3055 BA SANGAM COLLEGE

PH: 6674003/9264117 E-mail: basangam@connect.com.fj

WORKSHEET 18

School: Ba Sangam College **Year:** 12
Subject: Biology **Name:**

Strand	**1 – Structure and Life Processes**
Sub strand	**1.4 – Comparative Form and Function in Plants and Animals**
Content Learning Outcome	**-Differentiate between a stimulus and a nerve impulse and discuss the development of sensory systems.**

SENSITIVITY AND COORDINATION

- Organisms (plants and animals) need sensory and coordination abilities to find resources, avoid danger, and to time their reproduction with favorable seasons.

Endocrine vs. Nervous System

- In most organisms, both the endocrine (glands and hormones) and the nervous system help coordinate body response to stimuli.
- Stimulus/ stimuli are things that cause a response in organism.
- The endocrine system uses chemical messenger called hormones to coordinate slow and extended responses such as growth and metabolic rate.

	Nervous System	Endocrine System
Mode	Electrical → Chemical	Blood borne
Messengers	Neurotransmitters	Hormones
Release	Close to cell of influence	Distant to cell of influence
Target Cells	Specific location (only at nerve supply)	More widespread
Speed	Fast	Slow
Duration	Short	Long

PLANTS: SENSITIVITY AND COORDINATION

Plant Hormones

- Plants coordinate responses to stimuli using chemical messengers called **hormones**.
- Plants produce variety of hormones that diffuse through the plant to coordinate tropisms.
- Flowering, fruiting-ripening and falling of leaves in seasonal plants (eg. frangipani) is also controlled by hormones.
- Plant hormones coordinate their growth and reproductive responses to their environment.
- In Plants hormone may:
  - Induce different responses in different tissues.
  - Induce different responses at different times of development in the same tissue
  - Directly affect the activity or production of other hormones.
  - Induce different responses depending on concentration in a given tissue.
-

The sensitivity of a plant tissue to a given hormone may be altered either by:

- Changing hormone concentration in the target tissue.
- Altering receptor sensitivity to that hormone in the target tissue.

Hormone	Where Produced or Found in Plant
Auxin (IAA)	Apical meristems; other immature parts of plants
Cytokinins	Root apical meristems; immature fruits
Gibberellins	Roots and shoot tips; young leaves; seeds
Ethylene	Roots, shoot apical meristems; leaf nodes; aging flowers; ripening fruits
Abscisic acid	Leaves, fruits, root caps, seeds

Plant Growth Hormones

HORMONE	TYPICAL ACTIVITIES
Abscisic acid	Maintains seed dormancy and winter dormancy; closes stomata
Auxins	Promote stem elongation, adventitious root initiation, and fruit growth; inhibit axillary bud outgrowth and leaf abscission
Brassinosteroids	Promote stem and pollen tube elongation; promote vascular tissue differentiation
Cytokinins	Inhibit leaf senescence; promote cell division and axillary bud outgrowth; affect root growth
Ethylene	Promotes fruit ripening and leaf abscission; inhibits stem elongation and gravitropism
Gibberellins	Promote seed germination, stem growth, and fruit development; break winter dormancy; mobilize nutrient reserves in grass seeds

SENSITIVITY AND COORDINATION

1. Animal sense stimuli and coordinate responses with three types of structures:
   (1) Receptors;
   (2) communication system and
   (3) effectors.

(1) Receptors

- Responsible for sensing stimuli.
-

Organisms have receptors for environmental information useful to their survival.

- Photosynthetic protists-*euglena* have "eyespot" to sense light.
- Python snakes can perceive temperature by sight to find prey and all the snakes are highly sensitive to vibrations. Snakes can sense very faint vibrations in both the air and the ground using their inner ear.
- Sharks have sensory receptors (ampullae of Lorenzini) which detect electric fields created in the waters by other swimming creatures.

