CHAPTER: CONTROL AND COORDINATION

Grade: **10**
Board: **CBSE**
Book: **NCERT**

1.

Chapter Summary and Placement

<Read through the following to understand how this chapter is connected with the previous and next grades and also the important concepts covered in it.>

1. In the previous classes, students have learnt about the life processes or the maintenance process of all living beings like Nutrition, Respiration, Transportation and Excretion.
2. This chapter introduces the students to the control and coordination of plants and animals.
3. Since the chapter is focussed on a major life process of living organisms, the diagrams, images and models are used as the major resource for this teaching plan.

2. LEARNING OUTCOMES

<On completion of the chapter, students will be able to:>

1. List down the parts of human nervous system.
2. Understand the structure of a neuron.
3. Describe reflex actions and its working.
4. Describe a reflex arc.
5. Understand the structure of human brain.
6. Describe the protection of brain and spinal cord.
7. Explain different types of plant movements.
8. Define Stimulus.
9. List down various plant hormones and their functions.
10. List down various animal hormones and their functions.
11. Understand the feedback mechanism.

3. KEYWORDS

Definitions of some terms used in the chapter:

Nervous system: The network of nerve cells and fibers that transmits nerve impulses between parts of the body.

Reflex action: The involuntary functioning or movement of any organ or body part in response to a particular stimulus. The function or action occurs immediately, as soon as the stimulus is perceived by an individual, without the involvement of the will or consciousness.

Spinal cord: Part of the central nervous system that extends from the medulla to the lower back of a person. It consists of nerve cells.

Hormone: A chemical substance produced by a gland of a body which has a specific regulatory effect.

Feedback mechanism: A process in which the products of a process can act as regulators of that process.

3. TEACHING PLAN

Follow this section for getting ideas on teaching the content covered in the chapter. The subtopic given in the first column with the matching learning outcome can be explained using instructions and resources listed subsequently

Subtopic and Learning Objective #1

ANIMALS: NERVOUS SYSTEM - What happens in Reflex Actions?

1. List down the parts of human nervous system.
2. Understand the structure of a neuron.
3. Describe reflex actions and its working.
4. Describe a reflex arc.

Teacher Activity

In previous class, students have studied about composition of nervous tissue, structure of neuron, in humans..

1. Discuss with students that control and coordination in humans is controlled by the nervous system which constitutes of brain, spinal cord and nerves. Refer Resource 1.
2. Ask students about their reaction when they happen to touch a hot object or a cold object, hear sounds, taste variety of foods. They all will give you their different responses.
3. Make them understand that such information from the environment (given as examples by you) is detected by the specialised tips of our nerve cells present sensory organs like inner ear (hear), nose (smell), tongue (taste) and all parts of skin (touch).
4. Discuss with students that nervous tissue is made up of an organised network of nerve cells or neurons and that the information is transferred from one body part to another via nerve impulses.
5. Refer Resource 1 and discuss with them the structure of a neuron and the function of each of its parts (Axon, dendron, nucleus, cell body). Also discuss how electric impulse travels.
6. Perform Activity 1 to understand about reflex actions and arc.

Check for understanding:

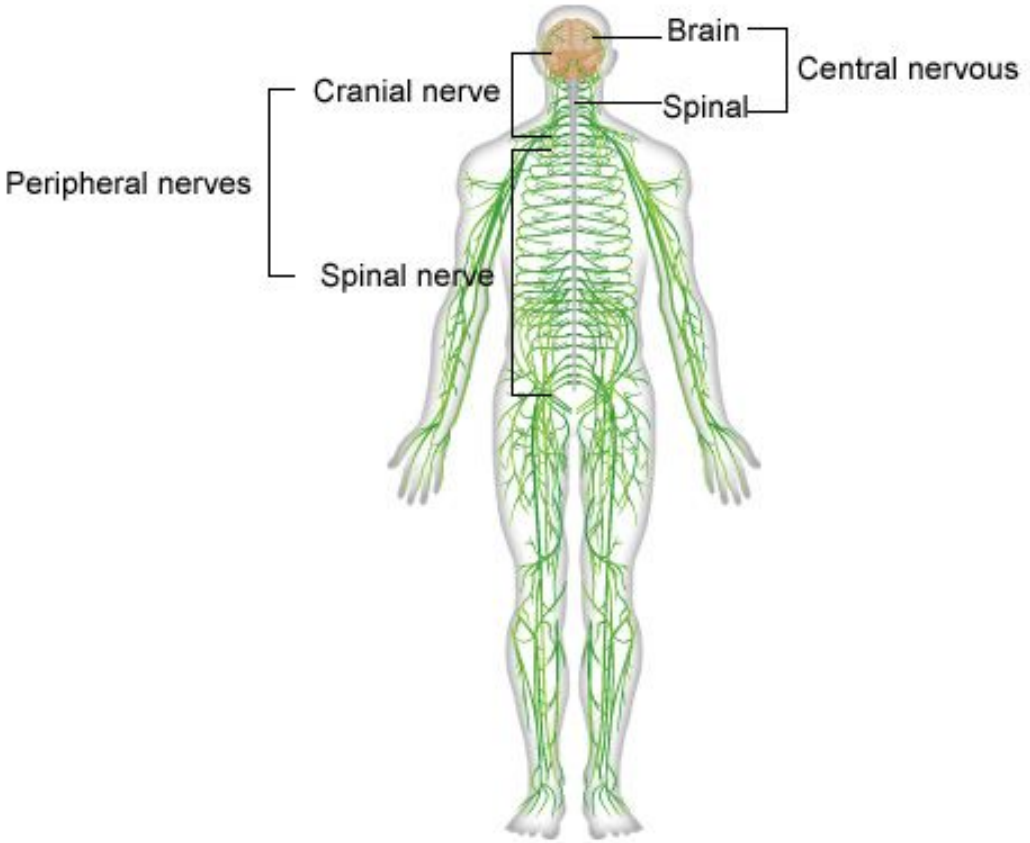
a. What are the major components of the nervous system?
b. Outline the pathway of the reflex arc?
c. What is the importance of reflex actions?

