

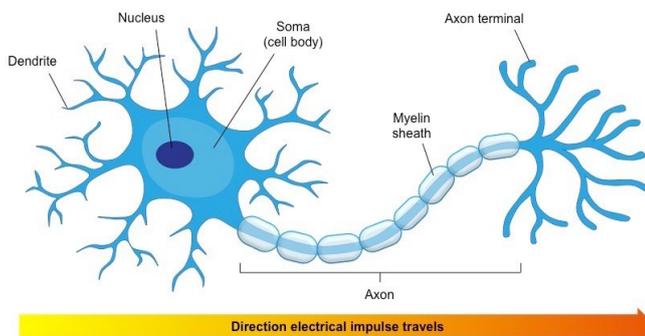
CONTROL AND COORDINATION — In Animals

- In animals, control and coordination are provided by **nervous and muscular tissues**.

A – NERVOUS SYSTEM

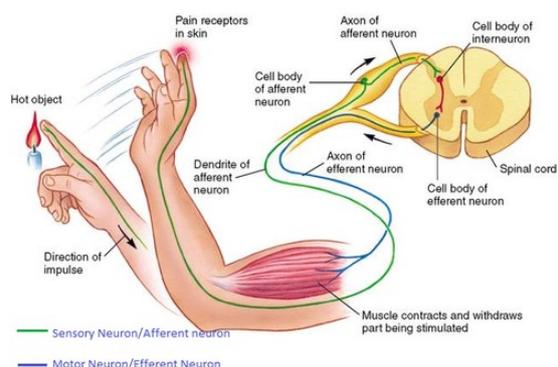
- The nervous system carries out the following functions:
 - It perceives the changes around us through our senses
 - It controls and coordinates all the activities of the muscles in response to the changes outside
 - It also maintains the internal environment of the body by coordinating the functions of the various internal organs and the involuntary muscles
 - It stores the previous experiences as memory that helps us to think and analyse our reactions
 - It conducts messages between different parts of the body
- The units of nervous system are specialised cells called the **neurons**. Around the **cell body** are short sensory projections called the **dendrons**. The fine branches of dendrons are called the **dendrites**. These short fibres receive messages and pass them on to the cell body or the **cyton**. The messages from the cyton are carried away by the long axon which ends in many fine branches. The branches end in **synaptic knobs**.

Ner



- Transmission of Messages - All information from our environment is detected by the specialised **tips of some nerve cells**. This information, acquired at the end of the dendritic tip of a nerve cell, sets off a chemical reaction that creates an electrical impulse. These impulse travels **from the dendrite to the cell body**, and then **along the axon to its end**. At the end of the axon, the electrical impulse sets off the **release of some chemicals**. These chemicals cross the gap, or **synapse**, and **start a similar electrical impulse in a dendrite of the next neuron**. This is a general scheme of how nervous impulses travel in the body.
- These receptors are usually located in our sense organs, such as the **inner ear**, the **nose**, the **tongue**, and so on. These **gustatory receptors will detect taste while olfactory receptors will detect smell**.
- The human nervous system can be divided into three main parts:
 - Central nervous system**
 - Peripheral nervous system**
 - Autonomic nervous system**
- Central Nervous System - It is made up of the **brain** and the **spinal cord** which is the continuation of the brain. Brain and spinal cord are surrounded by membranes called the **meninges**.
- Brain is part of the central nervous system that is present in the head and protected by the skull. The box that houses the brain within the skull is called the **cranium**. Inside the box, the brain is contained in a fluid-filled balloon which provides further shock absorption.
- The brain has three such major parts or regions, namely the **fore-brain**, **mid-brain** and **hind-brain**.

- The **fore-brain is the main thinking part of the brain**. It is made up of **cerebrum**, **hypothalamus** and **thalamus**.
 - Cerebrum is responsible for the intelligence, thinking, memory, consciousness and will power.
 - Thalamus - It is an area which coordinates the sensory impulses from the various sense organs - eyes, ears and skin and then relays it to the cerebrum.
 - Hypothalamus - It receives the taste and smell impulses, coordinates messages from the autonomous nervous system, controls the heart rate, blood pressure, body temperature and peristalsis.
- Separate areas of the fore-brain are **specialised for hearing, smell, sight** etc. The sensation of feeling full is because of a centre associated with hunger, which is in a separate part of the fore-brain.
- Mid Brain** -It serves as a relay centre for sensory information from the ears to the cerebrum. It also controls the reflex movements of the head, neck and eye muscles. It provides a passage for the different neurons going in and coming out of the cerebrum.
- Hind Brain** - It consists of **cerebellum**, **pons** and **medulla oblongata**.
 - Cerebellum** is responsible for maintaining the balance while walking, swimming, riding, etc. It is also responsible for precision and fine control of the voluntary movements. For example, we can do actions like eating while talking or listening.
 - Pons** serves as a relay station between the lower cerebellum and spinal cord and higher parts of the brain like the cerebrum and mid brain.
 - Medulla Oblongata**-It has the cardiovascular centre and the breathing centre. It also controls activities such as sneezing, coughing, swallowing, salivation and vomiting.
- Spinal Cord** - It is a collection of nervous tissue running along the back bone. It is a continuation of the brain. The functions of the spinal cord are:
 - Coordinating simple spinal reflexes
 - Coordinating autonomic reflexes like the contraction of the bladder
 - Conducting messages from muscles and skin to the brain
 - Conducting messages from brain to the trunk and limbs
- '**Reflex**' is some sudden action in response to something in the environment. A **reflex arc** is a neural pathway that controls **areflex**. In vertebrates, most sensory neurons do not pass directly into the brain, but synapse in the spinal cord. This allows for faster **reflex** actions to occur by activating spinal motor neurons without the delay of routing signals through the brain.