(2) Communication system

- Carries message between receptors and effectors.
- Simple and sessile organisms ---basic communication system.
- Eg: hydra -----nerve net, and vertebrate---neural network with a brain and a spinal cord centre.

(3) Effectors

- Are muscles and glands that act out responses.
- Fast animals ---complex nervous systems to keep up with their sensory and coordination needs.

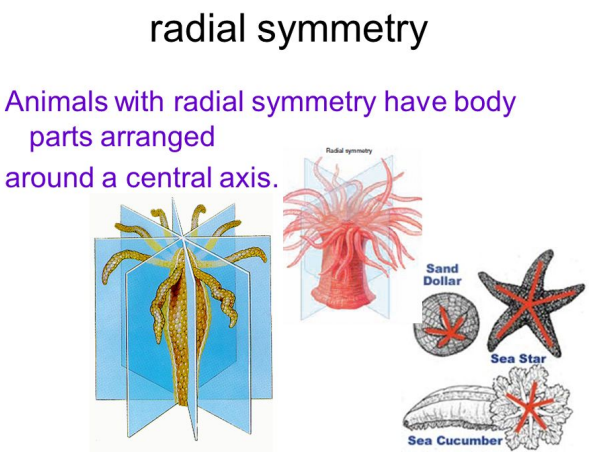
Body Symmetry

1. **Asymmetrical Animals**

- No body symmetry, eg: Sponges.

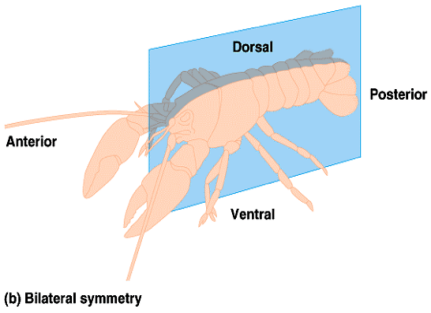
2. **Radially Symmetrical Animals**

- Animal can be divided into similar halves by passing a plane through the central axis.
- Animals have the ability to sense from all directions.
- Animals are mostly sessile (do not move) or sedentary (move very slowly) and therefore do not need very complex nervous system.
- Example: Cnidarians (jelly fish and hydra) and Echinoderms (star fish, sea urchin etc) as adults.

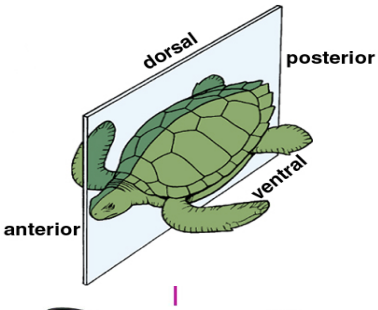


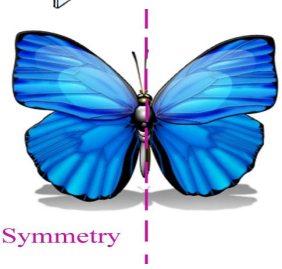
3. Bilaterally Symmetrical Animals

- Animal can be divided into two (bi= two) matching halves by passing a plane through the central axis.
- The head end is the first to come in contact with food or danger so natural selection favored sensory ability centralized in the head.
- Nerve centralization allowed evolution of increasingly complex animal nervous systems.
- Example: flatworms, annelids, arthropods, molluscs, vertebrates.