Resources Suggested

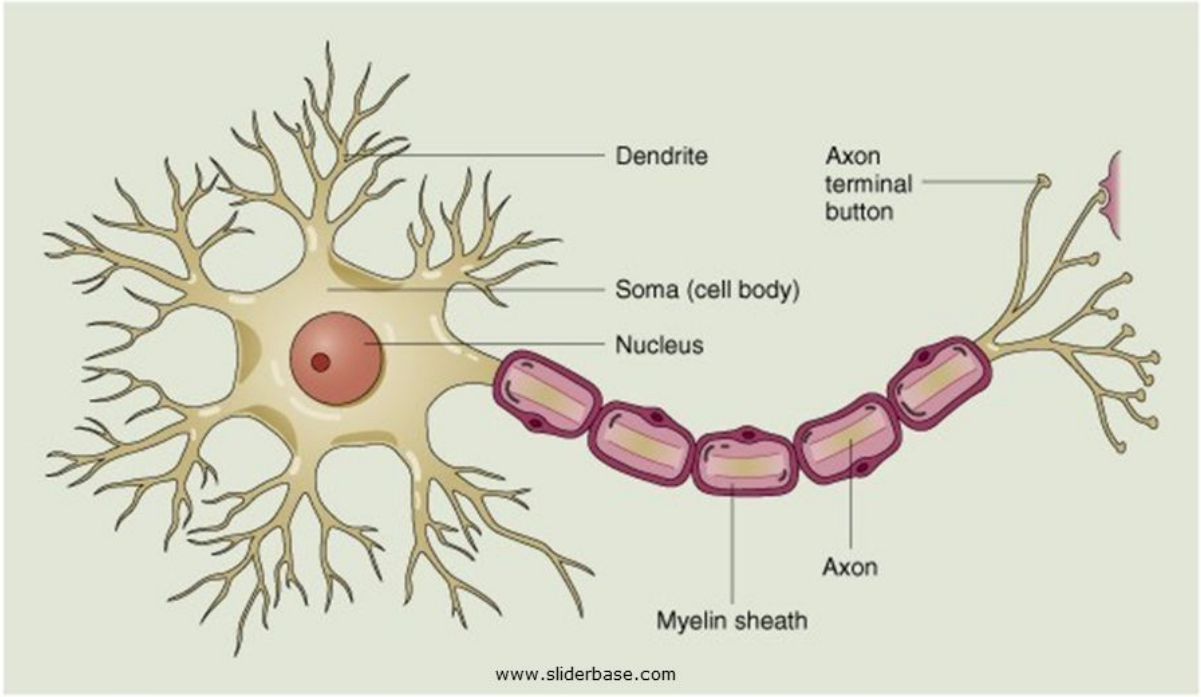
Blackboard, Chalk, Resource 1

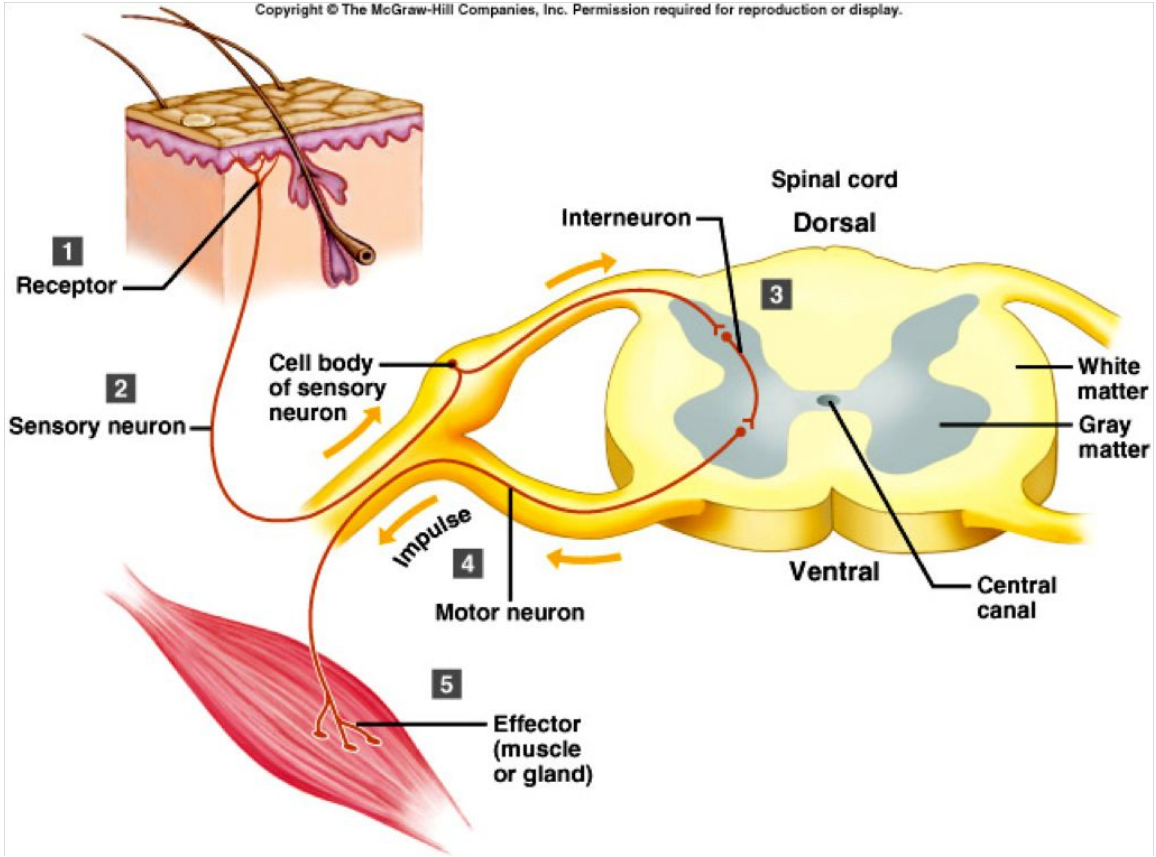
Resource 1:

