

# CHAPTER 12.1 – COORDINATION AND RESPONSE

## Coordination and response

- ⊞ Organisms have the ability to **detect changes** in their environments and **respond** to these changes
- ⊞ This ability is called **sensitivity** while the **change** that **stimulates** the **response** is known as a **stimulus** (plural: stimuli)
- ⊞ The stimulus is divided into **two** types
  - ✓ **External stimulus**  
Stimulus from the external environment include light, sound, smell, taste, surrounding temperature, pressure and touch
  - ✓ **Internal stimulus**  
Stimuli from the internal environment include changes in blood osmotic pressure, changes in body temperature and changes in blood sugar level

### RECEPTORS

- ✚ Mammals can **detect stimuli** via the **special sensory cells** known as **receptors**
- ✚ When a receptor **detects** a stimulus such as sound, the stimulus is **converted** to **nerve impulses**
- ✚ Nerve impulses are **sent** to the brain through **nerve cells** or **neurons**

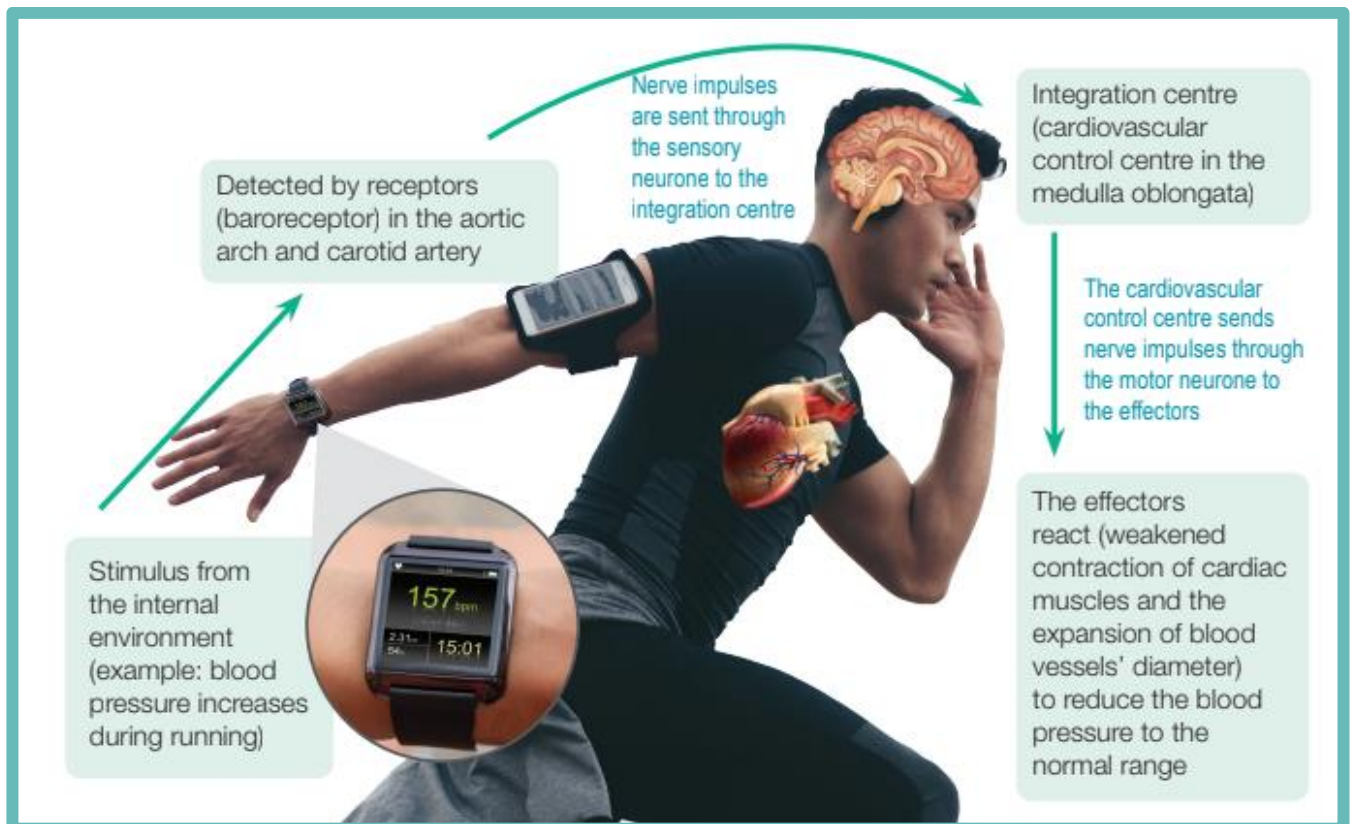
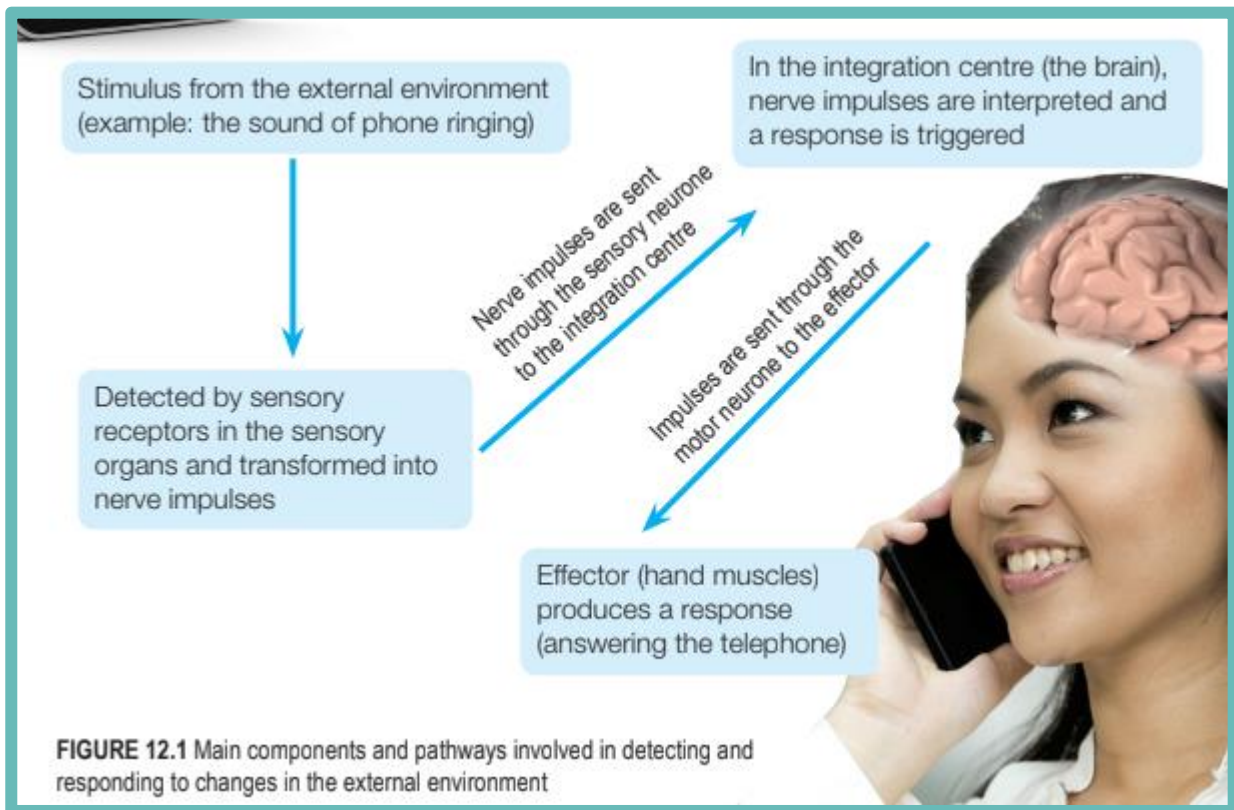
- ✚ The **brain** is the **integration centre** that **translates nerve impulses** and **coordinates** an **appropriate response**

