

## CONTROL AND COORDINATION

**Stimuli :-** The changes in the environment to which living organisms respond are called stimuli. Eg :- heat, cold, sound, smell, taste, touch, pressure, gravity, water etc. Living organisms respond to stimuli in the form of body movements.

**Coordination :-** For a proper response to a stimulus many organs in the body should work together. The working together of various organs in an organism to produce a proper response to a stimulus is called coordination.

- i) In animals control and co ordination is done by the nervous system and endocrine system.
- ii) In plants control and co ordination is done by chemical substances called plant hormones or phytohormones.

### Coordination in animals :-

In animals control and co ordination is done by the nervous system and endocrine system.

The nervous system consists of the brain, spinal cord and nerves.

**a) Receptors :-** are the sense organs which receive the stimuli and pass the message to the brain or spinal cord through the sensory nerves.

Eg :- **Photoreceptors** in the eyes to detect light.

**Phonoreceptors** in the ears to detect sound.

**Olfactory receptors** in the nose to detect smell.

**Gustatory receptors** in the tongue to detect taste.

**Tangoreceptors** in the skin to detect touch.

**b) Effectors :-** are the muscles and glands which respond to the information from the brain and spinal cord through the motor nerves.

**c) Sensory nerves :-** are nerves which carry information from the receptors (sense organs) to the brain and spinal cord.

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d) Motor nerves :- are nerves which carry information from the brain and spinal cord to the effectors (muscles and glands).

### Human nervous system :-

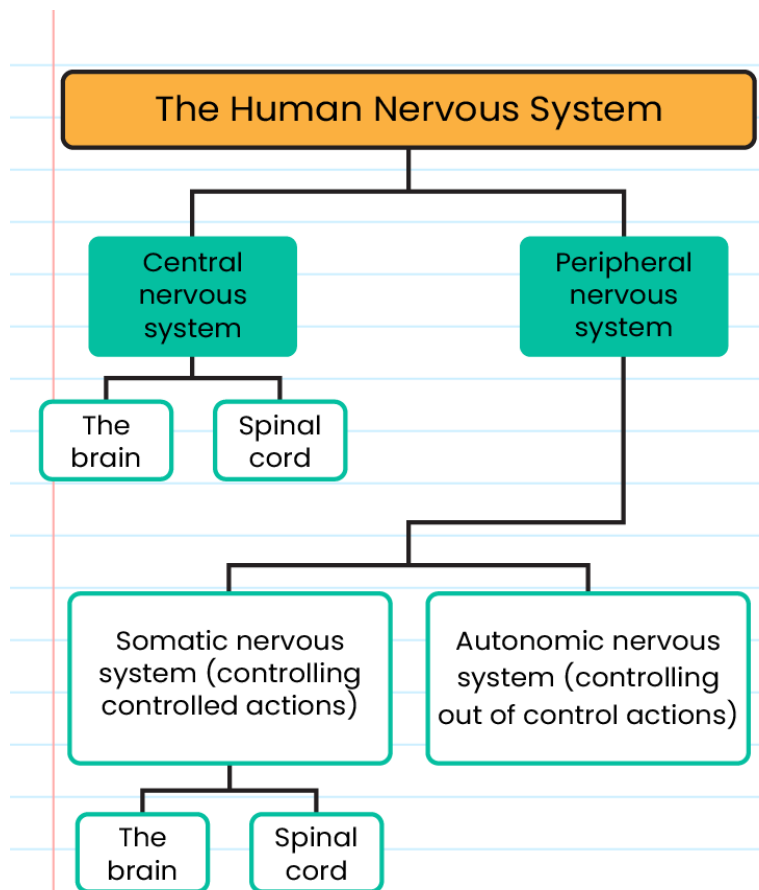
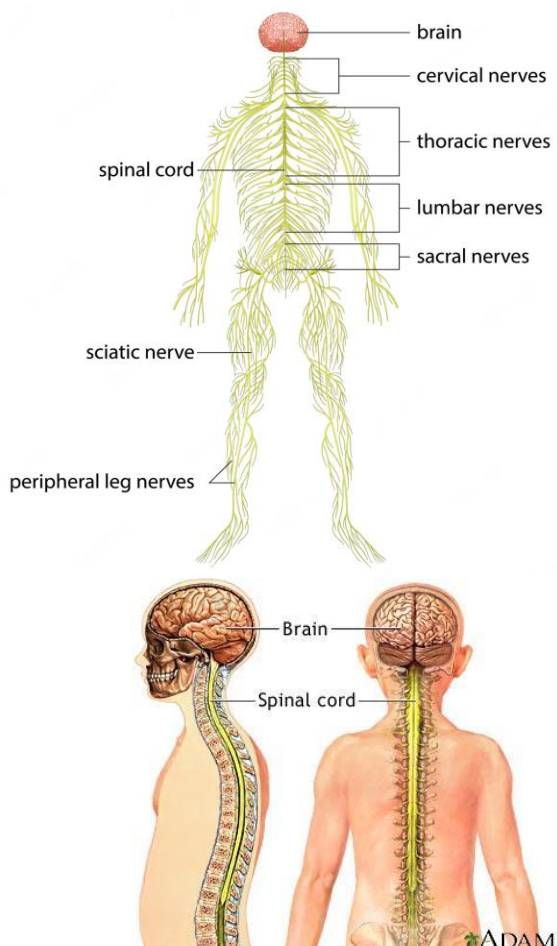
#### a) Parts of the nervous system :-

