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1

CHAPTER

Different Habitats of Animals, Birds and Humans

What is Habitat?

- Habitat refers to the place or environment where an organism (animal, bird, or human) lives and fulfills its needs. Or in simple words, habitat is the place where animals, birds, living beings, or humans live, obtain food, and reproduce.
- Each organism has its own specific habitat suited to its lifestyle, food, and safety needs.
- **According to R.S. Deshpande**, "Habitat is a shelter for human groups which has walls, floors, doors, windows, roofs, etc."
- **According to Uma Bernard Set**, "In reality, the place where a family life environment is found is called a home, whose essence lies in personal relationships within family life."

Need for Habitat

- **Provides protection:** Habitat protects living beings (animals, birds, humans) from external threats such as predators, natural disasters (rain, cold, heat), and other dangers.
- **Safe place for reproduction and nurturing:** Habitat is a safe and comfortable place for childbirth and raising children. For animals too, safe shelters are necessary to protect their offspring.
- **Comfortable place for survival:** Habitat provides humans with a suitable place for rest, comfort, and personal activities. Animals and birds also rest in their habitat and regain energy.

- **Conservation of natural resources:** Habitat helps in conserving resources like food, water, and energy.
- **Development of society and culture:** For humans, habitat is the center of social, cultural, and family life. Habitat is also a symbol of social identity and respect.
- **Privacy:** It serves to provide personal or family privacy.

Types of Habitat

- **Permanent Shelter:** Such shelters where living beings or humans live continuously and permanently are called permanent shelters.
 - **Examples:**
 - ✓ Forest – A natural and permanent dwelling place for many animals.
 - ✓ House – The main permanent residence for humans where they live with their family for years.
 - **Temporary Shelter:** Shelters where living beings or humans live for some time due to specific work, climate, or circumstances are called temporary shelters.
- Terrestrial Habitat:** Terrestrial habitats are those found only on land or those constructed on land by organisms for their residence.
- **Forest Habitat:**
 - ✓ For the development and stability of forests, ecological components such as temperature, humidity, and soil are considered essential.

- ✓ Globally, forests are mainly divided into three major categories—
 - First, tropical forests found in lower latitudes, where there is high temperature and heavy rainfall;
 - Second, temperate forests located in mid-latitudes, where temperatures are moderate and seasons are distinct;
 - Third, coniferous or taiga forests found in higher latitudes, which occur in cold climates.
- ✓ In India, forests are divided into five major types based on vegetation and climatic ecology. Additionally, Champion and Seth classified Indian forests into 16 categories based on vegetation structure, climate, topography, and other ecological factors, strengthening the scientific understanding of forests.

➤ **Grasslands as Habitat:**

- ✓ Grasslands are ecosystems where various types of grasses are found in abundance.
- ✓ These regions are generally located in areas with low rainfall, where annual rainfall ranges between 25 and 75 cm.
- ✓ Biologically, it is notable that about half of the total biomass in grasslands is stored in underground parts (roots, tubers, etc.).
- ✓ Grasslands are found in both tropical and temperate climates and play an important role in grazing, agriculture, and ecological balance.

Major Grasslands

Grassland	Country
Campos/Campos	Brazil
Prairies	North America
Downs	Australia

Veld	South Africa
Puszta	Europe
Llanos	Colombia
Savanna	Central Africa
Pampas	Argentina
Steppes	Central Asia
Sonamarg	Kashmir

➤ **Desert Habitat:**

- ✓ Desert habitats are ecosystems where the evaporation rate is very high and humidity is minimal.
- ✓ Deserts are generally found near the Tropic of Cancer and Tropic of Capricorn on the western coasts of continents between 15° and 35° latitudes.
- ✓ Currently, deserts cover about 20% of the Earth's land area.
- ✓ Based on temperature, deserts are divided into two categories:
 - Hot deserts, where daytime temperatures are extremely high and rainfall is negligible;
 - Cold deserts, where there is a lack of water vapor due to extreme cold.
- ✓ In India, the Thar Desert, which stretches from Punjab, Haryana, Rajasthan to Gujarat, is an example of a hot desert.
- ✓ Meanwhile, regions like Ladakh, Leh, Kargil, Lahaul-Spiti, and Kinnaur fall under cold desert habitats, where ice cover and low temperatures persist throughout the year.

➤ **Tundra Habitat:**

- ✓ The word Tundra means — flat or treeless plain, which remains covered with snow. A key feature of tundra ecosystems is the extreme lack of light, and most of the land remains covered with snow for at least eight months, known as permafrost.

- ✓ In this harsh condition, only certain types of mosses, lichens, and dwarf shrubs can grow.
- ✓ The tundra ecosystem is divided into two parts—
 - Arctic Tundra, located in Earth's northern polar regions;
 - Alpine Tundra, found in high mountainous areas where the tree growth limit ends.

Aquatic Habitat: Aquatic habitats refer to those ecosystems that are related to water, such as lakes, rivers, ponds, and wetlands. These are divided into two main categories – Freshwater and Marine habitats.

- **Freshwater Habitat:** This ecosystem is divided into two parts:
 - ✓ **Lentic Habitat:** Includes stagnant water sources such as ponds, lakes, reservoirs, etc., where water does not flow.
 - ✓ **Lotic Habitat:** Includes flowing water sources such as rivers, waterfalls, and streams, where water is in continuous movement.
 - **Marine Habitat:** About 71% of Earth's surface is covered with water, with oceans being the major contributor. Marine ecosystems are classified into the following main parts:
 - ✓ **Open Sea Community:** This region hosts three main types of living communities:
 - **Plankton:** Microorganisms found in the illuminated zone of the ocean, in the upper part of water up to 200 meters deep.
 - **Phytoplankton:** e.g., Diatoms, Algae
 - **Zooplankton:** e.g., Copepods. They are found on the water's surface in sunlight and produce oxygen through photosynthesis.
- Note :* A large portion of the oxygen available in Earth's atmosphere is due to them.

- **Nekton:** Includes larger and stronger organisms that can swim against water currents.
 - **Examples:** Dolphins, Whales, Sea Lions, Squids, etc.
- **Benthos:** These organisms live near the seafloor and within sediments.
 - **Examples:** Crabs, Starfish, Coral, Sponges, Turtles, Algae, Seagrasses, etc.
- ✓ **Barrier Island:** These islands are formed from sediment deposition in the sea and provide protection to coastal areas from storms and tsunamis. They have features of both terrestrial and aquatic ecosystems.
- ✓ **Intertidal Zone:** Also called the littoral or intertidal ecosystem. This is a highly biodiverse region that remains submerged and exposed during tides.
- ✓ **Coral Reefs:**
 - Coral is a lime-rich organism belonging to the phylum Cnidaria.
 - After dying, they join together to form wall-like structures called coral reefs.
 - Corals live in symbiosis with algae (Zooxanthellae).
 - They develop in tropical seas (between 30°N and 30°S latitudes) at temperatures of 20–21°C.
 - They are also called the "Rainforests of the Sea."
 - Coral is a keystone species – playing an essential role in maintaining ecosystem balance.
 - **Types of Coral Reefs:**
 - **Fringing Reef:** India – Rameswaram, Andaman-Nicobar, Southern Florida.
 - **Barrier Reef:** Great Barrier Reef (Australia) – the world's largest.
 - **Atoll:** Found in Fiji, Ellis Island, Lakshadweep.