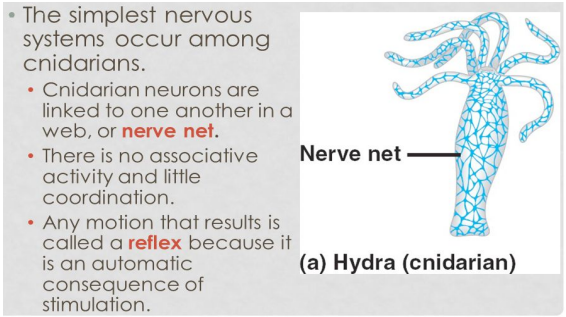
(b) Bilateral symmetry





Sensitivity and Coordination in Invertebrates

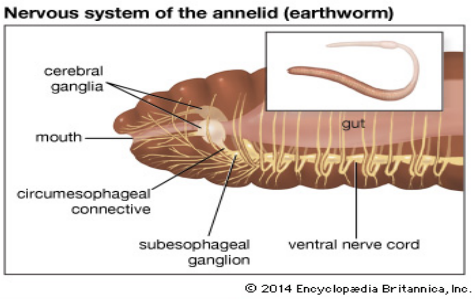
1. Cnidarians

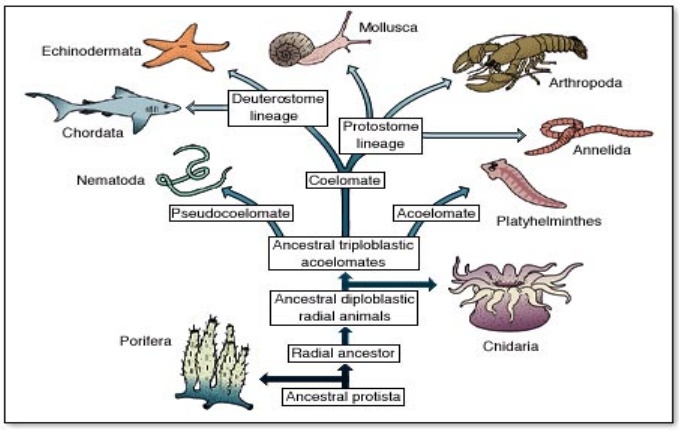


2. Annelids

- Simple bilateral organisms which have a back and a front region.
- Complex sensory and coordination abilities in comparison to cnidarians.
- Neurons concentrated into clusters called **ganglia**.

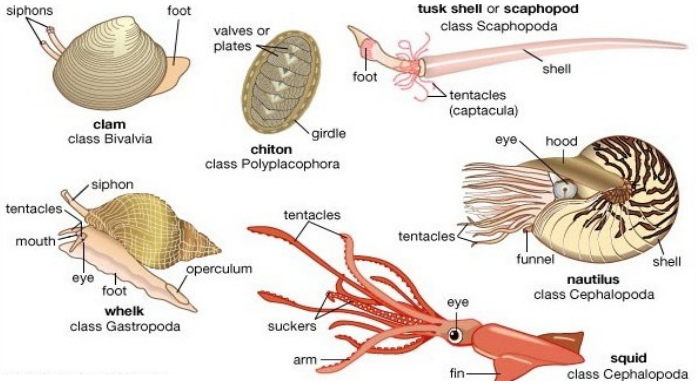
- Ganglia are connected to each other in chain-like fashion by two nerve cords.
- Nerve cord is a bundle of neurons that run the length of the organism.
- Ganglia in the anterior end (cerebral ganglia) functions like a 'mini' brain.
- This brain processes stimuli and, with the nerve cord, coordinates movements.
- Sensory abilities limited to light intensity, touch and chemical sensitivity.
- Earthworms avoid light to prevent dehydration- they need their skin to be moist in order to breath. The touch and chemical sensitivity allows it to search for food and avoid dangers.





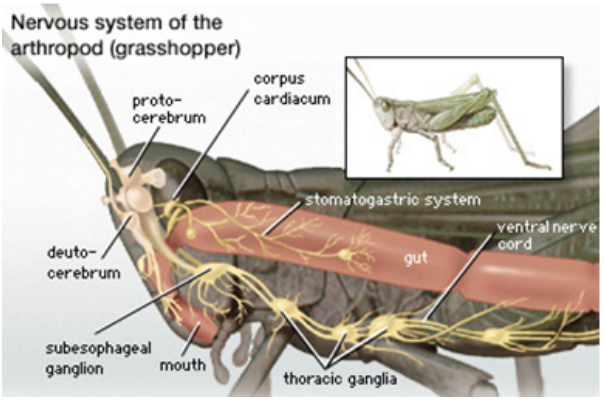
3. Molluscs

- Different classes within this phylum greatly differ in terms of the development of their nervous systems.
- Bivalves (*kai*) and snails are slow-moving ----- simple nerve network controlled by a brain-like neuron concentration.
- Squid and octopus are very fast swimmers-------well developed eyesight and a large and complex brain that allows them to respond very quickly to food and to danger.