The human nervous system consists of the Central Nervous System and Peripheral Nervous System.

i) The central nervous system :- consists of the brain, and spinal cord.ii)

The peripheral nervous system:- consists of cranial nerves arising from the brain and spinal nerves arising from the spinal cord.

**Human Nervous System**

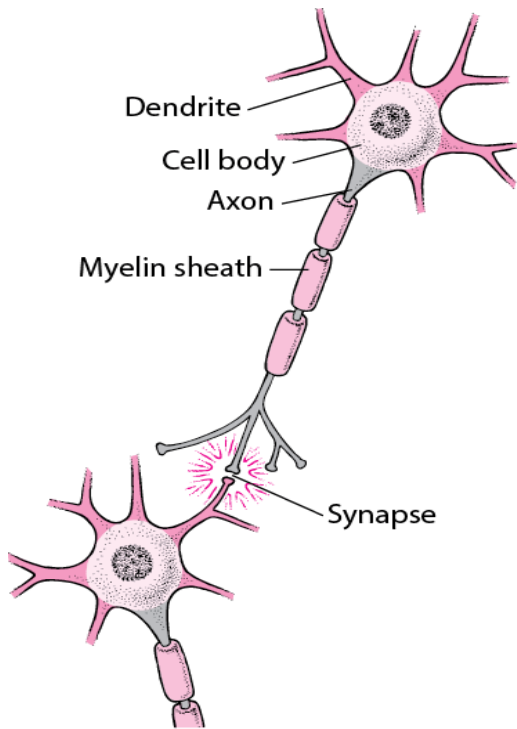


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b)



### Nerve cell (Neuron) :-

Neuron is the structural and functional unit of the nervous system. It has a cell body called cyton containing a nucleus and cytoplasm. It has several branched structures called dendrites. It has a long nerve fibre called axon which is covered by a protective covering called Myelin sheath. The junction between two neurons is called synapse.

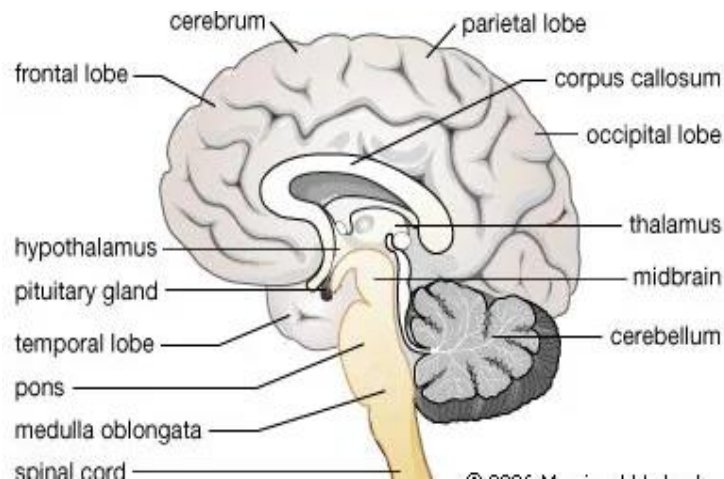
Messages pass through the nerve cell in the form of chemical and electrical signals called nerve impulse. The dendrites receive the information and starts a chemical reaction which produce electrical impulse

which passes through the axon.