### RESPONSE

- » Response **refers** to the way organisms **react** after detecting a stimulus
- » The part of the body that **responds** is called the **effector**
- » Receptors and effectors **work together** to **bring** suitable changes depending on the stimulus detected
- » Example of effectors
  - 1) Muscles
  - 2) glands

### COORDINATION

- ◇ Coordination is a **stimuli detection process** by **receptors** that ends in **appropriate responses** by effectors
- ◇ Coordination **ensures** that the overall activities and systems of an organism function and are **synchronised perfectly** as a **complete unit**
- ◇ The **role of coordination and response** is **conducted** by **two separate** systems
  1. Nervous system
  2. Endocrine system
- ◇ Both systems **work together** to **coordinate** and **control responses**



## Types of receptors

- ⊕ Sensory receptors found at the end of the nerve fibres detect information in the external and internal environments
- ⊕ The location of receptors will depend on the type of stimulus detected
- ⊕ Each type of receptor is usually sensitive to a specific stimulus
- ⊕ For instance, the sensory receptors that detect external stimuli are found in special sensory organs such as
  - a) Eyes
  - b) Nose
  - c) Tongue
  - d) Skin

- ⊕ The sensory receptors that detect internal stimuli are present in specific internal organs such as the pancreatic cells that detect blood sugar level

### TYPES OF SENSORY RECEPTORS AND STIMULUS INVOLVED

| Sensory receptor | Stimulus              |
|------------------|-----------------------|
| Photoreceptor    | Light                 |
| Thermoreceptor   | Change in temperature |
| Chemoreceptor    | Chemical substances   |
| Baroreceptor     | Change in pressure    |
| Mechanoreceptor  | Touch and pressure    |
| Nociceptor       | Pain                  |

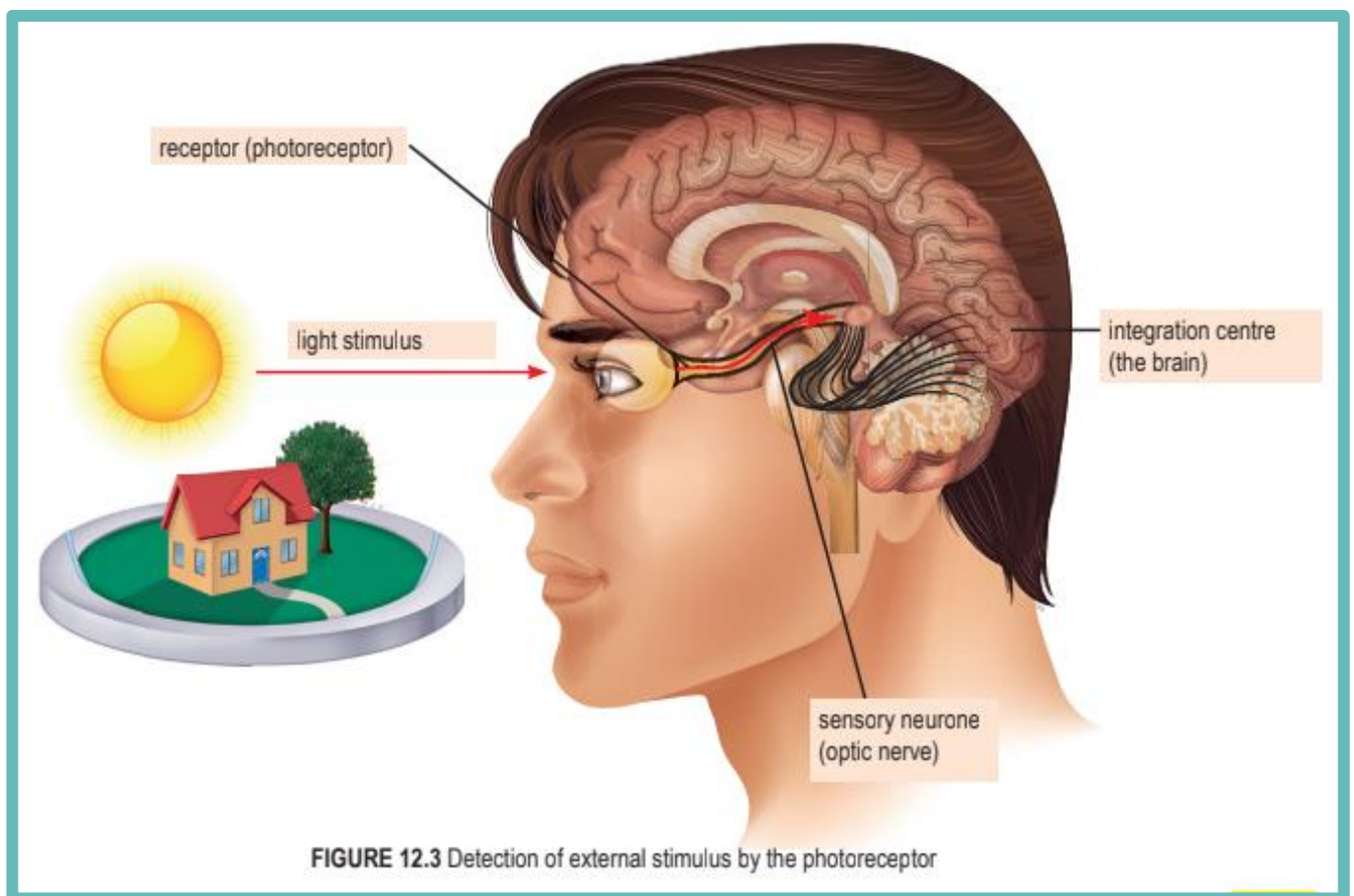


FIGURE 12.3 Detection of external stimulus by the photoreceptor

## Necessity of response

- Δ The ability of organisms to detect changes in the external environment and its response to the stimuli is very important for the survival of organisms
- Δ For some animals, a sudden change in climate conditions motivates the animals to look for new shelters
- Δ The ability of organisms to detect changes in the internal environment is also crucial so that the information can be transmitted to the integration centre
- Δ The integration centre will then transmit this information to the effectors to respond to the changes
- Δ For instance, when the body temperature increases above the normal range, this information will be transmitted to the integration centre by a receptor
- Δ The integration centre will send nerve impulses to the effectors to decrease the temperature back to its normal range
- Δ In conclusion, humans and animals need to respond to adapt to the changes in the environment