Components of Nervous system



Neuron Structure

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1
Receptor
2
Sensory neuron
Cell body of sensory neuron
Spinal cord
Dorsal
Interneuron
3
White matter
Gray matter
Central canal
Ventral
Impulse
4
Motor neuron
5
Effector (muscle or gland)

Reflex Arc

Activity 1

Name of the activity – Reflex Actions
Type of activity – Group/Individual Demonstration
Use it for – Understanding Reflex Actions and Reflex Arc
Materials – Hot container, Safety Pin

Procedure –

1. Ask students to close their eyes and extend their hands to to touch hot container (without telling them that it's hot) or prick their hand with a safety pin. Ask them to notice their reactions (immediate withdrawal of hand). This should be a slight touch and should only be done by the teacher
2. Explain them that the information perceived by their hand (heat of object or pricking - receptors via sensory neuron) which resulted into their sudden reaction (shown by muscle received via motor neuron), cannot go via the electric impulse as explained already since it didn't involve thinking.
3. Discuss that such reactions are called reflex actions, which are more efficient for quick responses. (Refer diagram below)

Conclude the activity by explaining about reflex arc.

Subtopic and Learning Objective #2

ANIMALS: NERVOUS SYSTEM - Human Brain, How are these tissues protected?, How does the nervous tissue cause action?.

1. Understand the structure of human brain.
2. Describe the protection of brain and spinal cord.

Teacher Activity

Let students understand that all our voluntary actions (walking, talking, clapping etc.) and involuntary actions (vomiting, salivation, heart beating etc.) are controlled by brain.

1. Discuss the structure of human brain - Forebrain, Midbrain, and Hindbrain. Refer Resource 2.
2. Also discuss the functions of each part of the brain. Refer Resource 2.
3. Then move to discussing about how these essential and delicate organs , the brain and spinal cord are protected.

Check for understanding:

a. What are the various parts of the brain?
b. What protects the spinal cord from injury?

Resources Suggested

Blackboard, Chalk, Resource 2

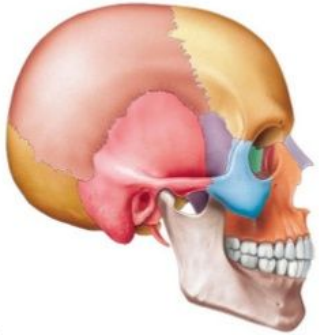
Resource 2:

Protection of the Central Nervous System

The brain and spinal cord are surrounded and protected by three different sets of tissue.