4. Arthropods

- All have a dorsal brain and a ventral nerve cord with ganglia from which lateral nerves extend in each segment----- control over coordination.
- In arthropods, class Insecta (insects) have the most developed sensory and coordination abilities especially those that can fly.
- Insects and some other arthropods have compound eyes which help them detect quick movements.
- Most insects have antennae, which often house receptors for sound, smell, taste and touch.
- Flies ----taste receptors on their feet.
- Grasshoppers ----ears in their abdomen section.



Sensitivity and Coordination in Vertebrates

- Vertebrates ---the most elaborate nervous system in the animal kingdom.
- The complex abilities of their nervous systems rest on the three major developments:
  (1) Well-developed **sense organs**,
  (2) complex **motor structures** and
  (3) Centralized **processing and control center**.

(1) Sensing

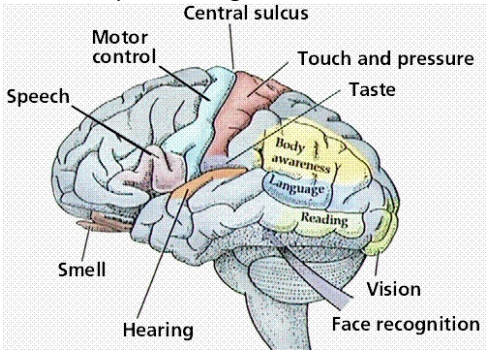
- Well-developed sense organs allow vertebrates to take in large amounts of detailed information about their environments.
- Fast moving animals need powerful sensory organs not only to avoid running into things, but also to find enough food to support their high energy demands.
- Birds-----sharp eyesight to avoid flying into things.
- Mongooses ------excellent sense of smell in order to track their prey.
- Bats discern the precise location of tiny insects by bouncing sounds against them.