# CHAPTER 12.2 – NERVOUS SYSTEM

## Nervous system

- ↗ The human nervous system is made up of a network of nerve cells or neurones
- ↗ This system is divided into two main subsystems
  - a The central nervous system
  - b The peripheral nervous system
- ↗ The central nervous system includes
  - 1 Brain
  - 2 Spinal cord
- ↗ The peripheral nervous system consists of
  - i 12 pairs of cranial nerves
  - ii 31 pairs of spinal nerves
- ↗ The cranial nerves send nerve impulses from and to the brain
- ↗ Spinal nerves send nerve impulses from and to the spinal cord

## The central nervous system

### Brain

- ↘ Brain is made up of more than 100 million neurones
- ↘ The brain is the coordination and control centre for humans
- ↘ The main components of the brain
  - I. Cerebrum
  - II. Hypothalamus
  - III. Cerebellum
  - IV. Medulla oblongata
  - V. Pituitary gland

## CEREBRUM

- The largest and most complex structure present in the frontal part of the brain
- The surface is folded to increase the surface area to hold more nerves
- It is the centre that controls emotions, hearing, sight, personality and controlled actions
- The cerebrum receives information and stimulus from the receptor
- This information is analysed, integrated and correlated to produce sensory perception
- The response is determined and instructions are given to the effectors
- The cerebrum is also responsible for higher mental abilities such as learning, memorising, linguistic skills and mathematics skills

## HYPOTHALAMUS

- ✚ Coordinating homeostasis
- ✚ It is control centre that regulates body temperature, water balance, blood pressure, and senses hunger, thirst and fatigue
- ✚ The hypothalamus connects the nervous system to the endocrine system through the pituitary gland
- ✚ Controls the secretion of a few types of pituitary gland hormones

## CEREBELLUM

- Δ Maintains body balance and coordination of muscle contraction for body movement

## MEDULLA OBLONGATA

- ⊕ Located at the anterior of the cerebellum
- ⊕ Controls involuntary actions
- ⊕ Example
  - 1) Heartbeat
  - 2) Breathing
  - 3) Food digestion
  - 4) Vasoconstriction
  - 5) Blood pressure
  - 6) Peristalsis
  - 7) Vomiting
  - 8) Coughing
  - 9) Sneezing
  - 10) Swallowing
  - 11) Blinking

## PITUITARY GLAND

- Located at the base of the hypothalamus
- The main gland in the endocrine system
- This gland secretes hormones that control the secretion of hormones by other endocrine glands

## Spinal Cord

- ❖ The spinal cord is contained within the vertebral column and is surrounded by cerebrospinal fluid that protects and supplies the spinal cord with nutrients
- ❖ The spinal cord is made up of white matter and grey matter

- ❖ In a cross section, the grey matter looks like a butterfly or the letter 'H'
- ❖ Grey matter comprises mainly of cell bodies and is surrounded by white matter
- ❖ White matter consists of axons covered in myelin sheath and extends up and down the spinal cord
- ❖ The spinal nerve extends from the spinal cord through two short branches or roots which are
  - a) Dorsal root
  - b) Ventral root
- ❖ The function of the spinal cord is
  - i) To process a few types of sensory information and to send responses through the motor neurones
  - ii) To control reflex action
  - iii) To connect the brain with the peripheral nervous system

## DORSAL ROOT GANGLION

- The sensory neurones' cell bodies are clustered in the dorsal root ganglion

## DORSAL ROOT

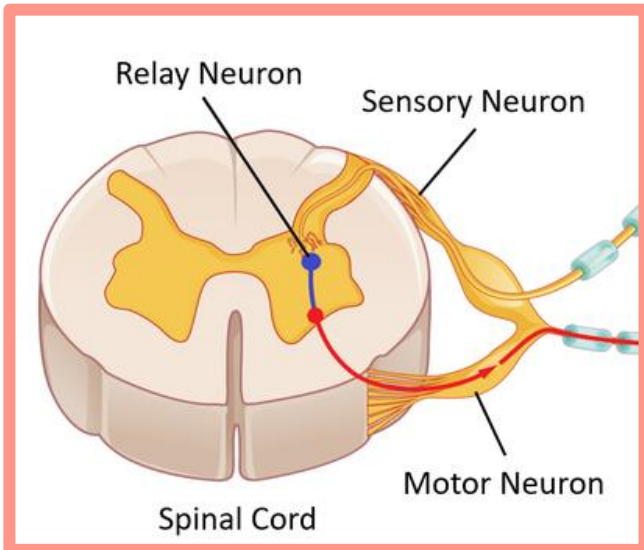
- Δ The dorsal root contains the axon of the sensory neurone that sends nerve impulses from the sensory receptor to the spinal cord

## VENTRAL ROOT

- ↳ The ventral root contains the motor neurone that sends nerve impulses from the spinal cord to the effector