CONTROL AND COORDINATION – In Animals

16. **Peripheral Nervous System** - The peripheral nervous system is made up of nerves that connect the different parts of the body (peripheral tissues) to the central nervous system. There are three types of nerves based on their composition:

- (i) sensory (afferent)
- (ii) motor (efferent)
- (iii) mixed

17. When a nerve impulse reaches the muscle, the muscle fibre must move. The simplest notion of movement at the cellular level is that muscle cells will move by changing their shape so that they shorten. Muscle cells have special proteins that change both their shape and their arrangement in the cell in response to nervous electrical impulses. When this happens, new arrangements of these proteins give the muscle cells a shorter form.

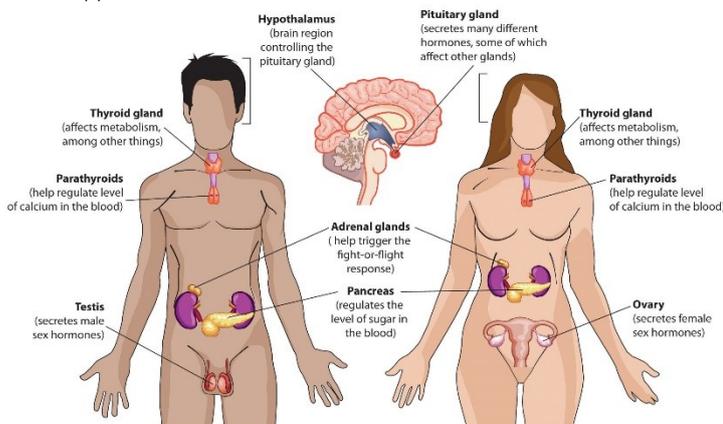
B – COORDINATION IN ANIMALS

1. The **endocrine system** is the collection of glands that produce hormones that regulate metabolism, growth and development, tissue function, sexual function, reproduction, sleep, and mood, among other things. **The control and coordination of the different bodily functions is also done with the help of the endocrine system.**

2. Exocrine glands are those which pour their secretions into a duct. For example, sweat glands, tear glands, etc. These glands are called the ductless glands as they do not have ducts. For example, thyroid, adrenal, etc.

3. The **human endocrine system** consists of the following glands:

- (i) Hypothalamus
- (ii) Pineal
- (iii) Thyroid
- (iv) Parathyroid
- (v) Pituitary
- (vi) Thymus
- (vii) Adrenal
- (viii) Pancreas
- (ix) Ovary in female
- (x) Testes in male



4. Pineal - It is a small round gland in the brain. It secretes melatonin that regulates the sexual cycle.

5. Thyroid - The hormone secreted is **thyroxine**. Functions of Thyroxine

- (i) **Thyroxine regulates carbohydrate, protein and fat metabolism** in the body so as to provide the best balance for growth.

(ii) Iodine is essential for the synthesis of thyroxine. In case iodine is deficient in our diet, there is a possibility that we might suffer from **goitre**.

(iii) Thermoregulation - it regulates the production of body heat by regulating respiration

(iv) regulates metabolic rate

(v) regulates mental and physical development

(vi) helps in absorption of glucose from intestine

6. **Parathyroid** - They secrete parathormone which is important in calcium and phosphorus metabolism. Deficiency of parathormone causes brittle bones.

7. **Pituitary - Growth hormone** is one of the hormones secreted by the **pituitary**. Growth hormone regulates growth and development of the body. If there is a **deficiency of this hormone in childhood, it leads to dwarfism**.

8. **Thymus** - It secretes hormone called **thymosin**. Thymosin helps in the production of lymphocytes.

9. **Adrenal** - A hormone called **adrenaline** is secreted from the **adrenal glands**. **Adrenaline is secreted directly into the blood and carried to different parts of the body**. The target organs or the specific tissues on which it acts include the heart. As a result, the heart beats faster, resulting in supply of more oxygen to our muscles. All these responses together enable the animal body to be ready to deal with the situation.

10. **Pancreas - Insulin** is a hormone which is produced by the **pancreas** and helps in **regulating blood sugar levels**. If it is not secreted in proper amounts, the sugar level in the blood rises causing many harmful effects.

11. The male gonads are the testes and the female gonads are the ovaries. Dramatic changes appear as you approached 10–12 years of age. These changes associated with **puberty** are because of the **secretion of testosterone in males and oestrogen in females**. **Testes produce testosterone** which produces the secondary sexual characteristics like moustache and beard. **Ovaries** along with the egg-production, **secrete oestrogen** from the mature follicle that produces the secondary sexual characteristics like enlargement of breasts. It also prepares for the monthly menstruation. After ovulation, another hormone, progesterone is produced from corpus luteum that maintains the pregnancy.

12. **Feedback Mechanism** - It is a method of controlling the hormone production. If the sugar levels in blood rise, they are **detected by the cells of the pancreas** which respond by producing more insulin. **As the blood sugar level falls, insulin secretion is reduced.**