➤ **Transitional Habitat:**

- ✓ Where two different ecosystems meet, a transitional habitat forms. This is extremely important in terms of biodiversity.

Major Transitional Ecosystems:

- ✓ **Estuary:** Places where rivers meet the sea without forming a delta.
 - **Examples:** India's Mahi, Tapi, Narmada, Mandvi rivers.
- ✓ **Wetland:** Marshy, muddy, or permanently/temporarily waterlogged areas, rich in fresh or saline water.
 - These can be natural or artificial, static or dynamic.
- ✓ **Mangrove Ecosystem:** Plants or shrubs that can survive in saline, semi-saline, or freshwater.
 - **Examples:** Sundarbans, Pulicat Lake, Gulf regions.

Major Factors Affecting Habitat

- **Geographical location of the place** – such as mountains, plains, deserts, coastal regions, etc.
- **Climate** – very hot, very cold, or humid climate determines the type of habitat.
- **Social status** – a person's economic and social status influences the design of their habitat.
- **Available materials** – the structure of habitat also depends on locally available resources (like wood, ice, clay).

Habitats of Animals and Birds

Animal Name	Type of Habitat	Characteristics
Lion	Forest (Wild Habitat)	Large wild animals live in open or dense forests.
Fish	Aquatic Habitat (river, pond, sea)	Live in water, their bodies are adapted for aquatic life.

Camel	Desert Habitat	Deserts have less water, so camels have the ability to conserve water in their bodies.
Elephant	Forests and Grasslands	Heavyweight animals, found in dense forests and open fields.
Squirrel	On Trees	Hide in trees, feed on leaves and pods.
Tiger	Forest	Use trees and bushes for hiding.

Bird Habitats

S.No.	Bird Name	Nesting / Residential Characteristics (sentence form description)
1	Tailor Bird	This bird stitches leaves with its pointed beak and prepares its nest by making thread from plant fibers.
2	Sunbird	These birds work in pairs and make beautiful hanging nests from branches of shrubs or small trees.
3	Starling Bird	These birds make nests from leaves. Their nests naturally possess antibacterial properties.
4	Indian Robin	This bird makes its nest using soft twigs, roots, wool, hair, and cotton-like materials, making it comfortable.
5	Dove	The dove builds its nest among the thorns of cactus plants, providing protection from predatory birds.

6	Sparrow	This bird uses small twigs, grass, feathers, and soft materials to make its nest, often found on house roofs or corners.	8	Vulture	Vultures lay eggs in rock crevices or high places where safety and Solitude is available.
7	Pigeon	Pigeons lay eggs on building walls, under bridges, or on rocks without making an elaborate nest.			

Human Habitats

- Human habitats can be both natural and man-made.
- The choice of habitat depends on climate, environment, security, and availability of resources.

Type of Habitat	Characteristics	Example
Rural Habitat	Mud houses, huts	Village houses, agriculture-dominated areas
Urban Habitat	Apartments, houses, colonies	City flats, bungalows
Mountainous Habitat	Wooden, stone houses	Villages in Himalayan regions
Desert Habitat	Clay, glass houses	Areas in the Thar Desert
Tribal Habitat	Traditional huts, tents	Tribals living in forests and forest areas

Tribes of the World and Their Habitats : Major Tribes of India and Their Habitats

S.No.	Tribe Name	Geographic Region	Habitat Description
1	Pygmy Tribe	Dense forests of Central Africa, Uganda, Philippines, New Guinea	Mainly live in dense forests, their shelters are temporary huts shaped like beehives.
2	Semang Tribe	Malaysia, Thailand, Indonesia, Brunei	This Southeast Asian tribe lives in temporary houses made of bamboo and leaves, suited to forest environments.
3	Bushman Tribe	Kalahari Desert (Botswana), Namibia, South Africa, Angola	Lives particularly in the harsh environment of the Kalahari Desert, with simple and temporary hut-like shelters.
4	Maasai Tribe	Southern regions of Tanzania and Kenya	Maasai people live in their traditional fortress-like dwellings called 'Enkangs', made from wood and branches, with space for livestock.
5	Eskimo Tribe	Northern Alaska, Canada, Greenland, Eastern Siberia	Eskimos live in 'Igloos' made of ice, providing warmth and safety in cold regions.
6	Kyrgyz Tribe	Central Asia – Kyrgyzstan and surrounding areas	This tribe lives in circular, portable tents called 'Yurts' made of felt, suitable for their nomadic lifestyle.

S.No.	Tribe Name	Main Area / State	Habitat Description (in sentences)
1	Gond Tribe	Madhya Pradesh, Chhattisgarh, Maharashtra	The Gond tribe lives in traditional houses made of mud and thatch, usually near rural forests.
2	Bhil Tribe	Rajasthan, Madhya Pradesh, Gujarat, Maharashtra	The Bhil community lives in 'Kuti', made of mud, wood, and straw, adapted to hot and cold conditions.
3	Kol Tribe	Uttar Pradesh, Madhya Pradesh, Bihar	The Kol tribe lives in houses made of mud and bamboo, simple structures based on local materials.
4	Munda Tribe	Jharkhand, Odisha, West Bengal	Munda people live in 'Kuti' style houses made of wood and straw, suited to forest ecology.
5	Santhal Tribe	Jharkhand, Bihar, West Bengal, Odisha	The Santhal community lives in 'Haat' metal houses or timber and thatched houses, offering protection from rain and heat.
6	Toda Tribe	Tamil Nadu – Nilgiri Hills	The Toda tribe lives in traditional round thatched houses made of bamboo and leaves, environmentally friendly.
7	Chenchu Tribe	Andhra Pradesh, Telangana	The Chenchu tribe mainly lives in forests, with shelters that are temporary and made from natural resources.
8	Changpa Tribe	Ladakh (Himalayan Region)	Changpa people live in tents called 'Rebo' woven from yak hair, fastened with nine poles embedded 2 feet into the ground. They have 'Lek' areas for sheep and goats.

Human-made (Artificial) Habitats

- Artificial or human-made habitats are structures built by humans to live safely, permanently, and comfortably. Compared to natural caves, trees, or temporary huts, these are more organized, protected, and durable.
- Their form varies according to geographical location, climate, cultural traditions, and available resources. The structure of the habitat is determined by local lifestyle, economic conditions, and availability of building materials.

The following types of human-made habitats are most commonly seen:

- **Kuti:** Traditional rural Indian dwellings usually made of mud, bamboo, and thatch (grass or palm leaves). Despite their simplicity, Kutis stay cool in summer and warm in winter, are environmentally friendly, and reflect local culture.
- **Hut:** A simple, temporary, lightweight structure often built from wood, bamboo, and palm/coconut leaves. Suitable for tribal areas, forests, and low-income rural regions. Quick to build with fewer resources, but vulnerable to natural disasters.