## SPINAL NERVE

- ✓ The spinal nerve contains the sensory neurone and motor neurone



## The peripheral nervous system

The peripheral nervous system consists of

- 1 Somatic nervous system
- 2 Autonomic nervous system

### THE SOMATIC NERVOUS SYSTEM

♥ **Regulates** all controlled actions

### THE AUTONOMIC NERVOUS SYSTEM

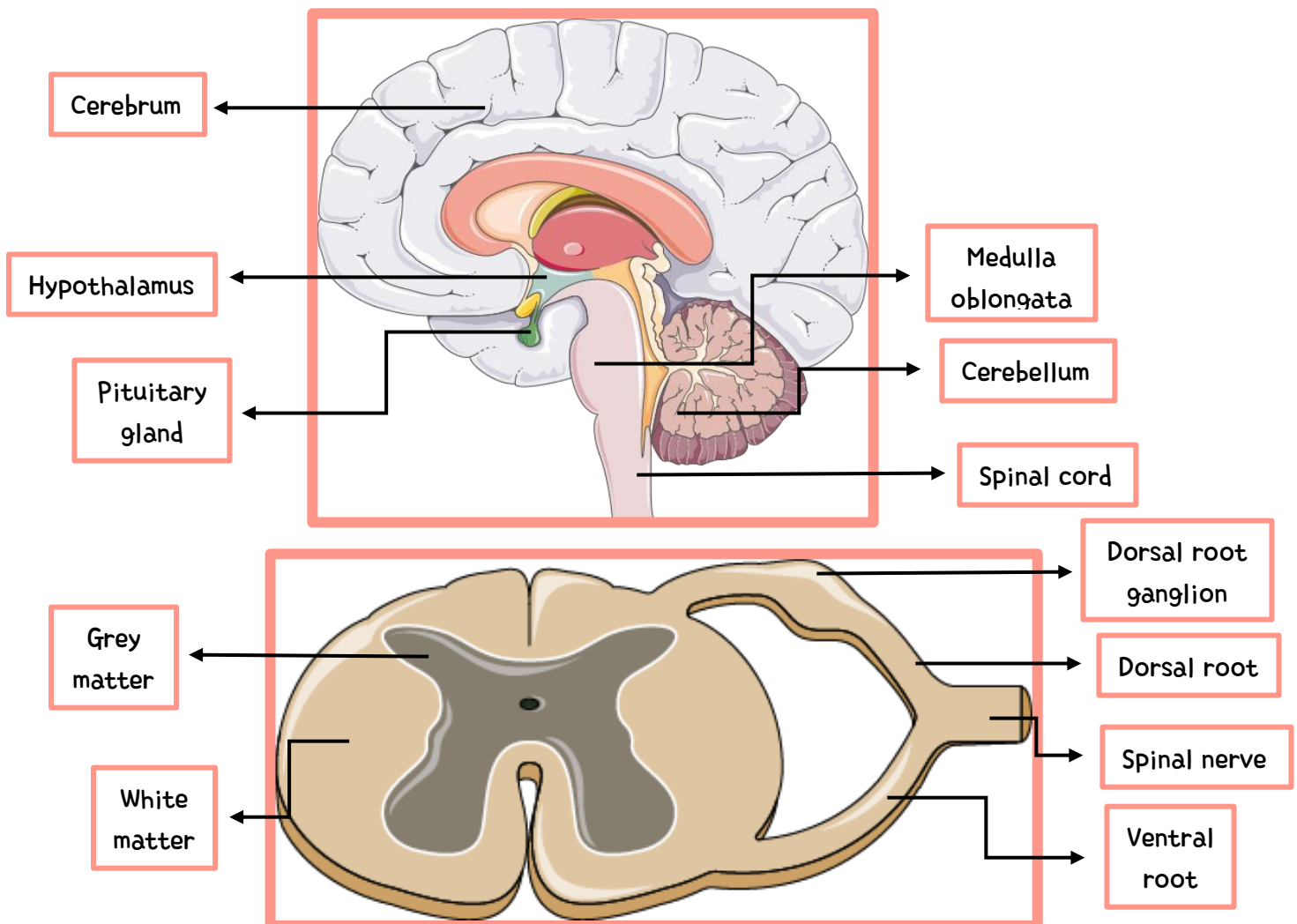
⊕ **Controls** involuntary actions

⊕ **Examples**

1. Heartbeat
2. Contraction of the blood vessels

### THE FUNCTION OF THE PERIPHERAL NERVOUS SYSTEM

◇ To **connect** sensory receptors and effectors to the central nervous system



# CHAPTER 12.3 – NEURONES AND SYNAPSE

## Neurons and synapse

- ⊞ The nervous system is made up of millions of nerve cells known as neurons
- ⊞ The basic structure of a neurone consists of
  - i Cell body
  - ii Axon
  - iii Dendrite
  - iv Myelin sheath
  - v A node of Ranvier
  - vi Synaptic knob
- ⊞ There are three types of neurones
  - I. Sensory neurones
  - II. Relay neurones
  - III. Motor neurones

### DENDRITE

- » Dendrites are short branches of the cell body
- » Dendrite receives nerve impulses from other neurones or the external environment and sends them to the cell body

### CELL BODY

- A cell body consists of a nucleus and many cytoplasmic projections called dendrites
- The cell body integrates signals and coordinates metabolic activities

### NODE OF RANVIER

- ♥ Certain neurons have parts that are not insulated by the myelin sheath at regular gaps along the axon
- ♥ This gap is known as a node of Ranvier
- ♥ The node of Ranvier helps to accelerate the flow of nerve impulses by allowing the nerve impulses to jump from one node to the following node

### AXON

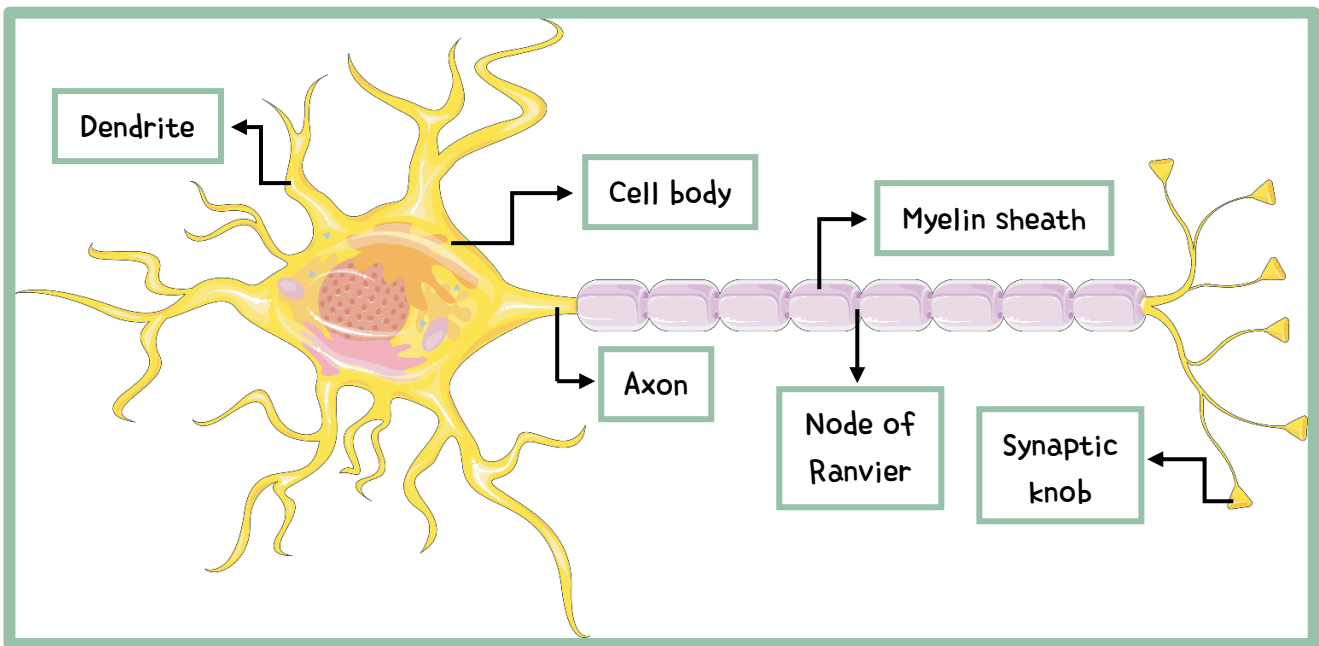
- ✓ Axon is an elongated branch of the body cell
- ✓ Axon carries impulses out of the cell body to other neurones or effectors