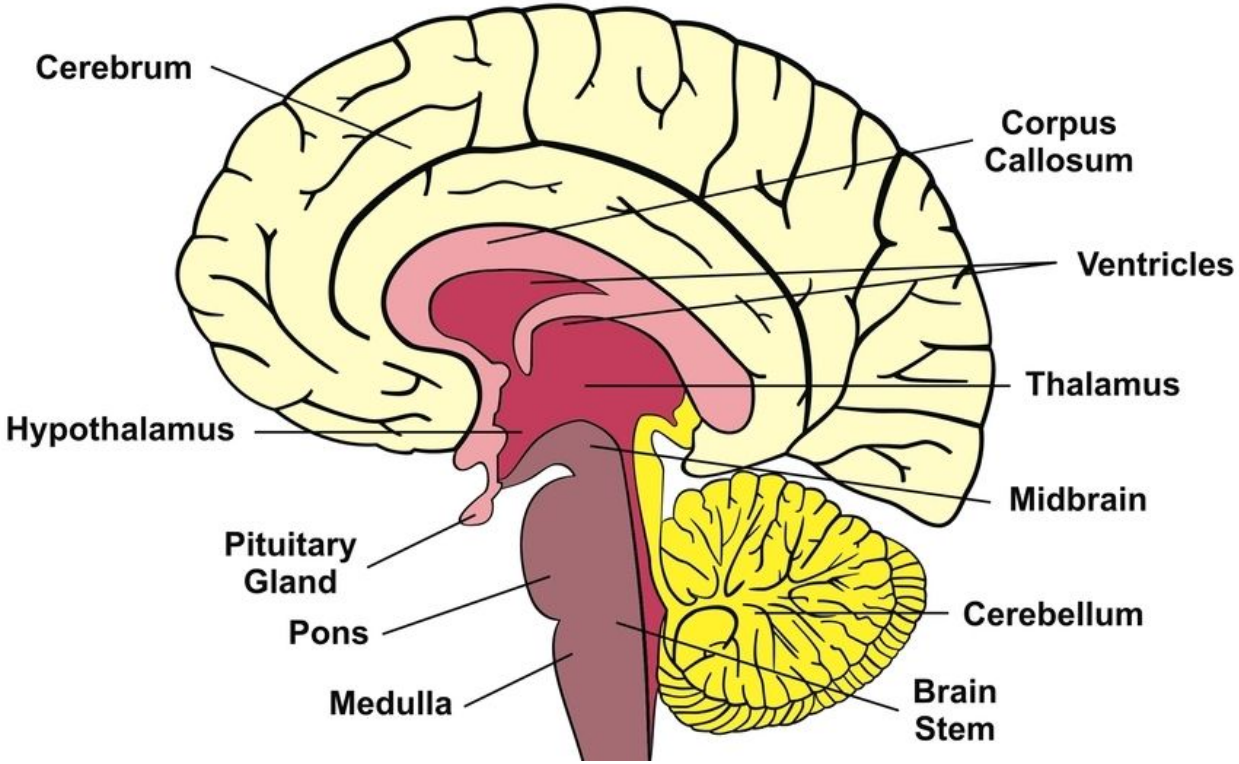
1. **Axial Skeleton**

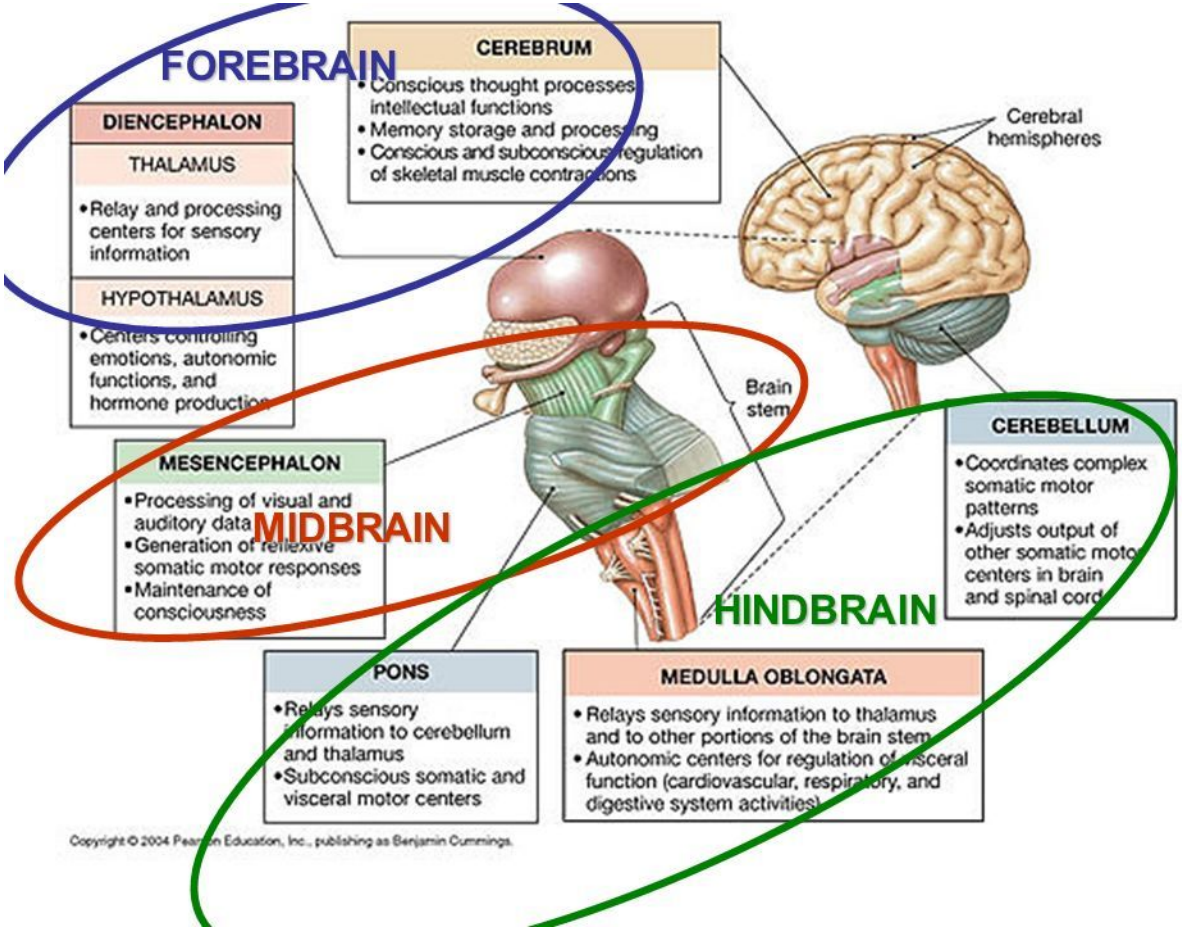
The ***brain*** and ***spinal cord*** are covered and protected by the bones of the skull, specifically the **cranium**, and the **vertebral column**.



Cranium

Vertebral Column


Cerebrum
Corpus Callosum
Ventricles
Thalamus
Hypothalamus
Midbrain
Pituitary Gland
Pons
Cerebellum
Medulla
Brain Stem



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Subtopic and Learning Objective #3

COORDINATION IN PLANTS - Immediate Response to Stimulus, Movement Due to Growth

1. Explain different types of plant movements.
2. Define Stimulus.
3. List down various plant hormones and their functions.

Teacher Activity

1. Ask students if they have ever seen and touched the leaves of a Touch-Me-Not plant. Refer Resource 3. Discuss the observation (Leaves droop down once touched).
2. Explain to students that plants do not have nervous or muscular tissue. Still the touching of the plant is transmitted from the point of touch to the point where it shows movement through electrochemical impulse.
3. Take students to any garden and show them a pea plant. Ask them to observe its tendrils (or Refer Resource 3.) (The tendrils circle around the object to get support and they are sensitive to touch).
4. Perform Activity 2 to make students understand the response of plant towards light and gravity.
5. Explain to students the growth of plants as a result of their hormones - Auxin, Gibberlins, Cytokinins, Abscisic acid, Ethylene. Refer Resource 3.

6. Conclude the discussion by categorizing the plant movements as :
    a. Dependent on growth (slower)
    b. Independent of growth (faster) (Touch-Me-Not plant, Tendrils of pea plant)

Check for understanding:

a. Name the plant growth hormone. Give some examples of where it acts.
b. Explain why leaves of touch me not close on touching?

Resources Suggested

Blackboard, Chalk, Resource 3.