➤ **House:** A modern, permanent dwelling built from brick, cement, concrete, stone, and other materials. Found in cities, towns, and developed villages, designed for single or joint families in various sizes and layouts. Provides protection from rain, temperature, and wind, and lasts long.

➤ **Flat (Flat / Apartment):** A single residential unit within a multi-storey building, common in urban areas. Due to urbanization and growing population, vertical construction accommodates more people on limited land. Each flat has its own entrance, kitchen, bedrooms, and bathroom, equipped with modern amenities.

Types of Houses in Different Geographical and Cultural Regions of India

Region	House Name	Place	Description
Western India	Koli House	Gujarat, Maharashtra (Coastal areas)	Made of wood and bamboo, built on high stilts to protect from coastal flooding.
	Kutch Houses	Parts of Gujarat, Rajasthan	Made of mud and wood with roofs covered in bamboo and leaves.
	Rajasthani House	Rajasthan	Made of mud with roofs covered with thorny bushes to protect from heat.
Northern India	Himachali House	Himachal Pradesh	Made of stone and wood, with wooden shingle roofs to withstand snowfall.
	Kumaoni House	Uttarakhand (Kumaon region)	Made of stone and wood with typically mud roofs.
	Manali House	Himachal Pradesh (Manali)	Made of stone or wood, with sloping roofs that help shed snow.
	Ladakhi House	Ladakh	Made of stone with wooden roofs and floors to retain warmth in high-altitude areas.
Eastern India	Bengali House	West Bengal	Generally three-storey houses with roofs of mud or tiles.
	Assamese House	Assam	Made of bamboo and thatch; due to heavy rainfall, built on embankments or 10–12 feet high bamboo stilts.
Southern India	Tamil Nadu House	Tamil Nadu	Traditional houses made of mud and palm leaves, with palm-thatched roofs.
	Keralite House	Kerala	Old-style houses made of wood; roofs of mud or palm leaves, designed to be airy.
North-East India	Mizo House	Mizoram	Made of wood, built on high stilts; roofs of palm leaves.
	Naga House	Nagaland	Made of wood and bamboo, built on high stilts to protect from flooding.
	Assamese House	Assam	Due to heavy rainfall, built on strong bamboo stilts about 10–12 feet high to avoid waterlogging.

Domiciliation

- A natural living place of a living being is called a habitat. It is the residential area where the creature obtains essential resources like food, water, air, and shelter for its life.
- Each living being's habitat depends on its body structure, food habits, temperature, and ecological needs.
- For example, the habitat of tigers is dense forests, where they have ample hunting opportunities, while fish habitats include water sources like rivers, ponds, and seas.

Human Habitat : Human habitat refers to places and conditions where human societies live and maintain their lifestyles. These habitats include physical structures, social organization, economic activities, and cultural elements.

Human habitats can be divided based on population density into two types:

- **Urban Habitat :** An urban habitat is an area where people live in towns or cities. It features high population density, multi-storey buildings, wide roads, urban amenities, and commercial activities. According to the Government of India's Census Department, the main features of an urban habitat are:
 - ✓ Population should be 5000 or more.
 - ✓ 75% of the working population should be engaged in non-agricultural activities.
- **Types of Urban Settlements:**
 - ✓ **Town** – Settlements between villages and cities with relatively low population and limited facilities. Population ranges from 500 to over 10,000.
 - ✓ **City** – Larger settlements with extensive facilities like education, healthcare, transport, and communication. Population over 100,000.
 - ✓ **Suburban Settlement** – Located at some distance from the main city area, developing basic infrastructure and facilities over time.

- ✓ **Metropolitan City (Mahanagar)** – Cities with a population over 1 million, major administrative and commercial centers with wide social, economic, and cultural influence.
- ✓ **Urban Village** – Villages near cities developing along with urban growth, with basic services like schools, shops, post offices, dispensaries. Population ranges from 150 to 500.
- ✓ **Adjacent Town** – Two separate towns that are connected to form an integrated urban area.
- ✓ **Metropolis** – Very large cities with populations over 5 million. Examples: Delhi, Mumbai, Kolkata, New York, London, Paris, Chicago.

- **Rural Habitat :** Rural habitats are residential areas located outside urban regions, mainly dependent on agriculture, animal husbandry, and traditional occupations. These are surrounded by natural environments and have a simple lifestyle.

➤ **Features of Rural Habitat:**

- ✓ **Population and Lifestyle:** Generally low population density. People follow traditional lifestyles like farming, animal rearing, handicrafts.
- ✓ **Basic Facilities and Infrastructure:** Limited availability of roads, electricity, water supply, health services; though some developed villages have better facilities.
- ✓ **Social Structure:** Rural society is divided into small communities. Traditional relationships, caste identity, and local governance like Gram Panchayat are important.
- ✓ **Economic Activities:** Main activity is agriculture. Other activities include cottage industries, fishing, and forest product collection.
- ✓ **Culture and Traditions:** Known for folk culture, festivals, customs, and linguistic diversity, deeply connected with local traditions.

Features of Housing for Healthy Living

A good dwelling is not just a place to live but plays an important role in maintaining a person's physical, mental, and social health. If housing is clean, safe, well-ventilated, and convenient, the quality of life improves. Below is a description of the features necessary for healthy living:

➤ **Cleanliness**

- ✓ For healthy living, it is essential that housing is clean. Maintaining cleanliness inside and around the home prevents diseases, pests, and infections.
- ✓ Garbage should be removed on time, and water stagnation or dirt should not be allowed.

➤ **Proper Ventilation**

- ✓ A healthy dwelling is one where there is free flow of fresh air. Open windows, skylights, and adequate spaces for air circulation are essential.
- ✓ This maintains the oxygen level indoors and reduces the risk of respiratory diseases.

➤ **Natural Light**

- ✓ Adequate entry of natural sunlight keeps the housing environment healthy, warm, and germ-free.
- ✓ Natural light provides Vitamin D and positively affects mental health. Lack of light can lead to depression, fatigue, and vision-related problems.

➤ **Proper Drainage System**

- ✓ A good dwelling should have proper drainage around it so that rainwater or domestic water does not accumulate.
- ✓ Standing water is responsible for spreading diseases like dengue, malaria, etc., through mosquitoes and flies.

➤ **Safety**

- ✓ For healthy living, it is necessary that housing is protected and sturdy enough to withstand natural disasters like earthquakes, storms, or fires.
- ✓ The house should also have security provisions like locks, grills, alarms, and emergency exit routes.

➤ **Environment Friendly**

- ✓ The construction of the house should use environment-friendly methods, such as:
 - Rainwater harvesting systems
 - Energy-saving appliances
 - Use of solar energy
 - Use of natural building materials
- ✓ This maintains environmental balance and ensures a healthy future for the coming generations.

➤ **Adequate Space**

- ✓ A healthy dwelling should provide enough space for each person for privacy, activities, and rest.
- ✓ Overcrowded homes lead to mental stress, risk of infections, and decline in living standards.