### MYELIN SHEATH

- Myelin sheath is an insulating membrane that coats the axon
- Function of the myelin sheath:
  - 1 Protects neurones from injury
  - 2 Functions as an insulator for electrical impulses
  - 3 Provides nutrients to the axon

### SYNAPTIC KNOB

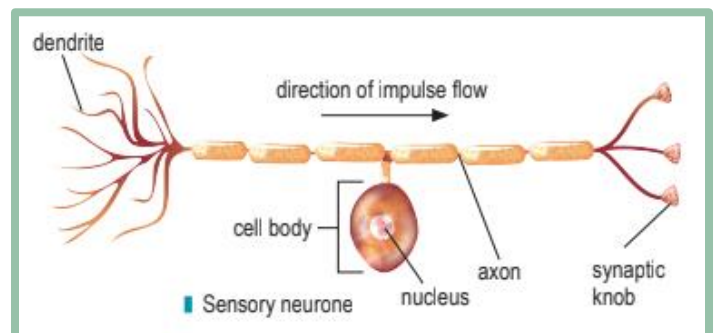
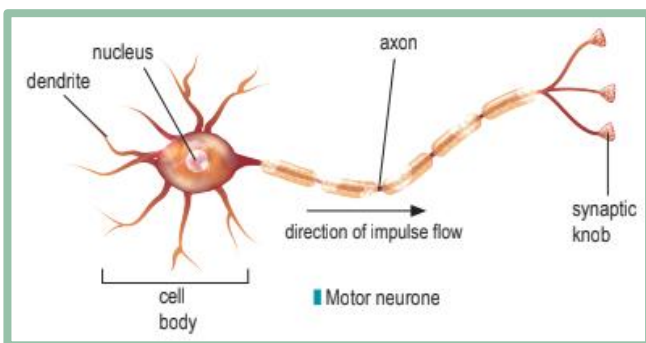
- The synaptic knob is a swelling at the end of the axon branch
- The synaptic knob sends signals to muscle cells, gland cells or other neurone dendrites



**MOTOR NEURONE**

- ↗ Can be found in the ventral root of the spinal nerve
- ↗ Receives nerve impulses from the relay neurone of the central nervous system and send nerve impulses to effectors (muscles, glands) to produce the appropriate response
- ↗ The cell body is present in the grey matter of the spinal cord

- ❑ The cell body is found in the dorsal root ganglion
- ❑ Dendrites receive nerve impulses from receptors and send them to the cell body
- ❑ The nerve impulses are transferred from the cell body through the axon to the next neurone



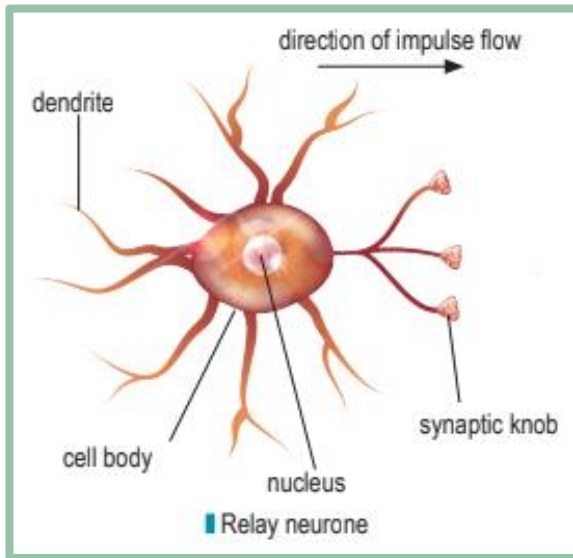
**SENSORY NEURONE**

- ❑ Present in the dorsal root of the spinal nerve
- ❑ Carries nerve impulses from the sensory organ receptors to the central nervous system

**RELAY NEURONE**

- ↘ Nerve fibres found in the central nervous system
- ↘ Connects the sensory neurone to the motor neurone
- ↘ The cell body can be found in clusters in the grey matter of the central nervous system
- ↘ Sends nerve impulses from the sensory neurone to the central

nervous system and from the central nervous system to the motor neurone



## Structure and functions of synapses

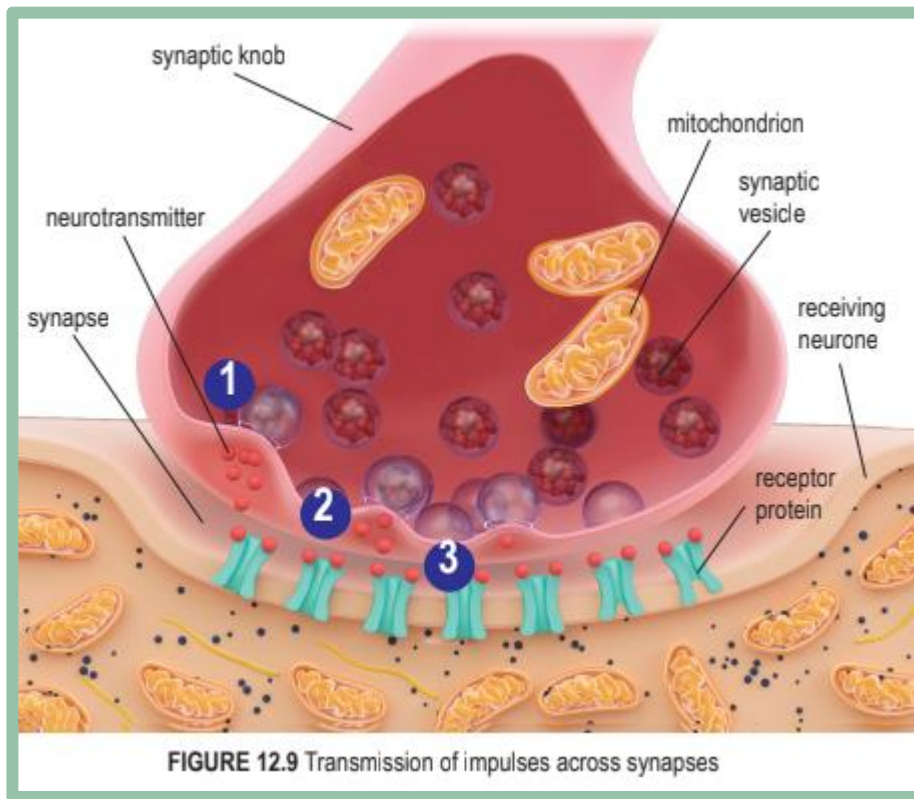
- ⇒ Information is sent along the neurone through electrical signals known as nerve impulses
- ⇒ Impulses are positively charged waves that flow along the axon to the synaptic knob
- ⇒ There is a narrow gap called synapse that separates the synaptic knob from neurone dendrites that receives the impulses
- ⇒ Electrical signals that carry information must be transferred across synapse for impulses to be transmitted to the following neurone
- ⇒ Synapse allow nerve impulses to travel in one direction
- ⇒ Therefore, synapses control the types of impulses that pass through them