### Brain :-

The brain is the main **coordinating centre** in the human body. It is protected by the **cranium**. It is covered by three membranes called **meninges** filled with a fluid called **cerebrospinal fluid** which protects the brain from shocks.

The brain has three main parts. They are fore brain, mid brain and hind brain.



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i) Fore brain :- consists of the cerebrum and olfactory lobes. It is the thinking part of the brain and controls voluntary actions. It controls touch, smell, hearing, taste, sight, mental activities like thinking, learning, memory, emotions etc.

ii) Mid brain:- controls involuntary actions and reflex movements of head, neck, eyes etc.

iii) Hind brain :- consists of cerebellum, pons and medulla.

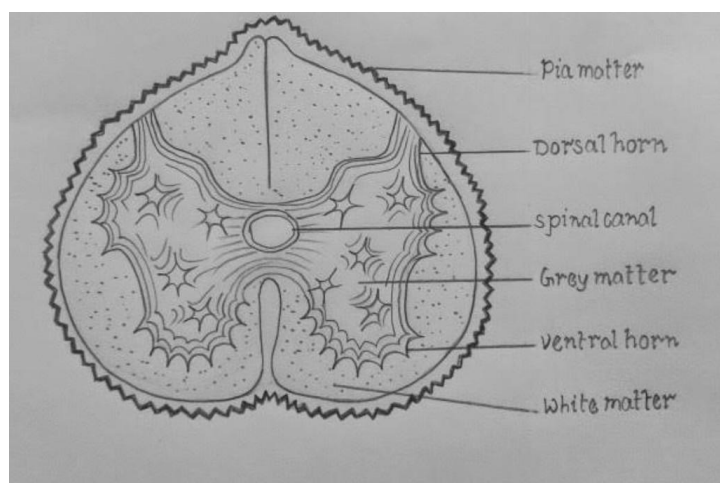
Cerebellum :- controls body movements, balance and posture.

Pons :- controls respiration.

Medulla :- controls heart beat, blood pressure, swallowing, coughing, sneezing, vomiting etc.

### Spinal cord :-

The spinal cord starts from the brain and extends through the vertebral column. It has 31 pairs of spinal nerves. It carries messages to and from the brain. It also controls reflex actions.



### a) Reflex action :-

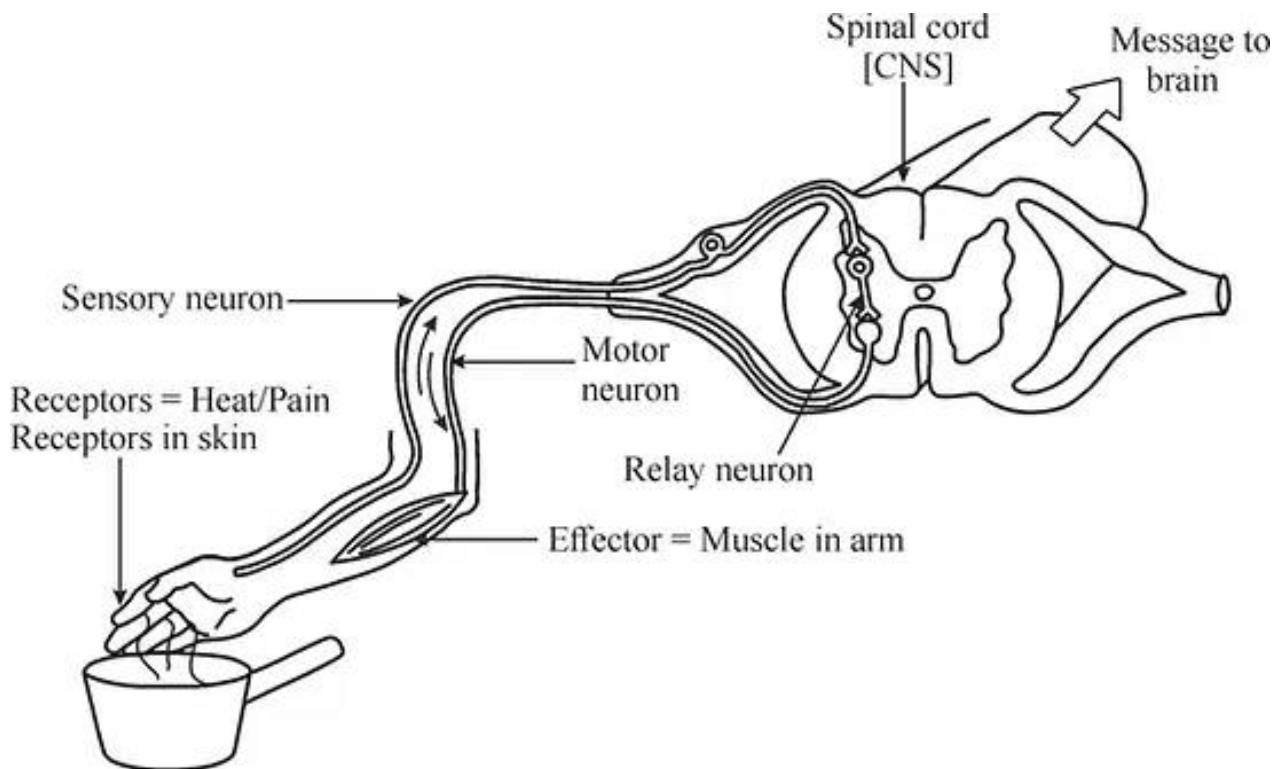
Reflex action is a sudden, unconscious and involuntary response of the effectors to a stimulus.