Resource 3:

Touch-Me-Not Plant

Pea Plant

There Are Five Major Types of Plant Hormones

The five categories are:

- Gibberellins
- Auxins
- Ethylene
- Abscisic acid
- Cytokinins

PLANT HORMONES

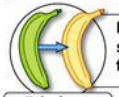
HORMONE	FUNCTION	LOCATION
Gibberellins	Increase the speed of seed germination; promote stem elongation; induce early blooming of flowers; increase fruit size	Shoot and root apical meristems; seeds
Auxins	Stimulate stem elongation; control seedling orientation; stimulate root branching; promote fruit development	Apical meristems; immature plant tissue
 Ethylene	Increases the speed at which fruit ripens; stimulates leaf dropping and the death of flowers	All parts of the plant including the fruits
Abscisic acid	Inhibits growth and reproduction; inhibits seed germination; stimulates closure of stomata	Leaves; fruits; root tips; seeds
Cytokinins	Cause rapid cell division, in conjunction with auxin; induce seed germination; initiate new branches from lateral buds	Roots and fruits, primarily

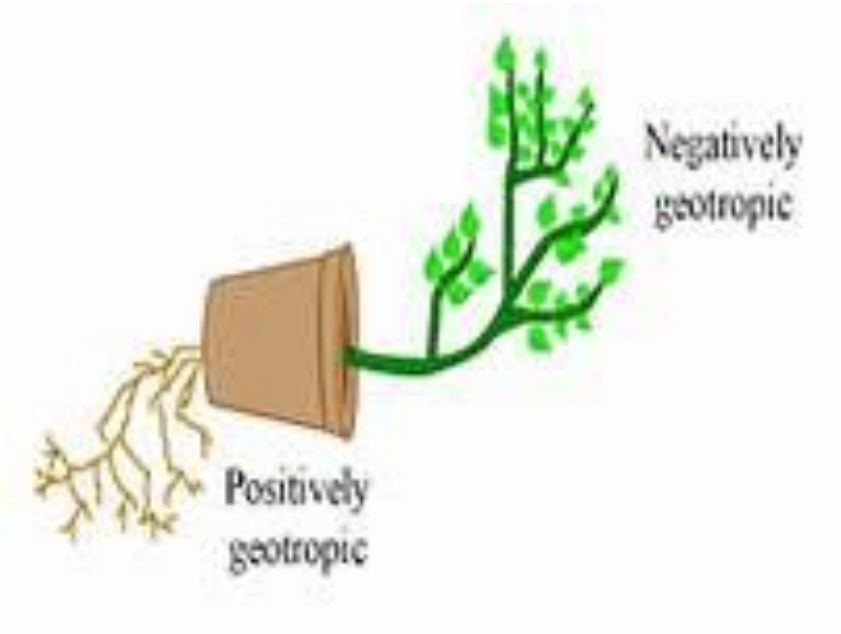
Figure 19-2
What Is Life? A Guide To Biology
© 2011 W. H. Freeman and Company

Activity 2

Name of the activity – How do plants behave towards light and gravity?
Type of activity – Group/Individual Demonstration
Use it for – Explaining Phototropism and Geotropism
Materials – Potted plants
Procedure –

1. Ask students to observe the plants put at a window of the room. They will notice that the shoot of the plant grow towards sunlight and roots of the plant grow away from sunlight.
2. Next you should ask students to observe the plants growth in terms of gravity. They may observe many plants and notice that the shoot of the plant grows away from earth's gravity while the roots of the plant grow towards earth's gravity.
   Explanation to students: Light and Gravity are environmental triggers called as stimulus towards which plants show responses via electrical impulse.
   Conclude the activity by defining stimulus, phototropism (plants response towards light) and geotropism (plants response towards gravity). Refer the diagram below.

Plants showing phototropism



Geotropism in Plants

Subtopic and Learning Objective #4

HORMONES IN ANIMALS -

1. List down various animal hormones and their functions.
2. Understand the feedback mechanism

Teacher Activity

Explain students that like plants hormones are also secreted by human beings.

1. Refer Resource 4 and discuss about various endocrine glands.
2. Describe about the hormones (Adrenaline, Growth hormone, Testosterone, Estrogen, Thyroxine) released by these endocrine glands.
3. List the hormones secreted by each and the target organ.
4. Also explain the effect of excess or less secretion of each of these
5. Move to the topic of feedback mechanism. Give analogy of a parent teacher meaning where a teacher informs a parent about students weakness and as a result student works well.
6. Use Resource 5 ato give examples of feedback mechanisms operating in the body

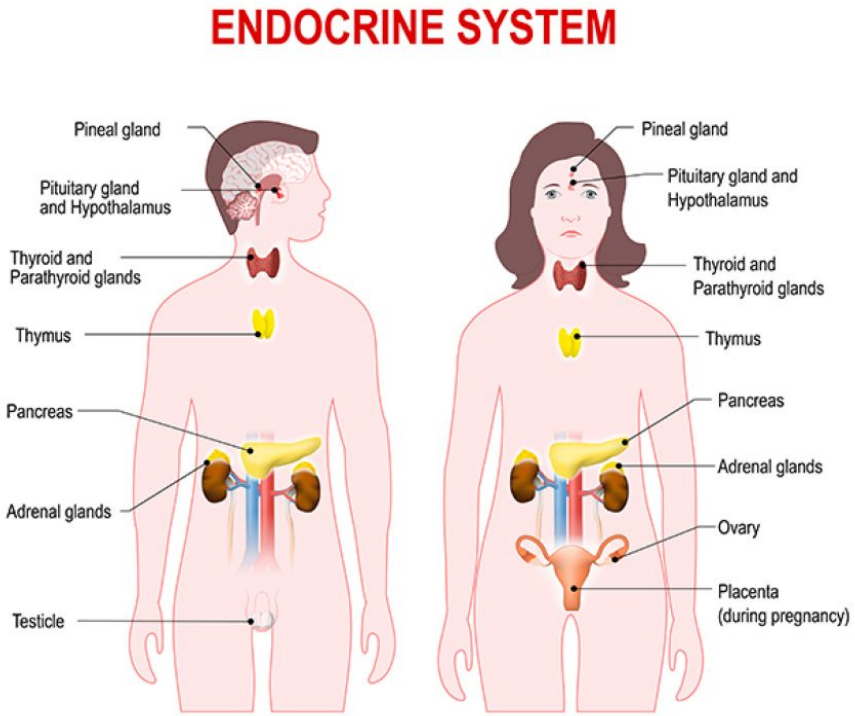
Check for understanding:

a. Explain how level of glucose is maintained in the body
b. Why is pituitary called the master gland?