## Transmission of impulse across a synapse

- Impulses are transmitted chemically across synapses
- The chemical substances involved are neurotransmitters that are kept in synaptic vesicles that are found at the end of the synaptic knob
- Examples of neurotransmitters found in most synapses
  - i) Acetylcholine (iii) Serotonin
  - ii) Noradrenaline (iv) Dopamine
- The process of transmitting impulses through synapse is slow as it occurs chemically
- At first, the electrical signal will be changed to a chemical signal in the form of a neurotransmitter, then the chemical substance is converted again to an electrical signal on the membrane of the receiving neurone

### TRANSMISSION OF IMPULSES ACROSS SYNAPSES

- 1 When electrical impulses reach the synaptic knob, synaptic vesicles are stimulated to release neurotransmitters into the synapses
- 2 The neurotransmitters diffuse through the synapse and combine to a specific receptor protein which is a receptor on the dendrite of the receiving neurone
- 3 The binding of the neurotransmitter and the receptor stimulates the initiation of the next impulse so that impulse can be transmitted through neurone

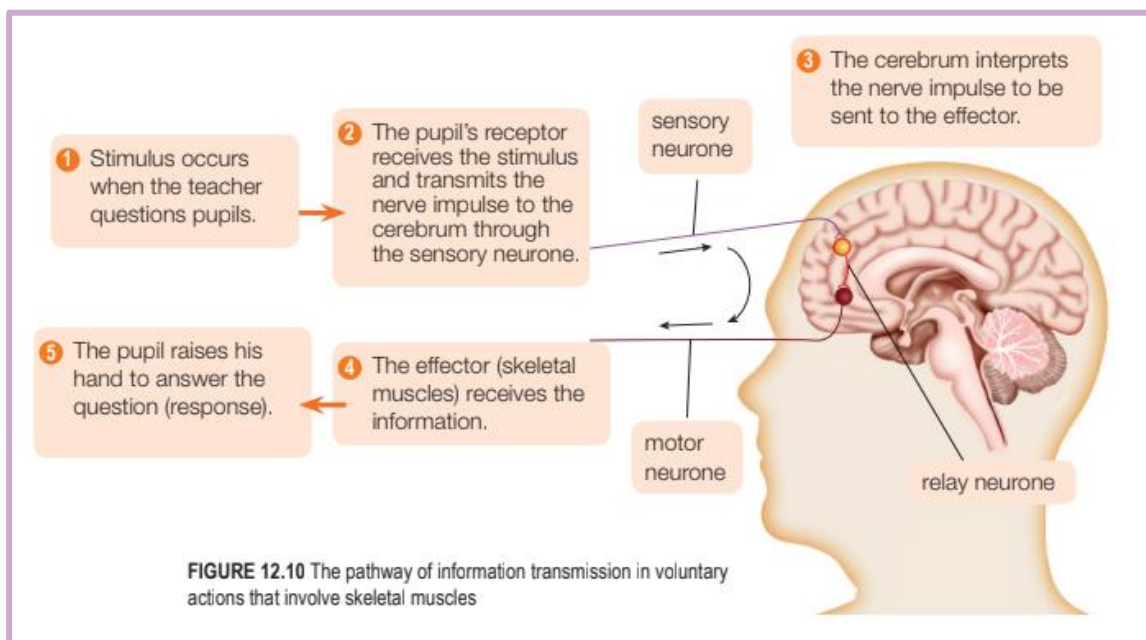


# CHAPTER 12.4 – VOLUNTARY AND INVOLUNTARY ACTIONS

## Voluntary actions

- ◇ Voluntary actions are **conscious actions** such as
  - 1) Walking
  - 2) Talking
  - 3) Brushing teeth

- ◇ For example, you **voluntarily** raise your hand to answer a question
- ◇ The voluntary actions involving the **skeletal muscles** are **controlled** by the **cerebral cortex**
- ◇ Since the information **reaches** the cerebral cortex, that is, our **level of consciousness**, our **perception of the surroundings** can be produced