Eg :- We suddenly withdraw our hand if we suddenly touch a hot object. In this reflex action, the nerves in the skin (receptor) detects the heat and passes the message through the sensory nerves to the spinal cord. Then the information passes through the motor nerves to the muscles (effector) of the hand and we withdraw our hand.

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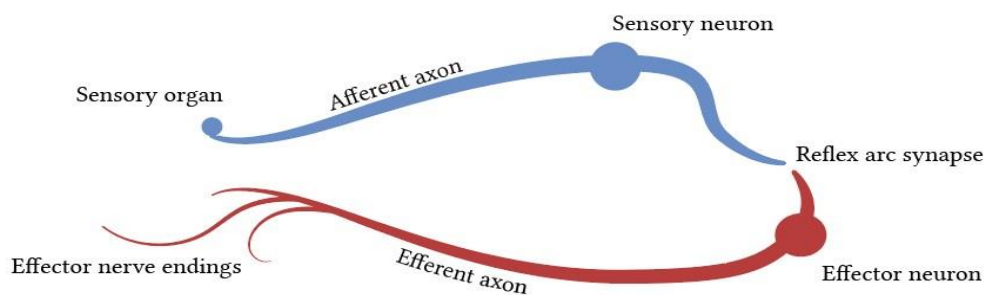
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### b) Reflex arc :-

The pathway of a reflex action is called reflex arc. In a reflex arc the stimulus is received by the receptors (sense organs) and it passes through the sensory nerves to the spinal cord. From the spinal cord the information passes through the motor nerves to the effectors (muscles/glands) for the response.





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### Control and Coordination in plants :-

The plants do not have a nervous system and sensory organs like eyes, ears and nose as animals have but they can still sense things.

The plants coordinate their behaviour against environmental changes by using hormones because they don't have a nervous system.

The plants respond to various stimuli very slowly by growing so in most cases plant response cannot be observed immediately.

The function of coordination in plants is performed by plant hormones called phytohormones.

### Phytohormones

Phytohormones are chemicals produced by plants that regulate their growth, development and reproductive processes.

There are 4 major types of plant hormones which are involved in the control and coordination in plants.

- i. Auxins
- ii. Gibberellins
- iii. Cytokinins
- iv. Abscissic acids
- v. Ethylene

### Auxins -

Auxins are plant hormones which promote cell enlargement and cell differentiation in plants.

Auxins also promote fruit growth.

Auxin hormone controls a plant's response to light and growth gravity. In other words, auxin hormone is responsible for phototropic and geotropic responses of plants.

### Gibberellins-

Gibberellins are plant hormones which promote cell enlargement and cell differentiation in the presence of auxins.

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Gibberellin help in breaking the dormancy in seeds and buds and promote growth in fruits.

### Cytokinin's -

Cytokinin's promote cell division in plant's.

It help in breaking the dormancy of seeds and buds. They delay the ageing in leaves. Cytokinin's promote the opening of stomata. They also promote fruit growth.

### Abscissic acid -

It is a growth Inhibitor. Abscissic acid (ABA) promotes the dormancy in seed and Buds. It also promotes the closing of stomata. It promotes the falling of leaves.

