LESSON NOTE 7

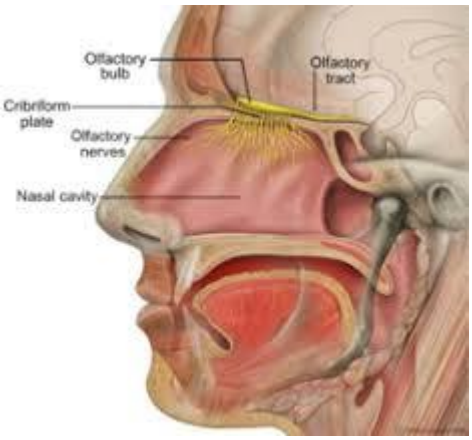
SENSE ORGANS

Sense organs are specialized structures in the human body that enable the perception of various stimuli from the external environment. These organs play a crucial role in gathering information about the surroundings and transmitting signals to the nervous system, allowing individuals to interpret and respond to their environment.

The primary sense organs include:

1. Eyes (Vision): Detects light and colour, allowing the sense of vision. Located at the Orbit of the skull.
2. Ears (Hearing and Balance): Detects sound waves for hearing and contributes to balance and spatial orientation. Located at the sides of the head.
3. Nose (Smell): Detects airborne molecules, providing the sense of smell. Located at the nasal cavity.
4. Tongue (Taste): Contains taste buds that detect different flavours, providing the sense of taste. Located in the mouth.
5. Skin (Touch, Temperature, and Pressure): Detects various stimuli such as pressure, temperature, and touch.

THE NOSE

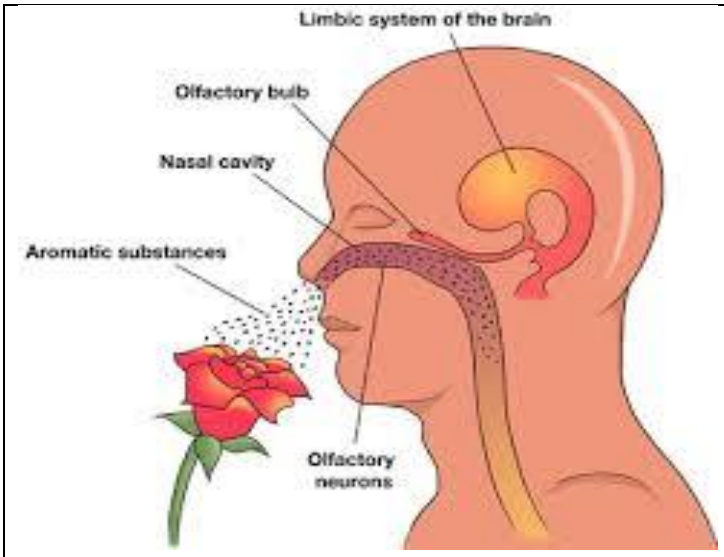


The **nose** is the organ responsible for the **sense of smell**. This sense helps us detect **odors** in our surroundings. Whether it's the sweet smell of flowers or the bad smell of rotten food, our nose helps us recognize these through a special system called the **olfactory system**.

Structure of the Nose (Olfactory System)

The sense of smell depends on **olfactory receptors**, which are tiny sensory cells located **at the top of the nasal cavity**.

Parts involved in smell:



- **Nostrils:** Openings through which air enters the nose.
- **Nasal cavity:** Hollow space behind the nose, lined with mucus.
- **Olfactory receptors:** Special cells that detect smell; found high inside the nasal cavity.
- **Olfactory nerve:** Carries smell signals from the nose to the brain.
- **Brain (olfactory bulb):** Interprets the signals and helps us recognize smells.

Mechanism of smelling with the help of olfactory chemoreceptor

- **Airborne particles** from objects (like perfume or food) enter the nostrils.
- These particles **dissolve in the mucus** inside the nose.
- The **olfactory receptors** detect the dissolved particles.
- The receptors send **nerve signals** through the **olfactory nerve** to the **olfactory bulb** in the brain.
- The brain **interprets the signal**, allowing us to identify the smell.