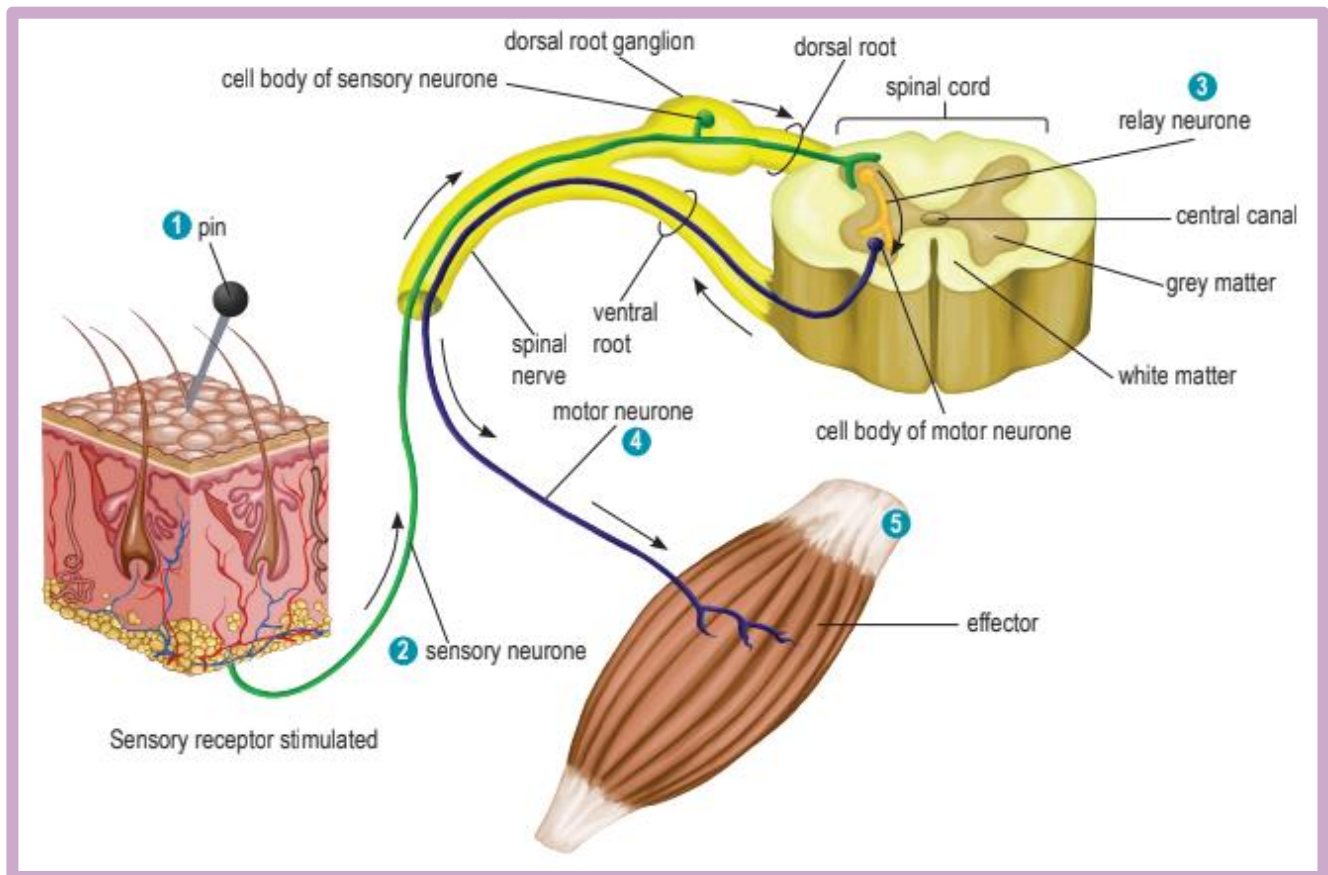
## Involuntary actions

- ⊗ Involving skeletal muscles: **reflex response**

### THREE-NEURONE REFLEX ARC

- ⊗ Several situations **require** immediate and spontaneous action
- ⊗ If you **accidentally prick** your finger on a sharp pin, you will **move** your finger **immediately** without much thought

- ⊗ This is known as a **reflex action**
- ⊗ A reflex action is a **fast response** a **stimulus without being controlled** by the brain
- ⊗ The **nerve pathway** involved in a reflex action is called the **reflex arc**
- ⊗ The reflex action of **moving** the finger from the sharp pin **involves three neurones** and **communication between the neurones** in the peripheral nervous system and the spinal cord

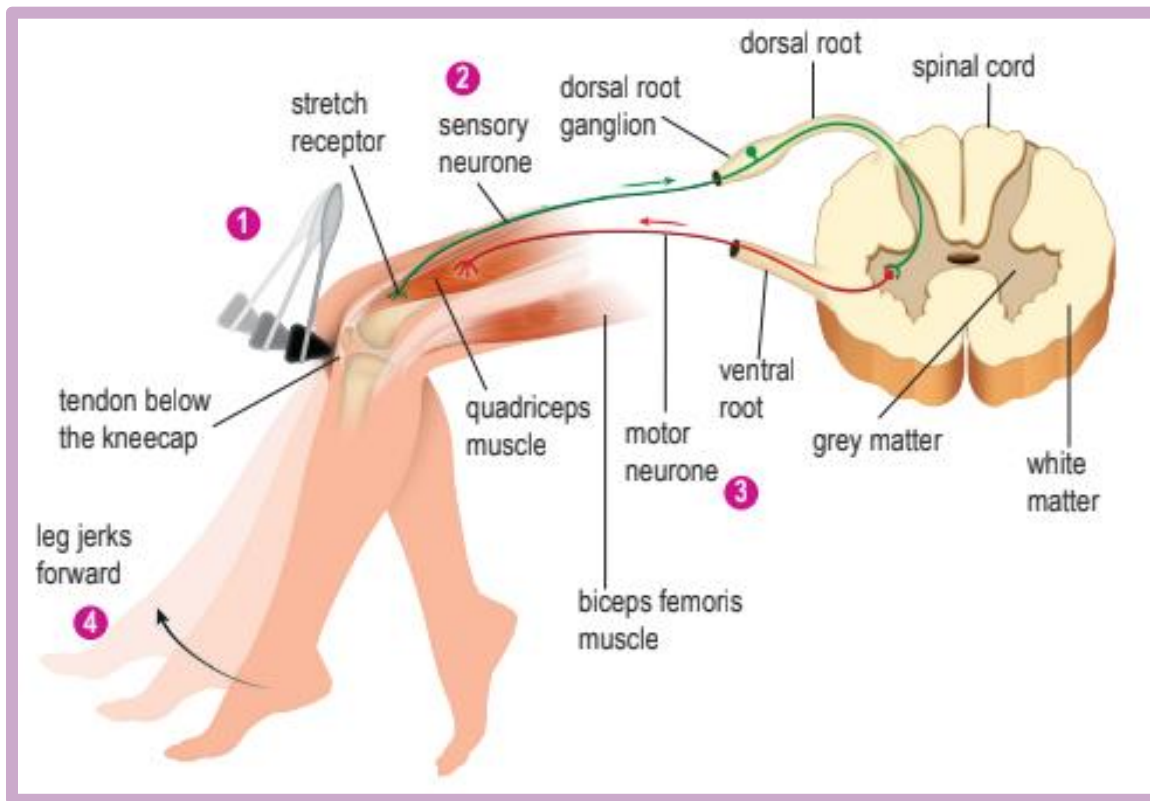


### THE REFLEX ARC THAT INVOLVES THREE NEURONE AND A SPINAL CORD

- O1 When a finger is pricked by a sharp pin, the **sensory receptor** detects the **stimulus** and **triggers** a **nerve impulse**
- O2 The nerve impulse is **transmitted** along the sensory neurone to the spinal cord
- O3 In the spinal cord, the nerve impulse is **transferred** from the sensory neurone **through** the synapse to the relay neurone
- O4 From the relay neurone, the nerve impulse is **transferred** to the motor neurone
- O5 The motor neurone **transfers** the nerve impulse from the spinal cord to the effector (muscle tissue) so that the finger can be move **quickly**

### TWO-NEURONE REFLEX ARC

- Δ Another reflex action is the **knee jerk** or **patellar reflex**
- Δ This reflex uses the **nerve pathway** that involves **two neurones**, that is
  - A. The sensory neurone
  - B. The motor neurone
- Δ The doctor sometimes **tests** the **effectiveness** of someone's nerve system by **tapping** on the **knee** using a **rubber hammer**



**THE REFLEX ARC IN KNEE JERK INVOLVING TWO NEURONES**

- 1 When the tendon below the kneecap is knocked, the quadriceps muscle stretches and stimulates the stretch receptors to trigger nerve impulses
- 2 The sensory neurone transmits the nerve impulses to the motor neurone in the spinal cord
- 3 The motor neurone then transmits impulses from the spinal cord to the quadriceps muscle
- 4 The quadriceps muscle contracts causing the leg to jerk to the front

**THE IMPORTANCE OF REFLEX ACTIONS**

- ◇ Reflex actions produce spontaneous responses without waiting for instructions from the brain
- ◇ The additional time that is needed by the brain to analyse information before triggering a response can lead to serious injuries
- ◇ Since reflex actions involve the spinal cord, the brain can focus on higher-level thinking