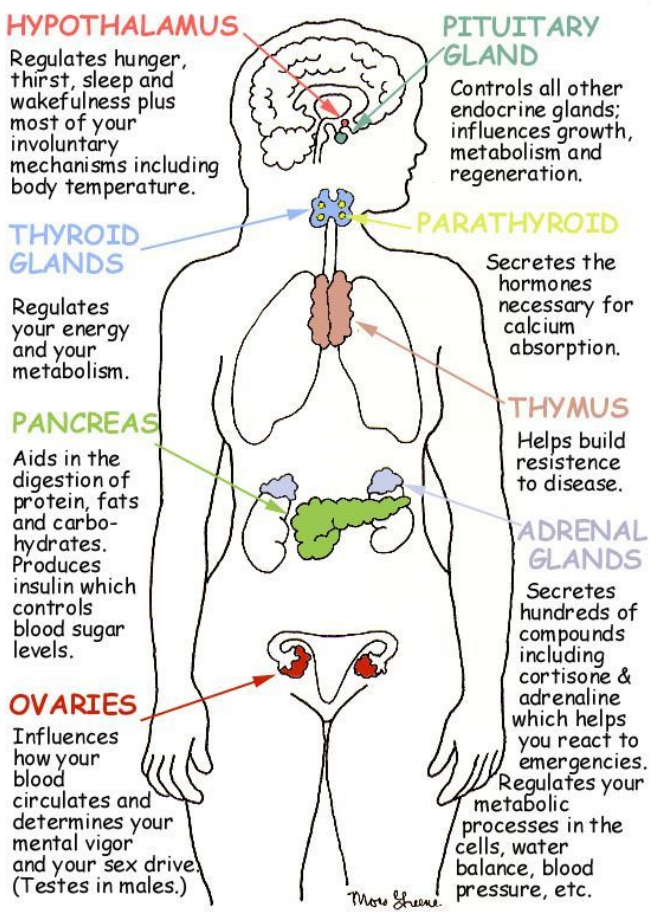
Resources Suggested

Blackboard, Chalk, Resource 4, Resource 5.

Resource 4:


ENDOCRINE SYSTEM
Pineal gland
Pituitary gland and Hypothalamus
Thyroid and Parathyroid glands
Thymus
Pancreas
Adrenal glands
Testicle
Pineal gland
Pituitary gland and Hypothalamus
Thyroid and Parathyroid glands
Thymus
Pancreas
Adrenal glands
Ovary
Placenta (during pregnancy)

THE ENDOCRINE SYSTEM



HYPOTHALAMUS
Regulates hunger, thirst, sleep and wakefulness plus most of your involuntary mechanisms including body temperature.

PITUITARY GLAND
Controls all other endocrine glands; influences growth, metabolism and regeneration.

THYROID GLANDS
Regulates your energy and your metabolism.

PARATHYROID
Secretes the hormones necessary for calcium absorption.

THYMUS
Helps build resistence to disease.

PANCREAS
Aids in the digestion of protein, fats and carbo-hydrates. Produces insulin which controls blood sugar levels.

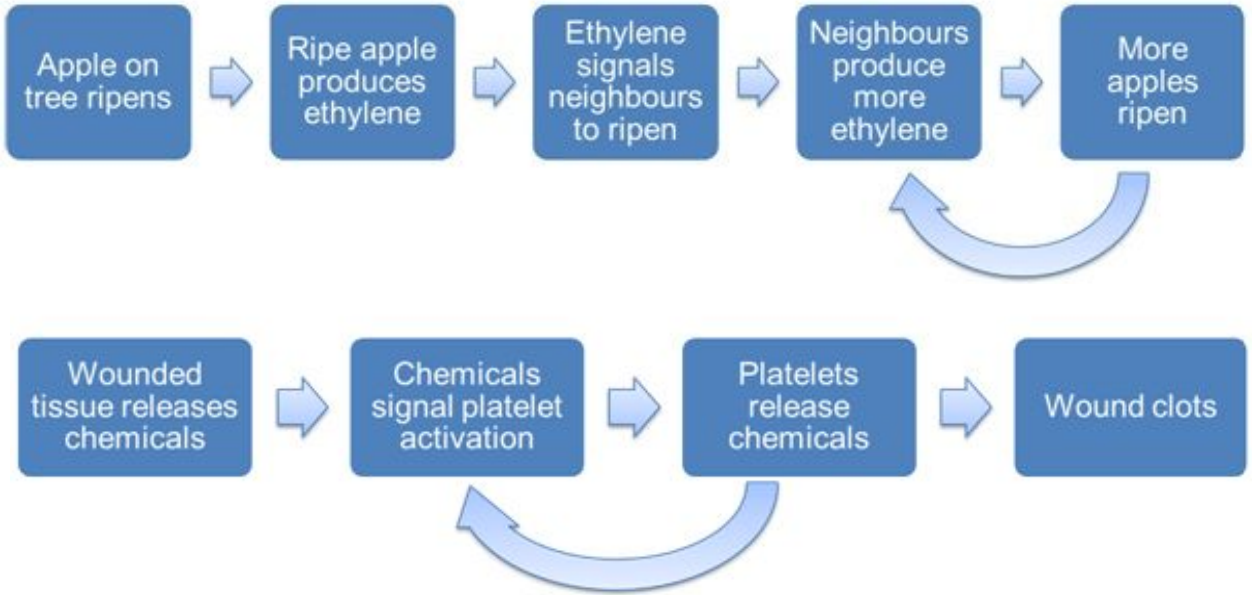
ADRENAL GLANDS
Secretes hundreds of compounds including cortisone & adrenaline which helps you react to emergencies. Regulates your metabolic processes in the cells, water balance, blood pressure, etc.