Adaptation for survival

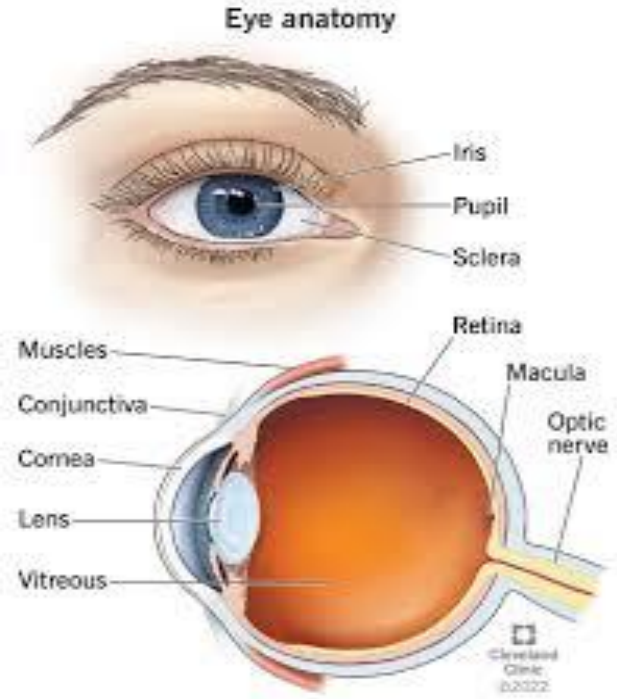
Adaptation for survival is a crucial aspect of the evolutionary process, and behaviours like sniffing in animals, such as dogs during hunting, are excellent examples. Here's how this adaptation contributes to survival:

1. Enhanced Detection of Odours: Dogs have an acute sense of smell, and sniffing allows them to detect and analyse a wide range of odours in their environment. This heightened olfactory ability is a result of evolutionary adaptations in their nasal anatomy and a large number of olfactory receptors.
2. Tracking and Hunting: Sniffing helps dogs track and locate prey. The ability to follow scent trails enables them to locate food sources efficiently, making them effective hunters.
3. Identification of Surroundings: Dogs use sniffing not only for hunting but also to gather information about their surroundings. They can detect the presence of other animals, identify territories, and assess potential threats or resources.
4. Communication: Dogs use scent marking and sniffing as a means of communication with other animals. This is important for establishing social hierarchies, identifying individuals, and conveying information about their presence.

5. Survival Instinct: The ability to use their sense of smell for survival is deeply ingrained in dogs' instincts. It helps them navigate and make decisions in their environment, contributing to their overall survival and success as a species.
6. Avoidance of Danger: Dogs can sniff out potential dangers, including predators or hazardous substances. This ability aids in avoiding threats and navigating through environments safely.

LESSON NOTE 8

SENSE ORGANS: THE EYE



The eye is the organ responsible for vision in humans and many animals. It is a complex sensory organ that detects light and converts it into electrical signals, which are then transmitted to the brain for interpretation.

The sense organ for sight is the eye. Its main parts include:

1. Cornea: The transparent outermost layer that helps focus light onto the retina.
2. Pupil: The adjustable opening in the center of the eye that controls the amount of light entering.
3. Iris: Colored part of the eye surrounding the pupil, controlling the size of the pupil and thus the amount of light that enters.
4. Lens:Transparent structure behind the iris that further focuses light onto the retina.
5. Retina: Innermost layer containing light-sensitive cells (rods and cones) that convert light into nerve signals.
6. Optic Nerve: Transmits nerve signals from the retina to the brain for visual processing.
7. Sclera: Tough, white outer layer providing structural support to the eye.
8. Vitreous Humor: Gel-like substance filling the inner cavity of the eye, maintaining its shape.

9. Aqueous Humor: Clear fluid between the cornea and lens, helping maintain eye pressure.

Functions of the eyes

The eyes perform two primary functions: image formation and accommodation.

1. Image Formation:

- Light enters the eyes through the cornea, where it undergoes initial refraction.

- The lens further refracts the light to focus it onto the retina at the back of the eye.

- The inverted image formed on the retina is then converted into electrical signals.

2. Accommodation

- Accommodation is the ability of the eyes to adjust their focus for objects at different distances.