### Ethylene -

Ethylene is a group of plant growth regulators which are widely used for ripening fruits and for the production of more flowers and fruits.

## 6) Movements in plants :-

Movements in plants are of two main types. They are :-Tropic movements and Nastic movements.

a) Tropic movements :- are directional movements towards or away from the stimulus and it depends on growth. They are of different types like Phototropism, Geotropism, Chemotropism, Hydrotropism, Thigmotropism etc.

i) Phototropism :- is movement of plants in response to light. If it is towards light, it is called positive phototropism. Eg:- Bending of shoot towards light. If it is away from light, it is called negative phototropism. Eg:- Bending of root away from light.

ii) Geotropism :- is the movement of plants in response to gravity. If it is towards gravity it is called positive geotropism. Eg:- Downward

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growth of roots. If it is away from gravity it is called negative geotropism. Eg:- Upward growth of shoot.

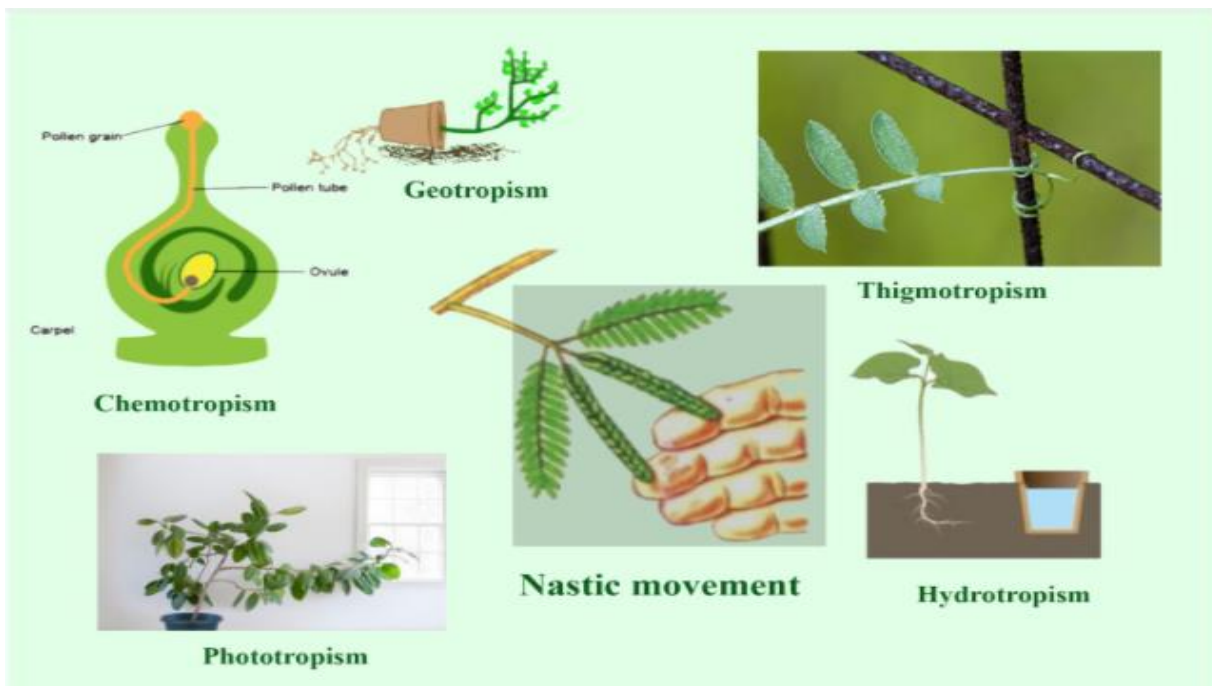
iii) Chemotropism :- is movement of plant in response to chemical stimuli.  
Eg:- Growth of pollen tube towards the ovule.

iv) Hydrotropism :- is the movement of plants in response to water.  
Eg :- Growth of roots towards water.

v) Thigmotropism:-The movement of plant in response to touch.  
Eg:-Tendrils

b) Nastic movements :- are non directional movements which are neither towards or away from the stimulus and it does not depend on growth.

Eg :- If we touch the leaves of touch me not plant, its leaves fold up and droops down immediately due to the change in the amount of water in the leaves. Depending upon the amount of water in the leaves, it swells or shrink.





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### Endocrine glands in human beings

The endocrine glands also help in control and coordination. The endocrine glands produce chemical substances which help to control and coordinate various activities in the body.