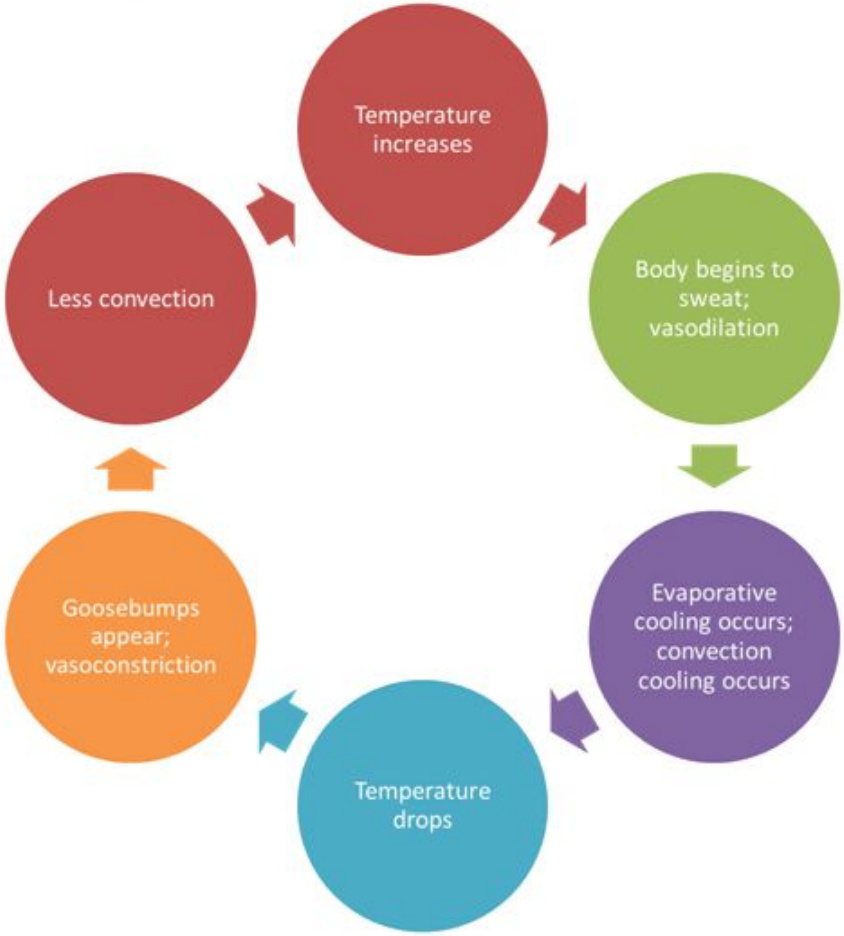
OVARIES
Influences how your blood circulates and determines your mental vigor and your sex drive. (Testes in males.)

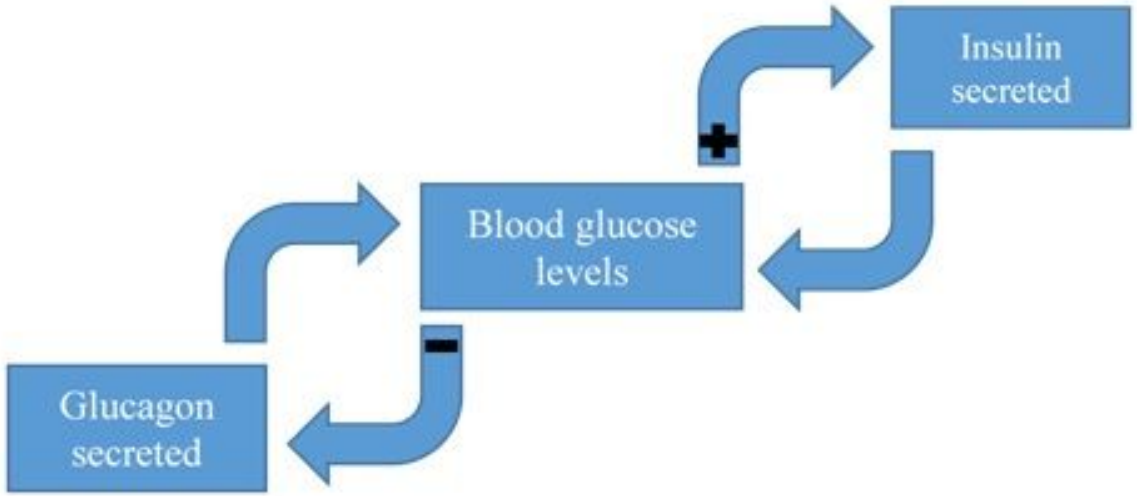
METABOLISM - The conversion of nutrients into energy and building materials to meet your body's needs.

Gland	Hormone	Function
Pineal	Melatonin	Controls sleep and wake cycle
Thyroid	Thyroxine	Controls appetite and metabolism
Adrenal	Adrenaline	Deals with stressful situations
Thymus	Thymosin	T-cell development (fight diseases)
Ovary	Estrogen	Female reproduction
Testis	Testosterone	Male reproduction

Resource 5:


Apple on tree ripens
Ripe apple produces ethylene
Ethylene signals neighbours to ripen
Neighbours produce more ethylene
More apples ripen
Wounded tissue releases chemicals
Chemicals signal platelet activation
Platelets release chemicals
Wound clots


Temperature increases
Body begins to sweat; vasodilation
Evaporative cooling occurs; convection cooling occurs
Temperature drops
Goosebumps appear; vasoconstriction
Less convection


Insulin secreted
Blood glucose levels
Glucagon secreted
+
-

4. WORKSHEETS

Print or copy the worksheet questions on the blackboard and ask the students to attempt them. They can be given as homework or a class test as well.

Worksheet 1

Use it like: test after the chapter is completely taught, homework, class assignment

1. Give the function of adrenaline hormone.
2. What is the function of a plant hormone Auxin?
3. Which part of brain is responsible for the involuntary actions occurring in our body? Name two involuntary actions.
4. Give two points of difference between nephron and neuron.
5. What is our nervous system composed of?
6. Give two examples of reflex actions.