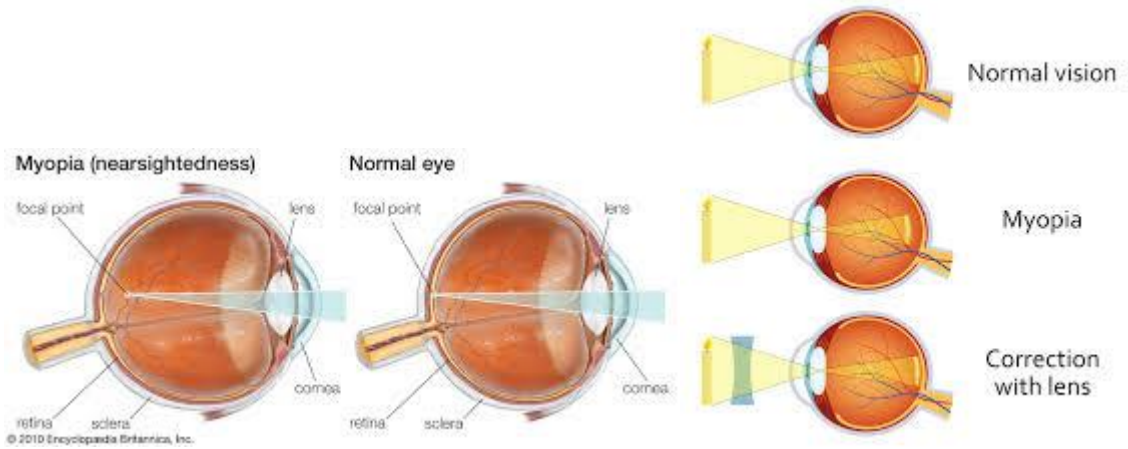
- Controlled by the ciliary muscles, accommodation changes the shape of the lens to refine the focus.

- This dynamic process ensures that images of objects at varying distances are sharply focused on the retina.

EYE DEFECTS AND CORRECTION

Common eye defects include:

1. **Myopia (Near-sightedness):**

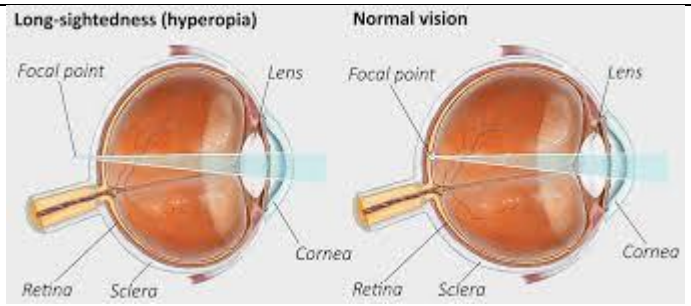


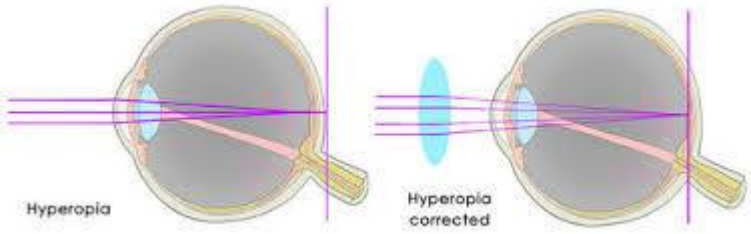
- Difficulty seeing distant objects clearly.

- Light focuses in front of the retina instead of on it.

- Corrected with concave lenses.

2. **Hypermetropia (Farsightedness):**





- Difficulty focusing on close objects.

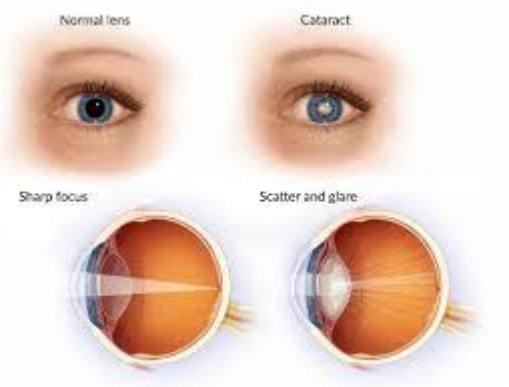
- Light focuses behind the retina.

- Corrected with convex lenses.

Eye problems/diseases

Various eye problems and diseases include:

1. Cataract:



- Clouding of the eye's lens, leading to blurred vision.