➤ **Accessible Location**

- ✓ For healthy living, the dwelling should be located where basic facilities such as drinking water, schools, hospitals, markets, transport, etc., are easily accessible.
- ✓ A convenient location saves time, resources, and energy and makes life smooth.

Ideal Housing

- An ideal house is one that fulfills all the essential needs of human living.
- It is safe, clean, comfortable, well-ventilated, and protected from natural disasters.
- An ideal house is suitable for the physical, mental, and social development of humans.

Materials Used in Building Ideal Housing

S.No.	Material Name	Description (in sentence form)
1	Wood	It is an ancient and traditional building material, generally obtained from trees with a circumference over 600 mm. It has properties like low thermal conductivity, low bulk density, and suitability for mechanical work. Timber such as sal, teak, sheesham, and bamboo is used for doors, windows, and walls. Currently, plywood is also widely used.
2	Cement	It is a very important construction material, made by combining clay and calcium-rich substances. It is mixed with sand and aggregate to produce concrete. It was invented in 1824 by Joseph Aspdin in England. Typically, Portland cement is used, which contains lime, silica, alumina, and iron oxide. It provides compressive strength to concrete.
3	Steel	Steel is called the backbone of the construction industry. It provides tensile strength to concrete. Generally, round-shaped Carbon steel is most commonly used. It is used in structural construction for trusses, beams, and frames. It is strong in compression but weak in tension, so it is combined with concrete.
4	Aggregate	Mainly obtained from igneous, sedimentary, or metamorphic rocks and commonly known as gravel. It makes up the major part of concrete volume. There are two types: coarse aggregates that form the framework of concrete, and fine aggregates that fill the spaces in between. It acts as a filler with cement and sand and bears the load.
5	Brick	A primary material for wall construction, generally made by firing clay at a specific temperature. Its standard size is 19×9×9 cm. Fly ash bricks are also used now. Its bright red color indicates its strength. Bricks are also used to build walls, stairs, roads, etc.
6	Stone	Made of two or more minerals with no definite chemical structure. They are strong and aesthetically pleasing. Basalt, marble, granite, limestone, etc., are used in foundations and decorative work.
7	Sand	An essential component of concrete that acts as a binding material when mixed with cement. Sand is obtained from sediment in riverbeds. It fills the empty spaces between aggregates and strengthens the construction.

Toilet Cleanliness and Good Habits

Toilet cleanliness is extremely important for personal health, social dignity, and environmental balance. A clean and hygienic toilet not only prevents germs and infections but also maintains a healthy environment at home and school. A clean toilet prevents diseases and promotes hygiene.

Benefits

- **Health Protection:** Dirty toilets can spread infectious diseases like diarrhea, cholera, and typhoid.
- **Clean Environment:** Clean toilets keep away foul odors and germs, maintaining a clean environment.

- **Safety and Convenience:** Clean toilets are safer and more convenient for women, children, and the elderly.
- **Support for Swachh Bharat Mission:** Maintaining toilet cleanliness contributes to the success of nationwide cleanliness campaigns.

Ways to Maintain Toilet Cleanliness

To keep toilets clean and germ-free, it is essential to adopt regular cleaning and good habits. A clean toilet not only protects our health but also promotes a culture of cleanliness in the family and society. The following effective measures can help ensure toilet cleanliness:

- **Clean Daily:** Clean the toilet seat, flush, washbasin, walls, and doors daily to avoid bacteria, bad odors, and dirt.
- **Scrub Tiles and Floors:** Use a brush to scrub tiles and floors and clean them thoroughly with disinfectant.
- **Use Toilet Cleaner or Bleach:** For internal cleaning of the toilet, use cleaner or bleach to remove bad odors and germs.
- **Spray Disinfectant:** Use Dettol, phenyl, or other disinfectants to destroy bacteria. Always follow the instructions for cleaning products.
- **Prevent Bad Odors:** Use toilet fresheners, naphthalene balls, or natural fragrance products to keep the environment fresh.
- **Ensure Water Availability:** There should always be enough water in the toilet for proper cleaning and uninterrupted flush system.

- **Wash Hands Every Time:** Washing hands with soap or hand wash after using the toilet is the most effective way to prevent infection.
- **Do Not Throw Garbage in Toilet:** Do not throw tissue paper, sanitary products, or any other solid objects in the toilet, as this can block the pipeline.
- **Use a Dustbin:** Keep a separate dustbin in the toilet and dispose of solid waste in it. It is also necessary to empty the dustbin regularly.
- **Use Public Toilets Properly:** Do not spread dirt in public toilets, do not write on walls, always flush, and maintain cleanliness.
- **Be Aware and Teach Others:** Educate family members, especially children, about proper cleaning and usage of toilets.
- **Support Government Cleanliness Campaigns:** Participate in campaigns like 'Swachh Bharat Mission' to raise awareness about cleanliness in society.

Nirmal Gram Puraskar : It was started in 2003 to recognize and reward those Gram Panchayats (village councils) that achieve 100% cleanliness and become free from open defecation.

Swachh Bharat Mission : It was launched on 02 October 2014 to promote sanitation and solid waste management in the country. Under this, the 3R (Reduce, Reuse, Recycle) policy is adopted.

Central Rural Sanitation Programme : It was started in 1986 to improve the quality of rural life and provide privacy and dignity to women.



- Plants carry out several physio-chemical activities. The study of the functioning of these activities is known as plant physiology.

Plant Water Relations and Physiological Processes

1. Water and Its Importance in Plants

- ✓ Water is essential for maintaining the structure and function of plant cells.
- ✓ It acts as a medium for transporting nutrients and minerals through xylem and phloem.
- ✓ Water movement follows a definite path: Soil → Root hairs → Root cortex → Xylem (root) → Xylem (stem) → Xylem (leaf).
- ✓ Water movement is unidirectional, whereas food transport in phloem is bidirectional.

2. Osmosis and Water Absorption

- ✓ Osmosis is the movement of water across a selectively permeable membrane from high to low water concentration.
- ✓ It equalizes solute concentration and is fundamental for water absorption in plants.
- ✓ Transport of food, amino acids, and hormones requires ATP (active transport).
- ✓ Combined active transport and osmosis ensure efficient absorption of water and minerals.

3. Turgor Pressure and Cell Growth

- ✓ Turgor pressure is the pressure exerted by cell contents against the cell wall.
- ✓ It is essential for cell enlargement and plant growth.
- ✓ Increased water uptake raises turgor pressure, leading to cell expansion.
- ✓ Auxins regulate growth by softening cell walls and promoting elongation.

4. Transpiration

- ✓ Transpiration is the loss of water vapor from aerial parts of plants, mainly through stomata.
- ✓ Steps: Water absorption → Xylem transport → Evaporation through stomata.
- ✓ **Stomata** are small openings on the surface of leaves controlled by **guard cells**.
- ✓ Guard cells regulate stomatal openings and control transpiration and gas exchange.