Worksheet 2

Use it like: checking students understanding in class, oral test

Multiple choice questions:

1. Which of the following is a hormone secreted by female ovaries?

a) Testosterone
b) Progesterone
c) Thyroxine
d) Auxin

2. Which of the following is NOT a plant hormone?

a. Auxin
b. Gibberlins
c. Cytokinins
d. Oestrogen

3. Which of the following is/are function(s) of brain?
a. Thinking and analyzing
b. Regulating heart beat
c. Maintain balance of the body
d. All the above

4. Which of the following is NOT a part of our brain?
a. Cerebrum
b. Cerebellum
c. Medulla
d. Spinal cord

5. Which of the following actions involve thinking?
a. Regulating heart beat
b. Balancing body
c. Analysing a situation
d. Watering of mouth on seeing a favourite dish

6. Which of the following protects our spinal cord?

a. Vertebral Column
b. Cerebrum
c. Bones
d. Cerebrum

7. Which of the following plants show response when its leaves are touched?

a. Rose
b. Neem
c. Touch-Me-Not
d. Cactus

8. Roots show positive _____.

a. Geotropism
b. Phototropism
c. Chemotropism
d. Hydrotropism

9. Growth of pollen tubes towards ovules is an example of _____.

a) Geotropism
b) Phototropism
c) Chemotropism
d) Hydrotropism

10. Which of the following is a disease caused by the deficiency of iodine in humans?

a. Diabetes
b. Goitre
c. Dwarfism
d. Thyroxine

Worksheet 3

Draw a flowchart to show the feedback mechanism of the action of hormones by taking the example of any one hormone.

5. SOLUTIONS

This section gives you sample answers for activities and questions listed above.

Worksheet 1

1. Adrenaline hormone help us to deal in stressful situations (increased heart rate, breath rate, and blood flow to our muscles).
2. Auxin stimulates the cells to grow longer on the side of the shoot which is away from light. Hence, it promotes growth.
3. The involuntary actions of our body are controlled by medulla part of our brain. Two examples of involuntary actions are salivation and vomiting.
4. The differences between nephron and neuron are:

Nephron	Neuron
1. It is the functional unit of a kidney. Its structure comprises of Glomerulus, Proximal Tubule, Loop of Henle, Distal Tubule, and Collecting Duct.	1. It is the functional unit of our nervous system. Its structure comprises of Glomerulus, Proximal Tubule, Loop of Henle, Distal Tubule, and Collecting Duct.
2. Its function is to do filtration, reabsorption and secretion to form urine.	2. Its function is to transmit messages from its one end to another through axon.

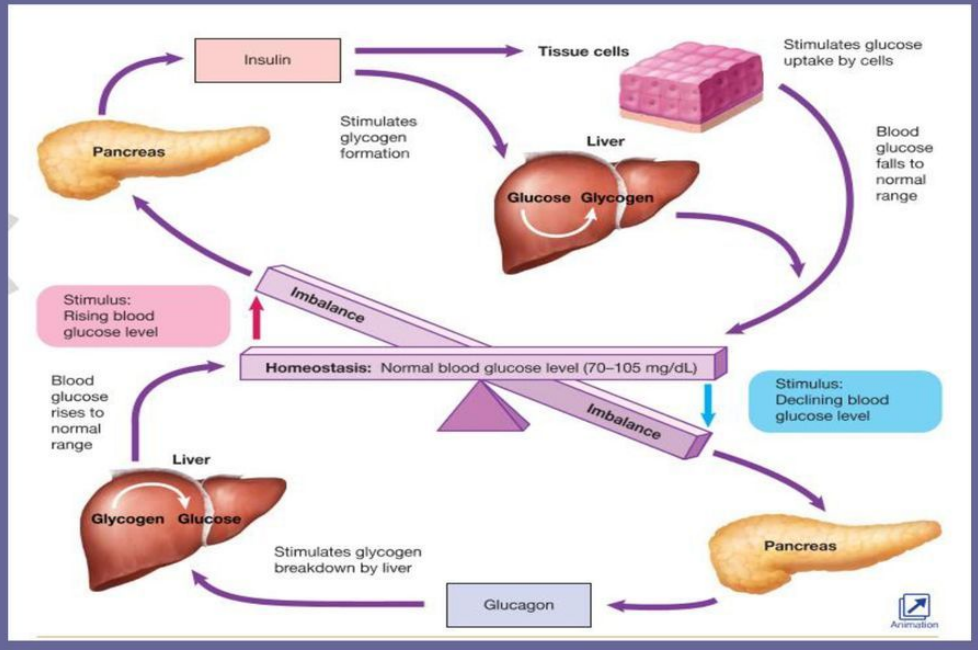
5. Our nervous system is composed of brain, spinal cord and nerves (cranial and spinal).
6. Two examples of reflex actions are:
    a. Withdrawing of our hand when we suddenly touch a hot object.
    b. Closing of our eyes when suddenly a bright source of light (torch) is directed at our eyes.

Worksheet 2

1. b. Progesterone
2. d. Oestrogen
3. d. All the above
4. d. Spinal cord
5. c. Analysing a situation
6. a. Vertebral Column
7. c. Touch-Me-Not
8. a. Geotropism
9. c. Chemotropism
10. b. Goitre

Worksheet 3

Blood Glucose Feedback Mechanism



6. EXTRA RESOURCES

Carry out the following suggested activities/ tasks if you have the time and resources to do them

1. **Video Links:**

   Show the following videos to the students on computer/ tablet/ screen:

a) Control and Coordination
   https://www.youtube.com/watch?v=tRjrEgNUPmM

b) Coordination In Plants
   https://www.youtube.com/watch?v=JgFBV7uIVbU

2. **Extension Activity 2:**
   To make the concept of action of hormones in humans more clear, students can be asked to make model of action of different hormones (thyroxine, oestrogen, progesterone, adrenaline, etc.) from glands like pancreas, thyroid, adrenal etc.