- Common with aging but can also result from injury or medical conditions.

- Surgical removal of the affected lens is a common treatment.

2. Night Blindness (Nyctalopia):

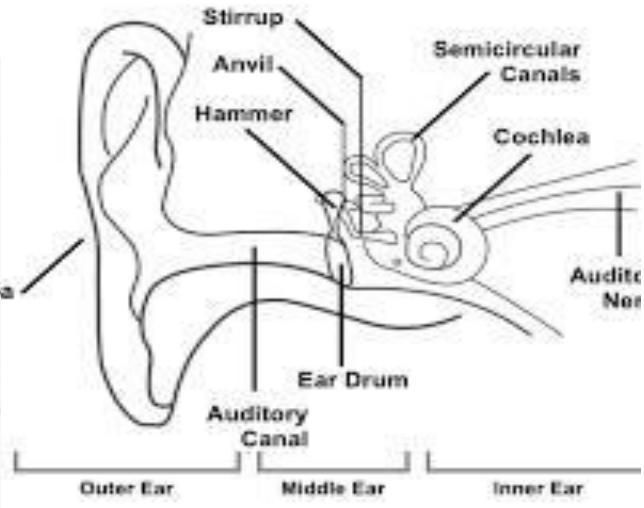
- Difficulty seeing in low light conditions.

- Often linked to vitamin A deficiency or conditions affecting the retina.

- Supplements or addressing the underlying cause may improve night vision.

SENSE ORGANS CONTINUED

The Human Ear



The ear is a vital sense organ responsible for **hearing** and **maintaining balance**. It is divided into three main parts:

◆ **1. Outer Ear**

- **Pinna (Auricle):** The visible part of the ear that is soft and flexible and only found in mammals. It detects the direction of sound waves, collects them and directs them into the auditory meatus (ear tube).

- **Auditory Meatus or Ear tube:** passage that contains wax-producing glands and fine hairs. Carries sound to the eardrum

◆ **2. Middle Ear**

- **Eardrum (Tympanic membrane):** Vibrates when hit by sound waves.
- **Ossicles:** Three tiny bones (malleus, incus, stapes) that amplify vibrations.
- **Eustachian Tube:** Balances pressure between the ear and the environment.

◆ **3. Inner Ear**

- **Cochlea:** Spiral-shaped organ that converts vibrations into nerve impulses.
- **Semicircular Canals:** Help in maintaining balance.
- **Auditory Nerve:** Sends signals to the brain.

Functions of the Ear

1. **Hearing** – Detects and transmits sound to the brain.
2. **Balance** – Maintains body equilibrium through the semi-circular canals.

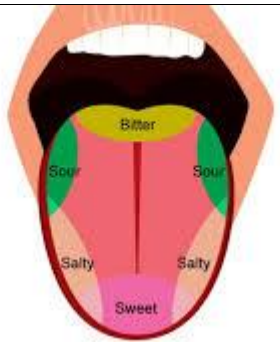
The Human Tongue

The tongue is a muscular organ in the mouth that helps in **taste**, **chewing**, **swallowing**, and **speech**. It is covered with **taste buds** located in structures called **papillae**.

◆ **Parts of the Tongue**

- **Papillae:** Small projections containing taste buds.
- **Taste Buds:** Sensory cells that detect different tastes.

Types of Taste Detected



1. **Sweet** – Tip of the tongue.
2. **Salty** – Front sides of the tongue.
3. **Sour** – Back sides of the tongue.
4. **Bitter** – Back of the tongue.
5. **Umami** – (Savory taste) found throughout.

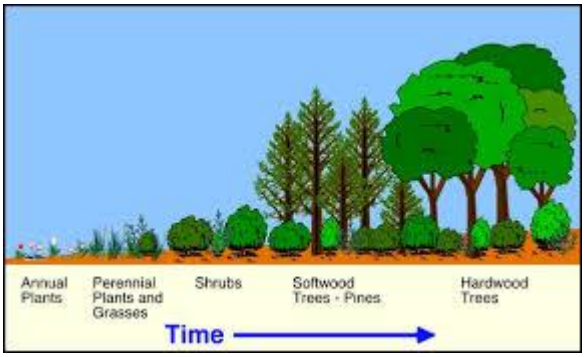
Functions of the Tongue

1. **Taste Detection** – Senses sweet, sour, salty, bitter, and umami.
2. **Speech** – Helps form words.
3. **Chewing and Swallowing** – Moves food and mixes it with saliva.

