) بولس اور کائم میں فرق بیان کریں۔

(iii) What is pleura? Write its function. (iii) پلیورا کیا ہے؟ اس کا فعل لکھیں۔

(iv) Write about the blood circulation in lungs. (iv) پھیپھڑوں میں خون کی گردش کے بارے میں لکھیں۔

(v) Mention the events during exhalation. (v) ایگزیلیشن (Exhalation) کے دوران ہونے والے واقعات بیان کریں۔

(vi) What are the causes and symptoms of emphysema? (vi) ایمفیسیما کی وجوہات اور علامات کیا ہیں؟

(vii) Compare the functions of thalamus and hypothalamus. (vii) تھیلیمس اور ہائپو تھیلیمس کے افعال کا موازنہ کریں۔

(viii) Name any four hormones secreted by anterior lobe of pituitary gland. (viii) پیچوٹری گلینڈ کے اینٹیریئر لوب سے خارج ہونے والے کسی چار ہارمونز کے نام لکھیں۔

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کوئی سے پانچ (5) سوالات کے مختصر جوابات لکھیے: (3)

Q. 3: Write short answers to any five (05) questions: (5X2=10)

(i) خون کے پلازما میں موجود کسی دو پروٹینز کے نام اور ان کے افعال لکھیں۔
(i) Give the names and functions of any two proteins present in blood plasma.

(ii) آے گرینولوسائٹس کیا ہیں؟ ان کی اقسام لکھیں۔
(ii) What are agranulocytes? Write its types.

(iii) پریشر فلٹریشن اور ٹیوبولر سیکریشن میں فرق بیان کریں۔
(iii) Differentiate between pressure filtration and tubular secretion.

(iv) لیتھوٹرپسی سے کیا مراد ہے؟
(iv) What do you mean by lithotripsy?

(v) رینل پیلوس کی تعریف کریں۔
(v) Define renal pelvis.

(vi) ایسٹروجن اور پروجیسٹرون کے افعال میں موازنہ کریں۔
(vi) Compare the functions of estrogen and progesterone.

(vii) یوکاریوٹک کروموسومز کی ترکیب کیا ہے؟
(vii) What is the composition of eukaryotic chromatin?

(viii) مینڈل نے مٹر کے پودے کو تجرباتی طور پر کیوں منتخب کیا؟ دو وجوہات لکھیں۔
(viii) Why did Mendel choose pea plant as an experimental material? Give two reasons.

کوئی سے پانچ (5) سوالات کے مختصر جوابات لکھیے: (4)

Q. 4: Write short answers to any five (05) questions: (5X2=10)

(i) جینیاتی تبدیلی میں بیکٹیریا کا کردار بیان کریں۔
(i) Mention the role of bacteria in Genetic Modification.

(ii) بائیوٹیکنالوجی کے دو ممکنہ خطرات لکھیں۔
(ii) Write any two potential risks of biotechnology.

(iii) فنگس اور پیراسائٹک پروٹوزوا سے ہونے والی بیماریوں کے نام لکھیں۔
(iii) Name the infections caused by fungi and parasitic protozoan.

(iv) زونوٹک بیماریاں کیا ہیں؟ دو مثالیں دیں۔
(iv) What are zoonotic diseases? Give two examples.

(v) غیر فعال (vestigial) ساختوں کی تعریف کریں۔ انسانوں میں مثالیں دیں۔
(v) Define vestigial structures. Give examples in humans.

(vi) تغیر (Variation) کے بنیادی ذریعہ کے طور پر میوٹیشن کیسے کام کرتا ہے؟
(vi) How does mutation act as the main source of variation?

(vii) سمپیٹرک اسپیشی ایشن کیا ہے؟ ایک مثال دیں۔
(vii) What is Sympatric Speciation? Give an example.

(viii) نیچرل سلیکشن کے مختلف مراحل بیان کریں۔
(viii) List the steps in the process of natural selection.

Subjective Type (Part II)

Note: Attempt any two questions. (2x9=18)

نوٹ: کوئی سے دو سوالات کے جوابات لکھیے۔

Q.5. **(a)** Describe the absorption of food in small intestine.

(الف) چھوٹی آنت میں غذائی اجزاء کے جذب (Absorption) ہونے کی وضاحت کریں۔

(b) How does blood circulate in human heart?

(ب) انسانی دل میں خون کیسے گردش کرتا ہے؟

Q.6. **(a)** What are sexually transmitted diseases? Explain with an example of AIDS.

(الف) جنسی طور پر منتقل ہونے والی بیماریاں (STDs) کیا ہیں؟ AIDS کی مثال کے ساتھ وضاحت کریں۔

(b) Describe the hormones with functions of the adrenal gland.

(ب) ایڈرینل گلینڈ کے ہارمونز اور ان کے افعال کی وضاحت کریں۔

Q.7. **(a)** In what ways do killer cells and protective proteins contribute to the second line of defence?

(الف) کلر خلیے (Killer cells) اور حفاظتی پروٹین دوسری دفاعی لائن میں کس طرح کردار ادا کرتے ہیں؟

(b) How does biotechnology help in medical field?

(ب) طب (Medical field) کے میدان میں بائیوٹیکنالوجی کس طرح مدد کرتی ہے؟

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