The endocrine glands in our body are :- pineal, hypothalamus, pituitary, thyroid, parathyroid, thymus, adrenal, pancreas, testes and ovary.

#### Pituitary Gland

It is a pea-sized gland located at the base of the brain.

- It is the master gland, as it controls the secretions of all the other endocrine glands.
- It also secretes Growth Hormone (GH). Under-secretion of GH causes Dwarfism, and over-secretion causes Gigantism in children and 'Acromegaly' in adults.

#### Thyroid Gland

- It is a butterfly-shaped gland located in the throat.
- It secretes the hormone 'Thyroxine', which regulates the metabolism of the body.
- Iodine is required to synthesize thyroxine in the body.
- In the case of iodine deficiency, under-secretion of thyroxine leads to goitre.

#### Pancreas

- It is a leaf-like gland present behind the stomach in the abdomen.
- It is an endocrine as well as an exocrine gland.

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- As an endocrine gland, it manufactures two hormones – Insulin and glucagon. Both these hormones act antagonistically and regulate the sugar level in the blood.
- As an exocrine gland, it secretes enzymes to break down the proteins, lipids, carbohydrates and nucleic acids in food.
- An insufficient amount of insulin from the pancreas leads to diabetes.

### Adrenal Gland

- Occurs in pairs above each kidney.
- It decreases in size with age.
- Secretes the hormone adrenaline, which helps in flight and fight response.
- Also secretes noradrenaline.

### Gonads

- Gonads are the gamete-producing organs – testes in males and ovaries in females.
- The testes produce the male hormone testosterone, and the ovaries produce the female hormones oestrogen and progesterone.
- Testosterone and oestrogen help in producing gametes and are responsible for the sexual characteristics of males and females, respectively.
- Progesterone is the pregnancy hormone.

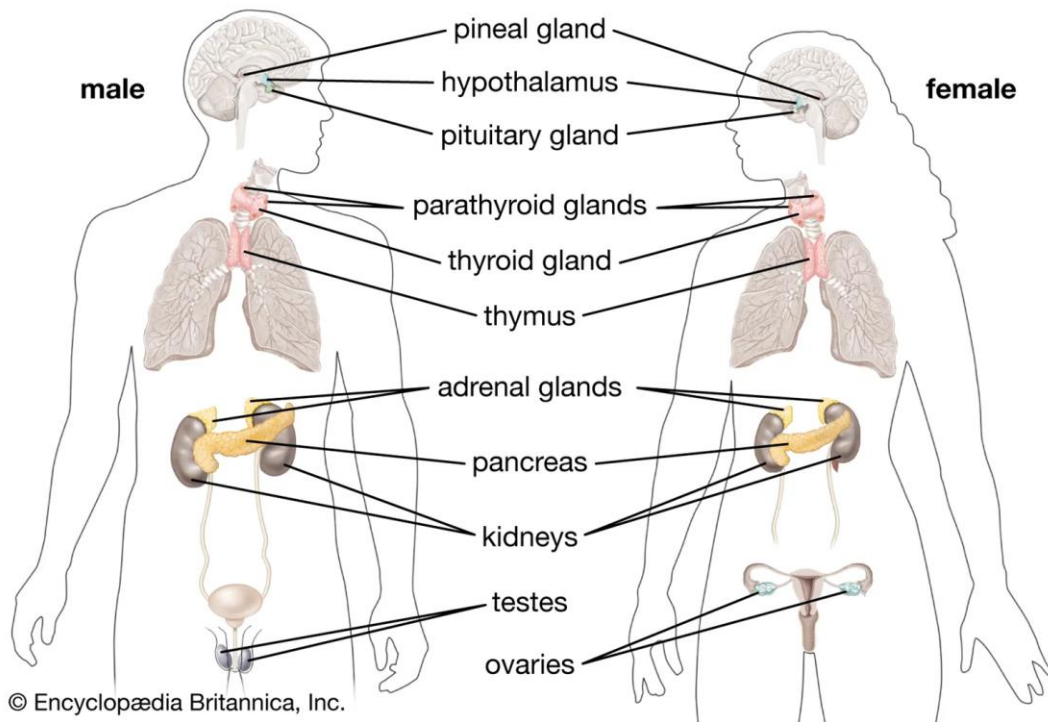
### Other Endocrine Organs

- The other endocrine organs include the hypothalamus, parathyroid, pineal and thymus glands.

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