LESSON NOTE 9

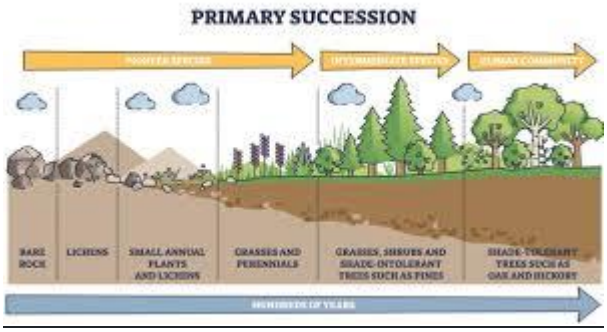
ECOLOGY OF POPULATION

SUCCESSION



This is the orderly change in the inhabitants of an area over time. It can be defined as the step by step orderly and gradual replacement of communities of organisms that lead to a climax community.

Types of Succession



Primary Succession: this type begins from bare ground, bare body of water or bare rock. The first in any succession are called primary colonizers and are usually autotrophic plants, followed by lichens and mosses in the second year and by the third year small herbaceous plant may be present. As years pass by, more species come into the habitat, while some face out until a climax is reached. Then bigger life forms like shrubs and trees are found growing.

Secondary Succession: this type occurs when an area has not been totally stripped of soil and vegetation. It begins from an existing community which has been interfered with by man and other factors such as drought, floods.

DIFFERENCE BETWEEN PRIMARY AND SECONDARY SUCCESSION

Primary succession	Secondary succession
-starts on bare surface	starts on colonized surface
-takes longer time to reach climax	reaches climax faster
-starts with lower organisms	starts with fairly complex organisms

CHARACTERISTICS OF SUCCESSION

- Pioneer organisms are producers
- Biodiversity of organisms which increase from year to year
- Orderly, starting with microscopic green plants and ending with big trees
- Competition among organism for available resources (water, oxygen, light, space) etc.

The final outcome of succession is the climax or stable community and it is characterised by

- High biodiversity

- Complex food webs
- Stable population sizes
- Efficient nutrient recycling- via decomposers
- Resistance to change i.e can recover from minor disturbances
- Sustainable energy flow throw tropic levels

POPULATION SPACE

This refers to the physical area occupied by individuals of a population. Factors that affect space include;

- Availability of food and water
- Shelter and breeding sites
- Climate and environmental conditions
- Human activities (deforestation, farming)
- Competition
- Predation

Importance of population space:

- Ensures organisms have access to resources for survival
- Reduces stress and competition
- Helps maintain ecological balance
- Prevents spread of disease
- Promotes healthy reproduction.

Population density studies

Population density studies in ecology involve examining the number of individuals of a species within a defined area and understanding the interactions between population size and available resources. These studies are closely linked to the availability of resources, as population density is often influenced by the quantity and distribution of essential resources such as food, water, and shelter. This relationship is crucial for several reasons:

1. Resource Management: Population density studies help in managing and preserving resources by providing insights into how populations utilize available food, water, and habitat.
2. Carrying Capacity: By monitoring population density in relation to available resources, scientists can estimate the carrying capacity of an ecosystem, which is the maximum population size it can sustain.
3. Conservation Planning: Understanding how population density responds to resource availability is essential for developing effective conservation strategies, ensuring the long-term survival of species.
4. Predicting Population Trends: Population density studies allow scientists to predict how populations might change over time in response to fluctuations in resource availability, climate, or other environmental factors.

LESSON NOTE 10

ECOLOGY OF POPULATION

RELATIONSHIP BETWEEN SUCCESSION AND COMPETITION

As succession progresses:

- Different species **compete** for limited **resources** such as light, nutrients, water, and space.
- **Competition** drives **natural selection**: species that are better adapted outcompete others.
- This leads to the **replacement** of early colonizers (pioneer species) with more competitive organisms.
- Eventually, the ecosystem reaches a **climax stage** with less dramatic changes.

Example:

- In a grassland succession, grasses may first dominate, but are later replaced by shrubs and trees as they outcompete grasses for sunlight and water.