5. Importance of Transpiration

- ✓ Creates transpiration pull, helping water rise through xylem.
- ✓ Assists in mineral and nutrient transport.
- ✓ Cools the plant through evaporation.
- ✓ Maintains water balance and supports photosynthesis.

6. Guttation

- ✓ Guttation is the exudation of liquid water from leaf margins or tips.
- ✓ Occurs when soil moisture is high, root pressure is strong, and transpiration is low.
- ✓ Takes place through hydathodes.
- ✓ Unlike transpiration, guttation releases liquid water.

7. Transportation and Translocation in Plants

- ✓ Food transport occurs in sieve tubes with the help of companion cells (bidirectional).
- ✓ Transportation includes movement of water, minerals, and nutrients.
- ✓ Occurs at three levels:
 1. Cell-to-cell (diffusion and osmosis).
 2. Long-distance via xylem and phloem.
 3. Exchange between cells and surroundings.

Do You Know That?

- The cuticle reduces water loss.
- Lenticels allow gas exchange and contribute slightly to transpiration.

Transport of Minerals:

- The movement of **essential minerals (ions and nutrients) from the soil through roots to other plant parts via xylem.**

Translocation of Organic Solutes:

- Translocation is the **movement of organic solutes**, mainly sucrose, from the source (usually leaves or storage organs) to the sink (roots, fruits, flowers, and growing tissues) through the phloem.

- The flow is bidirectional, meaning it can move upward or downward depending on the plant's requirements.

Minerals in Plants:

- **Plants require essential nutrients for growth, which are obtained from soil, water, and air. Carbon and oxygen are taken from atmospheric carbon dioxide, while hydrogen is obtained from water.**
- Mineral nutrients such as nitrogen, phosphorus, potassium, calcium, and magnesium are absorbed from the soil, with nitrogen being one of the most important elements for plant growth.

Classification of Plants Based on Nutritional Mode

Type of Plant	Nutritional Mode	Examples
Autotrophic Plants	Synthesize their own food using photosynthesis.	Mango, Grass, Sunflower
Heterotrophic Plants	Depend on other organisms for food.	Cuscuta (Parasite), Nepenthes (Carnivorous)
Symbiotic Plants	Form mutualistic relationships with other organisms for nutrients.	Lichens (Algae + Fungi), Legumes (Rhizobium)
Saprophytic Plants	Derive nutrients from decaying organic matter.	Mushrooms, Indian Pipe (Monotropa)

Essential Plant Nutrients:

- Plants require **17 essential elements** for growth and metabolism, classified into **macronutrients** (large amounts) and **micronutrients** (small amounts).

Macronutrients (Required in Large Quantities)

Nutrient	Function	Deficiency Symptoms
Nitrogen (N)	Used in the synthesis of proteins, enzymes, and chlorophyll.	Yellowing of leaves (chlorosis)
Phosphorus (P)	Root growth, ATP and DNA synthesis.	Poor root development
Potassium (K)	Enzyme activation, stomatal regulation, helps crops withstand pests.	Wilting, weak stems
Calcium (Ca)	Cell wall structure, membrane stability, also helps crops withstand pests.	Stunted growth, necrosis
Magnesium (Mg)	Chlorophyll synthesis, enzyme activation, helps crops withstand pests.	Yellowing between leaf veins
Sulfur (S)	Amino acids, proteins, and vitamins.	Yellowing of younger leaves

Micronutrients (Required in Small Quantities)

Nutrient	Function	Deficiency Symptoms
Iron (Fe)	Micronutrient that helps in chlorophyll formation and enzyme activity.	Interveinal chlorosis (yellowing between veins)
Zinc (Zn)	Enzyme activation, auxin (growth hormone) production.	Stunted growth, curling of leaves

Manganese (Mn)	Photosynthesis and respiration.	Brown spots on leaves
Boron (B)	Cell division, flowering, and fruiting.	Poor flower formation
Copper (Cu)	Enzyme activation, lignin formation.	Pale leaves, wilting
Molybdenum (Mo)	Nitrogen metabolism.	Yellowing of leaves
Nickel (Ni) and Cobalt (Co)	Involved in nitrogen fixation and metabolism (trace micronutrients).	—

Absorption and Movement of Minerals:

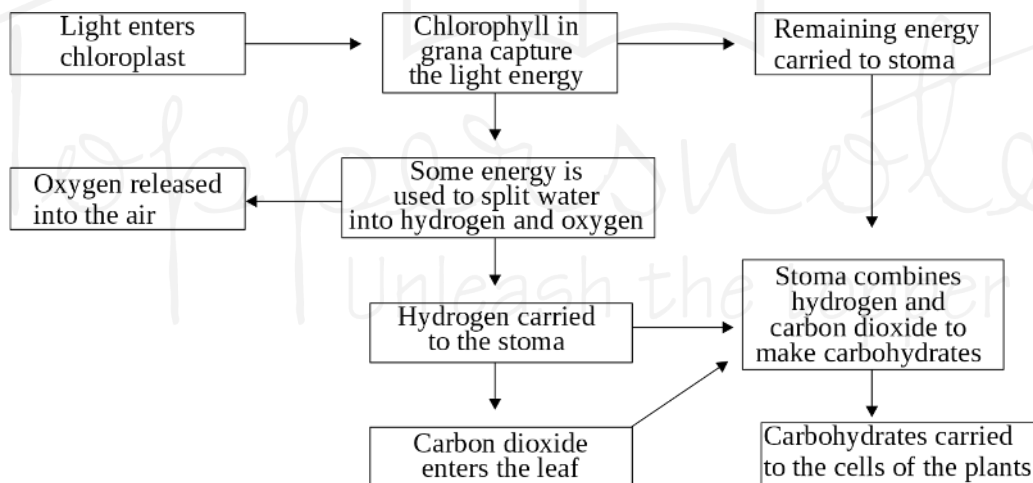
- Minerals are efficiently absorbed from the soil solution through the **root zone**, which is the primary site for water and nutrient uptake in plants.

Types of Plants Based on Light

- **Heliophytes (Sun-loving plants)**
 - ✓ Adapted to grow in high sunlight conditions (open fields or forest canopies).
 - ✓ Example: Banyan tree.
 - ✓ Often have smaller leaves and thicker cuticles to reduce water loss.
- **Sciophytes (Shade-loving plants)**

- ✓ Adapted to grow in low-light or shaded environments.
- ✓ Have larger leaves and more chlorophyll; photosynthesis saturates at about 20% of full sunlight.
- ✓ Example: Orchids.
- **Autotrophic Mode of Nutrition:** Plants follow the autotrophic mode of nutrition, meaning they prepare their own food.
 - ✓ The process by which plants synthesize food is called **photosynthesis**.
 - ✓ During photosynthesis, the carbon and energy requirements of autotrophic organisms are fulfilled.