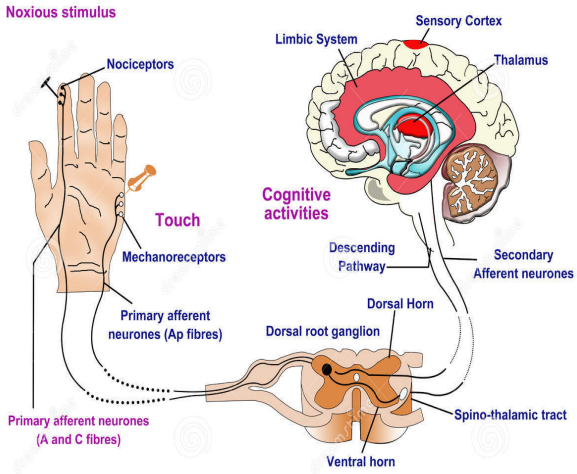
(2) Effect Output

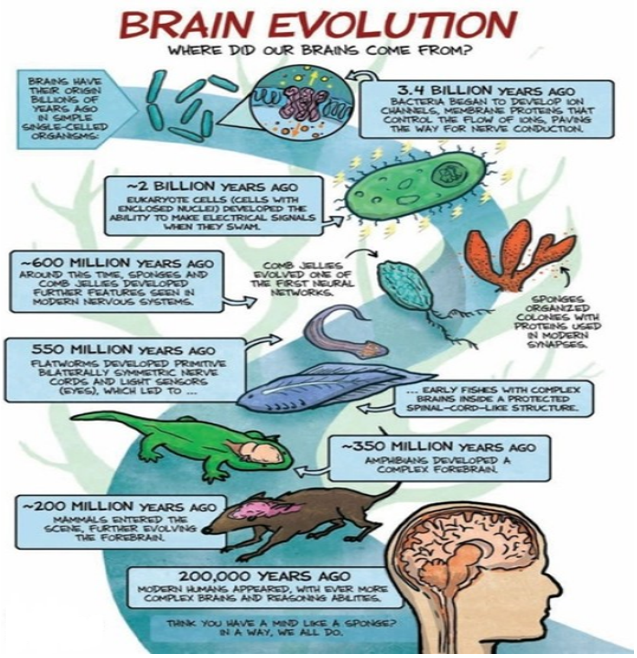
- The vertebrate's nervous system coordinates dozens of different muscles to make smooth, rapid movements.
- The brain directs the heart, diaphragm, stomach walls and other involuntary muscles.
- Muscular system of a vertebrate works precisely as directed by the brain and spinal cord.
- Hormones from the endocrine system manage metabolic rate, emotions, growth and other gradual processes requiring coordination.

(3) Processing

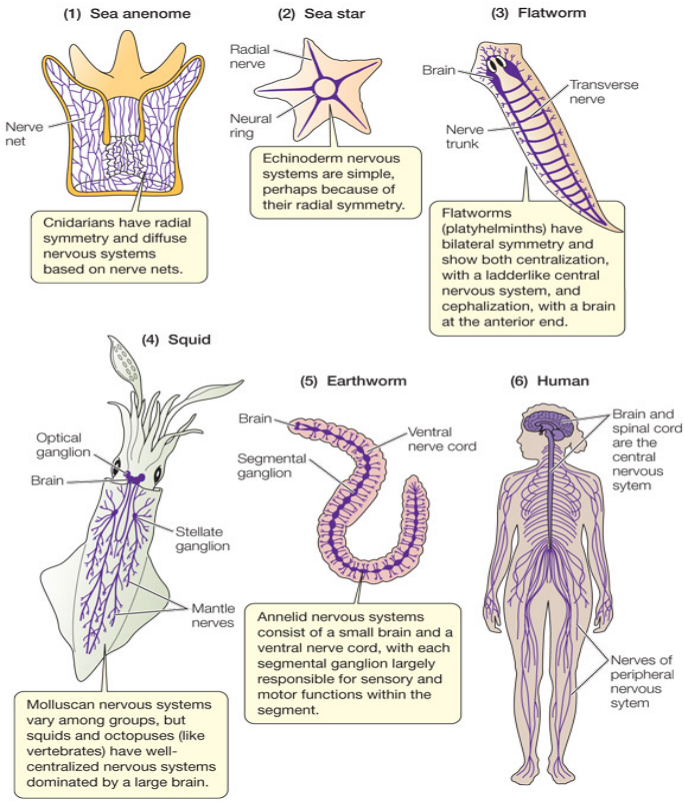
- Vertebrates have **central nervous system** (CNS) consisting of a brain and spinal cord.
- **Thinking** ----cerebrum.
- The rest of the vertebrate brain is devoted to reflex action such as heart beat, breathing and muscles coordination.
- A large cerebrum means greater intelligence. Some birds, reptiles and mammals are capable of complex processes such as memory, learning and even emotion.
- The 'highest' mammals, such as chimpanzees, humans and dolphins, can think and reason. The cerebrum cover, called the cerebral cortex, has evolved into a complex information processing centre in mammals.







Evolutionary Trend



Exercise

1. The sensitivity of a plant tissue to a given hormone may be altered either by:
2. Give one advantage of radial symmetry?
3. In annelids neurons concentrated in clusters is called_____.
4. Identify the difference between a reflex action and an ‘intelligent’ action.
5. Explain the difficulties that jellyfish would face with bilateral symmetry. How has it overcome that difficulty?
6. Explain why the sensitivity and coordination ability of parrots will differ from that of an earthworm.