COMPETITION

Competition is the interaction between organisms (of the same or different species) that vie for the same limited resources—such as food, space, water, light, and mates—within an environment.

It occurs when demand exceeds supply, especially during overcrowding, **succession**, or **resource scarcity**.

Types of Competition

1. **Intraspecific Competition**
    - Occurs **within the same species**.
    - Example: Two lions competing for territory or food.
2. **Interspecific Competition**
    - Occurs **between different species**.
    - Example: Grass and shrubs competing for sunlight in a savanna.

OVERCROWDING

This refers to a situation where a population of organisms exceeds the carrying capacity of its environment.

CAUSES

high birth rate

low death rate

abundant resources

lack of predators.

Habitat destruction causing forced grouping

Effects of overcrowding include, stress, increased competition, food scarcity, disease, emigration and death.

Effects of Food Shortage

What is Food Shortage?

A condition where **available food is insufficient** to meet the needs of a population.

Effects on Population and Ecosystem:

- **Malnutrition** and weakened immune systems
- **Increased death rates** and reduced reproduction
- **Migration** to search for food (emigration)
- **Predator-prey imbalance**
- **Selective survival**: only the fittest survive
- **Possible extinction** of less-adapted species

LESSON NOTE 11

BALANCE IN NATURE

Balance in nature refers to a **state of dynamic equilibrium** in ecosystems where the **populations of organisms** and **availability of resources** are maintained in a way that supports the survival of all species without overexploiting the environment.

It is achieved when biotic (living) and abiotic (non-living) components of the environment work together harmoniously.

Factors That Maintain Balance in Nature

1. **Predator-Prey Relationships**
    - Predators help control the population of prey, preventing overgrazing or depletion of vegetation.
    - Example: Lions control the population of herbivores like antelopes.
2. **Availability of Food and Water**
    - Resources like food and water limit how many organisms an environment can support.
3. **Natural Population Control**
    - Birth rates, death rates, and disease help regulate population sizes.
4. **Decomposers**
    - Organisms like fungi and bacteria break down dead matter, recycling nutrients into the soil.
5. **Photosynthesis and Respiration**

- These processes maintain the balance of oxygen and carbon dioxide in the atmosphere.

Roles of Biotic and Abiotic Factors

Biotic Factors (Living)	Abiotic Factors (Non-Living)
Producers (plants)	Light
Consumers (animals)	Water
Decomposers (fungi, bacteria)	Air
Parasites	Temperature
Competitors	Soil

These components interact in food chains and webs to regulate energy flow and nutrient cycling.

Human Activities That Affect Balance

Negative Effects:

- **Deforestation** – leads to loss of biodiversity.
- **Pollution** – harms aquatic and terrestrial life.
- **Overpopulation** – increases pressure on resources.
- **Overhunting/poaching** – disrupts food chains.

Positive Contributions:

- **Reforestation**
- **Wildlife conservation laws**
- **Environmental education**
- **Family planning** to control population growth.

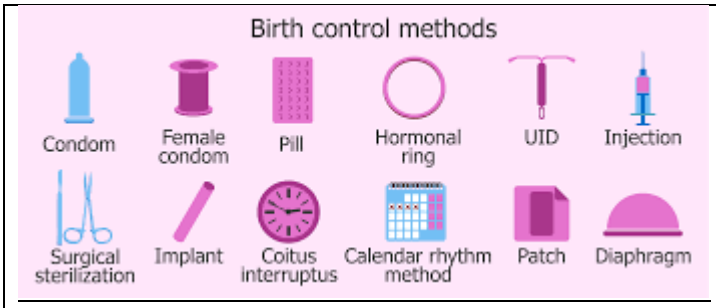
Family Planning as a Population Control Method

Family planning refers to the practice of controlling the number and timing of children in a family. It helps reduce **human population pressure** on the environment.

Importance.

- Prevents overuse of natural resources
- Reduces environmental degradation
- Improves quality of life and resource availability

Family planning methods include:



Type	Examples	Description
Natural	Calendar method, withdrawal	No devices used, relies on timing
Artificial	Condoms, pills, IUD (intra-uterine device), injections	prevents pregnancy using device or medication
Permanent	Vasectomy (male), tubal ligation (female)	Surgical procedures to permanently prevent pregnancy