Photosynthesis in Plants :



- Photosynthesis is the process by which green plants synthesize food (glucose) using sunlight, carbon dioxide (CO₂), and water (H₂O) in the presence of chlorophyll.
 - ✓ This process releases oxygen (O₂) as a byproduct or Waste Product.
- **Photosynthesis Reaction:**

$$6\text{CO}_2 + 6\text{H}_2\text{O} + \text{Light Energy} \rightarrow \text{C}_6\text{H}_{12}\text{O}_6 + 6\text{O}_2$$

- ✓ **Reactants:** Carbon dioxide (CO₂), Water (H₂O), Light Energy
- ✓ **Products:** Glucose (C₆H₁₂O₆), Oxygen (O₂)
- ✓ During photosynthesis, the carbohydrates synthesized are stored in the form of **starch**.
- ✓ The energy conversion in photosynthesis → **Light energy to chemical energy.**

Factors	Light-Dependent Reactions	Light-Independent Reactions
Location	Thylakoid membrane	Stroma
Requirements	Sunlight, Water (H₂O), ADP, NADP⁺	CO₂, ATP, NADPH
End Products	ATP, NADPH, Oxygen (O₂)	Glucose (C₆H₁₂O₆)

Process of Photosynthesis

- **Light Reactions:**
 - ✓ Chlorophyll absorbs photons (light energy).
 - ✓ Water splitting (photolysis): $\text{H}_2\text{O} \rightarrow 2\text{H}^+ + 2\text{e}^- + \frac{1}{2}\text{O}_2$; oxygen is released as a byproduct.
 - ✓ ATP and NADPH are produced through the electron transport chain (ETC).
 - ✓ Overall, six water molecules are formed from twelve water molecules during the complete photosynthetic reaction.
- **Dark Reactions (Calvin Cycle):**
 - ✓ CO_2 combines with RuBP in the presence of the enzyme RuBisCO.
 - ✓ ATP and NADPH convert CO_2 into a three-carbon compound (G3P).
 - ✓ Some G3P regenerates RuBP, while the rest is used to form glucose.

Chloroplast and Pigments

- Chloroplasts in green plant cells contain chlorophyll, the main site of photosynthesis.
- Chlorophyll captures light energy from sunlight.
- Carotenoids are accessory pigments that assist in trapping light energy.

Adaptations in Desert Plants (CAM Plants)

- CAM plants open their stomata at night to reduce water loss and take in CO_2 .
- CO_2 absorbed at night forms intermediate compounds for use during the day.

- In desert plants like cactus, the stem performs photosynthesis.

Essential Elements

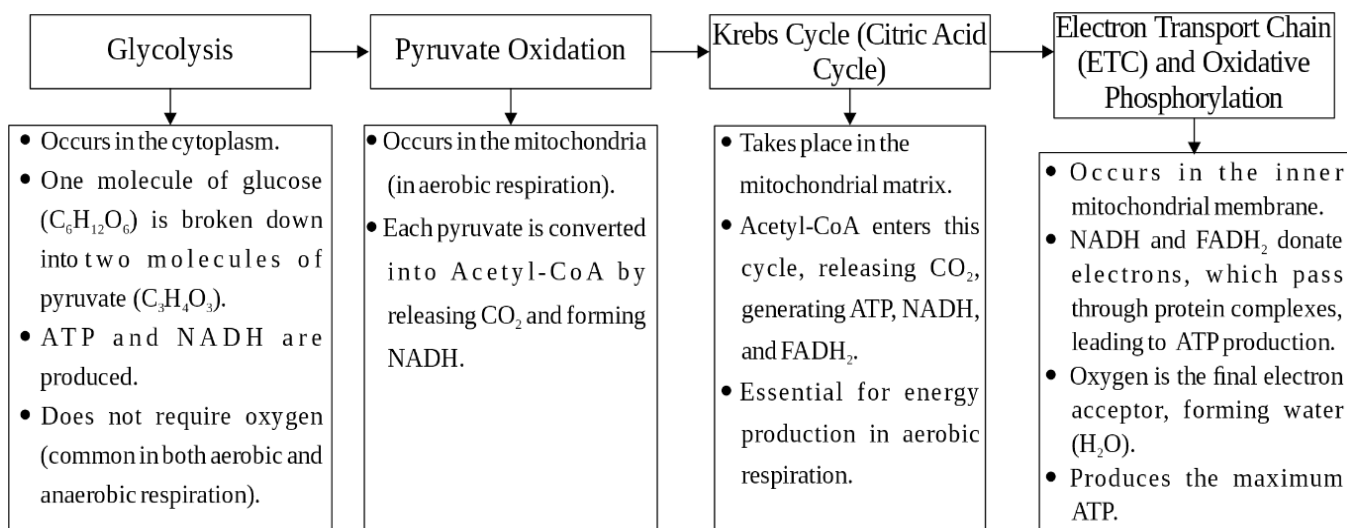
- Plants require nitrogen, phosphorus, magnesium, and iron from the soil.
- Chlorophyll contains carbon, hydrogen, and magnesium, with magnesium as the central atom.
- Richard Willstätter identified magnesium as the central atom in chlorophyll.

Efficiency of Photosynthesis

- Green plants capture only about 1% of sunlight energy in terrestrial ecosystems.
- Sugarcane is an efficient plant in converting sunlight into chemical energy.

Respiration in Plants:

- Respiration is a catabolic process in which complex organic compounds like glucose are oxidized in the cytoplasm (and mitochondria) in the presence of enzymes to release energy in the form of **ATP, involving exchange of oxygen and carbon dioxide.**
- Aerobic respiration requires oxygen.” & “The exchange of carbon dioxide and oxygen in plants takes place through diffusion.
- Plants **exchange gases through stomata.**
- In woody plants, gaseous exchange occurs through the small pores in the stem called lenticels.
- At night, plants continue to respire but do not perform photosynthesis. Therefore, they release CO_2 instead of oxygen.



Classification of Respiration:

Type	Oxygen Requirement	Breakdown of Glucose	ATP Yield	Equation	Example / Location
Aerobic Respiration	Requires oxygen	Complete breakdown	~36–38 ATP	$C_6H_{12}O_6 + 6O_2 \rightarrow 6CO_2 + 6H_2O + \text{Energy (ATP)}$	Occurs in mitochondria of most plants under normal conditions
Anaerobic Respiration	Occurs without oxygen	Partial breakdown	~2 ATP	Ethanol + CO ₂ (yeast) / Lactic acid (muscle)	Flooded plant roots, germinating seeds, yeast

- Complete the step of anaerobic respiration: Glucose → Ethanol + CO₂ + Energy (ATP).
- **Fermentation:** The process is the pyruvate converted into ethanol and carbon dioxide.
 - ✓ **Equation in plants (Fermentation process):** $C_6H_{12}O_6 \rightarrow 2C_2H_5OH$ (Ethanol) + 2CO₂ + Energy (ATP)
 - ✓ Fermentation in yeast and anaerobic respiration in human muscle cells are similar because **both take place in the cytoplasm** of the cell.
- **Respiration Steps and Intermediates**
 - ✓ **Glucose** is the **best organic substrate** for respiration.
 - ✓ **Glycolysis** is the process where **glucose is converted into pyruvic acid**.
 - ✓ **Pyruvic acid** is the **intermediate substance** in the breakdown of glucose.
 - ✓ **Yeast** uses nutrients for the **fermentation process**.
 - ✓ **Pyruvate** is the **common product** formed initially in both aerobic and anaerobic respiration.

- ✓ **Three-carbon molecules** formed during respiration include **lactic acid and pyruvate**.
- **Effects and Byproducts**
 - ✓ If the rate of respiration exceeds photosynthesis, more food will be oxidized than produced, and the plant will starve and die.
 - ✓ Waste products of plants include CO₂, O₂, and water vapour.
 - ✓ Many excretory products of plants are useful, such as gums and resins (stored in old xylem).

Excretion in Plants:

- Excretion in plants is the process by which plants remove or manage metabolic waste products formed during respiration, photosynthesis, and other life processes. Since plants lack specialized excretory organs, they eliminate wastes through different structural and physiological methods.

Modes of Excretion in Plants:

Mode of Excretion	Description	Examples
Gaseous Waste Removal	Oxygen (O ₂) is released during photosynthesis and carbon dioxide (CO ₂) during respiration. Gases diffuse out through stomata (leaves) and lenticels (stems).	O ₂ and CO ₂ diffusion
Storage in Vacuoles	Wastes like alkaloids, tannins, and essential oils are stored in vacuoles; often serve defensive roles.	Nicotine (tobacco), Quinine (Cinchona), Tannins (bark), Eucalyptus oil
Leaf Fall (Abscission)	Waste products accumulate in old leaves, which are later shed.	Deciduous trees
Excretion through Bark & Old Xylem	Wastes deposited in bark and old xylem; resins and gums may aid in wound healing.	Resin (pine), Gum (Acacia)

Root Excretion	Roots release wastes into soil by diffusion; some plants excrete organic acids to alter soil conditions. Aquatic plants diffuse wastes into water.	Citric acid, Oxalic acid
Special Structures	Hydathodes release excess water (guttation); nectaries secrete sugars; salt glands remove excess salts.	Guttation (grass), Nectaries (flowers), Salt glands (mangroves)

Coordination in Plants :

➤ Coordination in plants is the control of growth and responses to stimuli **through plant hormones**.

Types of Tropic movement		
Types	Descriptions	Examples
Phototropism (Response to Light)	<ul style="list-style-type: none"> ➤ Movement of a plant towards or away from light. ➤ Hormone Involved: Auxin (accumulates on the shaded side, promoting growth). 	<ul style="list-style-type: none"> ➤ Positive phototropism: Shoots grow toward the light. ➤ Negative phototropism: Roots grow away from light.
Geotropism (Response to Gravity)	<ul style="list-style-type: none"> ➤ Growth response to gravity. 	<ul style="list-style-type: none"> ➤ Positive geotropism: Roots grow downward (in the direction of gravity). ➤ Negative geotropism: Shoots grow upward (against gravity).
Hydrotropism (Response to Water)	<ul style="list-style-type: none"> ➤ Growth in response to water availability. ➤ More dominant than geotropism (roots prioritize water over gravity). 	<ul style="list-style-type: none"> ➤ Roots grow toward moisture (positive hydrotropism) to absorb water.
Thigmotropism (Response to Touch)	<ul style="list-style-type: none"> ➤ Response to contact with a solid object. ➤ Helps plants attach to structures for support. 	<ul style="list-style-type: none"> ➤ Tendrils of climbing plants (like pea plants, vines) coil around a support.
Chemotropism (Response to Chemicals)	<ul style="list-style-type: none"> ➤ Growth in response to chemical stimuli. 	<ul style="list-style-type: none"> ➤ Pollen tube growth toward the ovule in fertilization (positive chemotropism). ➤ Roots growing away from harmful chemicals (negative chemotropism).
Thermotropism (Response to Temperature)	<ul style="list-style-type: none"> ➤ Response to temperature changes. 	<ul style="list-style-type: none"> ➤ Certain plants close their flowers in cold temperatures to conserve energy.

Plant Hormones:

➤ The hormones (Chemical messengers) present in plants which cause control and coordination in them are called **plant hormones or phytohormones**. The term "hormone" was first used by **Ernest Starling in 1905**.



Hormones	Functions	Examples / Notes
Abscisic Acid (ABA)	<ul style="list-style-type: none"> ➤ Inhibits plant growth and induces dormancy in seeds. ➤ Promotes stomatal closure to reduce water loss during drought. ➤ Involved in leaf abscission (shedding). ➤ Helps plants respond to stress conditions (cold, heat, salt stress). ➤ It is responsible for wilting of leaves 	<ul style="list-style-type: none"> ✓ Used to induce dormancy in seeds before storage. ✓ Helps in drought resistance by reducing water loss.

Ethylene (Growth Inhibitor & Promoter)	<ul style="list-style-type: none"> ➤ Promotes fruit ripening (bananas, mangoes). ➤ Induces leaf and flower senescence (aging). ➤ Stimulates abscission (shedding) of leaves, flowers, and fruits. ➤ Helps in breaking seed dormancy. ➤ Plays a role in stress responses (drought, flooding). 	<ul style="list-style-type: none"> ✓ Used for artificial fruit ripening (ethylene treatment in mangoes, bananas). ✓ Used to promote flowering in pineapples.
Auxins (Growth Promoters)	<ul style="list-style-type: none"> ➤ Promotes cell elongation in shoots. ➤ Stimulates root initiation and growth. ➤ Controls apical dominance (inhibits lateral bud growth). ➤ Helps in phototropism and geotropism (plant responses to light and gravity). ➤ Used in tissue culture and fruit development (prevents premature fruit drop). 	<ul style="list-style-type: none"> ✓ Used for vegetative propagation (cutting and grafting). ✓ Used in weed control (2,4-D selectively kills dicots). ✓ Natural Auxin: Indole-3-acetic acid (IAA). ✓ Synthetic Auxins: Indole-3-butyric acid (IBA), 2,4-D (Weed killer).
Gibberellins (GAs) (Growth Promoters)	<ul style="list-style-type: none"> ➤ Stimulates stem elongation (tallness in plants). ➤ Breaks seed dormancy and promotes germination. ➤ Induces flowering and fruit development. ➤ Delays senescence (aging) of leaves. 	<ul style="list-style-type: none"> ✓ Used to increase fruit size (grapes, apples). ✓ Used in malting of barley (breaking dormancy). ✓ Induces parthenocarpy (seedless fruits like grapes). ✓ Gibberellic Acid (GA₃) – Most common form.
Cytokinins (Growth Promoters)	<ul style="list-style-type: none"> ➤ Promotes cell division in roots and shoots. ➤ Delays leaf senescence (aging). ➤ Stimulates lateral bud growth, overcoming apical dominance. ➤ Works with auxins in tissue culture to induce shoot formation. ➤ Cytokinin (high in developing fruits) 	<ul style="list-style-type: none"> ✓ Used to increase shelf life of vegetables and flowers. ✓ Helps in micropropagation (tissue culture techniques). ✓ Natural Cytokinin: Zeatin. ✓ Synthetic Cytokinins: Kinetin, Benzyladenine (BA).

Reproduction in Plant :

- **Sexual reproduction** in plants involves the fusion of male and female gametes to produce offspring.
- The **flower** is the reproductive organ of flowering plants.
- A **unisexual flower** contains either stamens or a pistil (e.g., corn, papaya, cucumber).
- A **bisexual flower** contains both stamens and pistil (e.g., mustard, rose, petunia).
- The **androecium** is the male reproductive part and consists of stamens, each made up of an anther and a filament.

- The **anther** contains pollen grains, which produce male gametes.
- Meiosis occurs in the anther (pollen mother cells), producing haploid pollen grains and halving the DNA content.
- **Pollen grains** are spherical and have a two-layered wall: outer exine and inner intine.
- A mature pollen grain contains a vegetative cell and a generative cell; the generative cell divides mitotically to form two male gametes.
- The **pistil (gynoecium)** is the female reproductive part and consists of stigma, style, and ovary.
- The ovary contains ovules, and the female gamete (egg) is formed inside the ovule.

Types of Reproduction in Plants

1. Asexual Reproduction:

➤ Asexual reproduction occurs without the involvement of gametes (sex cells). **It results in offspring that are genetically identical (clones) to the parent.**

➤ Types of Asexual Reproduction

Method	Description	Example
Vegetative Propagation	New plants grow from stems, roots, or leaves.	Potato (tuber), Onion (bulb), Strawberry (runner)
Budding	A small outgrowth (bud) develops into a new individual.	Yeast
Fragmentation	The plant body breaks into pieces, each growing into a new plant.	Algae (Spirogyra)
Spore Formation	Special cells called spores are released, which grow into new plants.	Ferns, Fungi (Mushrooms)

➤ Asexual Reproduction

- ✓ Leishmania → **Regeneration**
- ✓ Yeast → **Budding**
- ✓ Plasmodium → **Multiple fission**
- ✓ Hydra → **Regeneration**

"Pollination is not an asexual form of reproduction in plants; it is a process that leads to sexual reproduction."

2. Sexual Reproduction in Plants:

➤ Sexual reproduction involves the fusion of male and female gametes and results in genetic variation.

➤ **It occurs in flowering plants (angiosperms) as well as non-flowering plants like gymnosperms and ferns.**

a. Pollination:

➤ Pollination is the transfer of pollen grains from the anther to the stigma of a flower.

➤ **Self-pollination (Autogamy): Pollen reaches the stigma of the same flower.** It does not require external agents and prevents pollen wastage, but it does not produce new varieties.

➤ **Cross-pollination: Pollen is transferred to the stigma of another flower of the same species.** It requires external agents, causes some pollen wastage, but produces new varieties and more viable seeds.

➤ Agents for Cross-Pollination

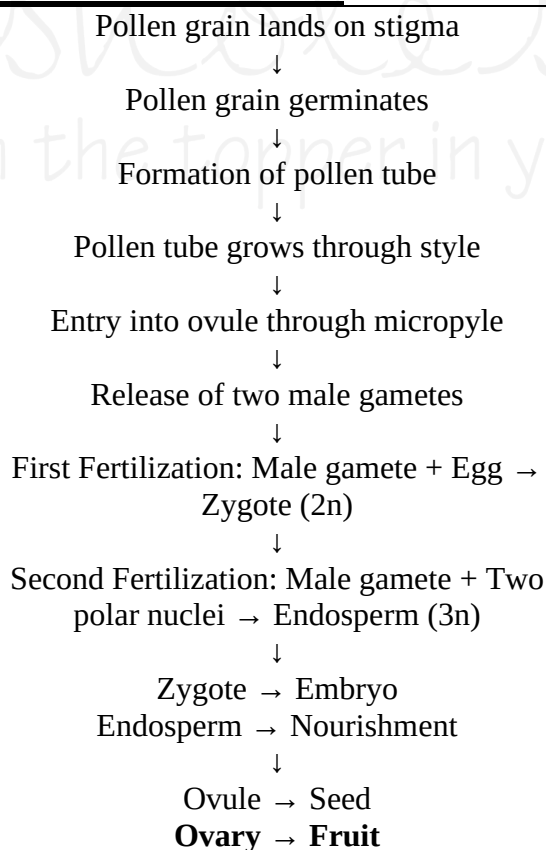
Agents	Descriptions	Examples
Water	Hydrophily, in aquatic plants	Hydrilla, Vallisneria
Air	Anemophily, pollen blown long distances	Grasses, Some cacti

Insects	Entomophily, flowers attract insects with color, smell, nectar	Honeybees
Animals	Zoophily, flowers attract animals	Squirrels pollinate silk cotton trees

- Pollination by birds is called → **Ornithophily**
- Transport of male gametes in bryophytes and pteridophytes occurs through → **Water**

Fertilization in Plants:

Process of Fertilization:



- After landing on the stigma, the pollen grain germinates and forms a pollen tube.
- The pollen tube grows down through the style toward the ovule inside the ovary.
- Male gametes travel through the pollen tube to reach the ovule.
- The pollen tube enters the ovule through a small opening called the micropyle.
- Inside the ovule, the embryo sac contains the egg cell and other supportive cells.
- Double fertilization (unique to angiosperms) occurs inside the ovule.
- One male gamete fuses with the egg cell to form a zygote (first fertilization).
- The second male gamete fuses with two polar nuclei to form a triploid endosperm nucleus (second fertilization).
- The zygote develops into an embryo, and the endosperm provides nourishment to the growing embryo.
- After fertilization, the ovule develops into a seed, and fertilization takes place inside the ovary of the flower.

- "Fertilization in plants takes place in the ovary of the flower."
- "After fertilization in plants, the ovule gets converted into a seed."
- "When a pollen grain lands on the stigma, it first grows a pollen tube to transfer its nucleus to the ovule."

Formation of Seed and Fruit

- After fertilization, the **ovule develops into a seed**, and the **ovary develops into a fruit**.

- Most floral parts (stamens, petals, style, stigma) usually wither and fall off; sepals may persist in some plants.
- The ovary wall thickens to form the **pericarp** (fruit wall).

Structure of Seed:

- **Embryo** – The developing young plant.
- **Endosperm** – Stored food (present in seeds like maize; absent in seeds like beans).
- **Seed coat (Testa)** – Protective outer covering.
- **Cotyledons** – Seed leaves that store or absorb nutrients.
- The **radicle** develops into the root during germination.
- The embryo grows into a **seedling** under suitable conditions.

Important Facts:

- **Apple** is a false (accessory) fruit; the edible part develops from the thalamus.
- **Banana** plants are monocarpic, flowering only once in their lifetime.
- **Mulberry** is a multiple fruit (sorosis) formed from fused flowers.
- In **poppy**, seeds are dispersed through pores (sieve-like mechanism).
- During the **Green Revolution**, high-yielding variety (HYV) seeds were introduced.
- **Protogyny** refers to a condition where the female reproductive organs mature before the male ones (not actual sex change).