# CHAPTER 12.5 – HEALTH ISSUES RELATED TO THE HUMAN NERVOUS SYSTEM

## Nervous system disease

There are eight example of health issues

- ✎ Multiple sclerosis
- ✎ Alzheimer's disease
- ✎ Parkinson's disease
- ✎ Lou Gehrig / amyotrophic lateral sclerosis (ALS)
- ✎ Attention-deficit hyperactivity disorder (ADHD)
- ✎ Autism
- ✎ Epilepsy
- ✎ Brain paralysis (cerebral palsy)

### MULTIPLE SCLEROSIS

- ⇒ A progressive disease as a result of an abnormality in the immune system that attacks the myelin sheath in the brain and spinal cord
- ⇒ The damaged myelin sheath prevents transmission of impulses from and to the brain

### ALZHEIMER'S DISEASE

- ⊡ This disease causes the ability to reason and to take care of oneself
- ⊡ The patient is usually confused, forgetful and disoriented even in a familiar place
- ⊡ If the deterioration of the brain continues, the patient will lose the ability to read, write, eat, walk and talk

### PARKINSON'S DISEASE

- ⊕ It is the shrinkage of the nervous system that causes tremors in the limbs, jaw, foot and face
- ⊕ The patient will also have difficulty maintaining body posture and balance

### LOU GEHRIG / AMYOTROPHIC LATERAL SCLEROSIS (ALS)

- ◇ This disease is caused by the deterioration and death of motor neurones that control the movement of muscles such as chewing, walking and talking

### ATTENTION-DEFICIT HYPERACTIVITY DISORDER

- ⊕ A type of brain disease that causes someone to become hyperactive, unable to concentrate and gets easily bored

### AUTISM

- » A type of disease related to the development of nerves in the brain
- » Autism causes an individual to experience problems communicating and interacting

### EPILEPSY

- The occurrence of abnormal activities in certain parts of the brain causing the nerve cells to produce unusual signals

- A person suffering from epilepsy may become **unconscious** and **experience muscle spasms**

### BRAIN PARALYSIS (CEREBRAL PALSY)

- △ Brain paralysis **occurs** because of **brain damage** before or after a baby is born
- △ It could also **possibly occur** in children between the ages 3-5 years old
- △ This disease causes **failure** in **muscles** and the **ability of motor neurones** to function properly

## The effects of drug and alcohol abuse on human coordination and response

- There are **many types** of drugs used for medical purposes
- For example, **marijuana** is used by doctors in small quantities to **reduce nausea** in cancer patients after **undergoing chemotherapy treatment**
- However, drug abuse other than for medical purposes can cause serious side effects and would most likely be fatal
- Among the **effects** of drug abuse on drug addicts
  - a. Addiction
  - b. An addiction that causes withdrawal symptoms if the drug is not taken
- Among the **withdrawal symptoms** are
  - I. Shivering
  - II. Sweating
  - III. Vomiting

## The effects of drugs and alcohol on nervous system

### STIMULANT DRUGS (STIMULANTS)

- ✚ **Increases** the activity of the central nervous system
- ✚ Excessive use **causes temporary euphoria** which is followed by **depression**

### SEDATIVE DRUGS (DEPRESSANTS)

- **Delays the transmission** of nerve impulses
- **Calms** the mind

### HALLUCINOGENIC DRUGS

- ❖ **Causes** the user to **hallucinate**
- ❖ **Relief** from pain and anxiety

### NARCOTIC DRUGS

- ♥ **Delays** the normal functions of the brain

### ALCOHOL

- ✓ **Disrupts** coordination and thinking
- ✓ **Delays the transfer** of nerve impulses



# CHAPTER 12.6 – ENDOCRINE SYSTEM

## Endocrine system

- ◇ The coordination system of the body needs cooperation between the endocrine system and the nervous system
- ◇ Both systems play an important role in **maintaining homeostasis**
- ◇ Even though both systems have different functions, they interact and complement each other to regulate and coordinate all processes and activities in the body

## Endocrine system of humans

- The endocrine system is made up of glands that **secrete chemical substances**, that is **hormones**
- The endocrine glands are **ductless glands**

- So, the hormones are **secreted directly** into the **blood flow**
- Even though the hormones are **transported** throughout the body in the blood, the hormones only **influence and affect specific target cells**
- The hormones **bind with specific molecule receptors** on the **membrane surface of target cells** and **produce specific responses**
- The endocrine system of humans is made up of many glands
- The glands secrete different hormones involved in **specific psychological processes**
- The functions of hormones
  - i. **Reproduction**
  - ii. **Growth**
  - iii. **Homeostasis**

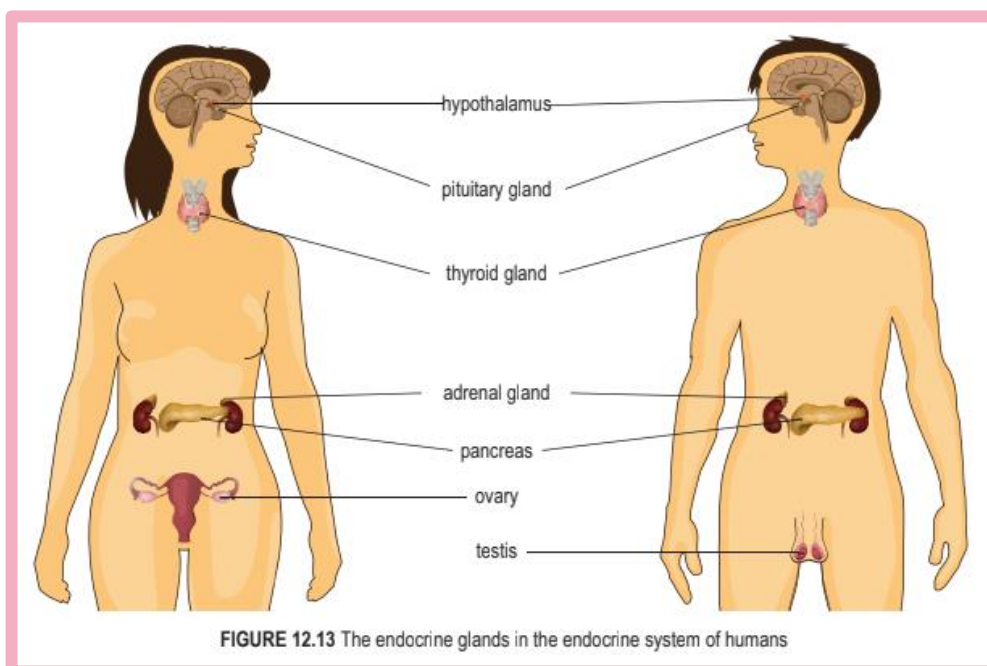


FIGURE 12.13 The endocrine glands in the endocrine system of humans

## The functions of hormones secreted by each endocrine glands

- » The pituitary gland is the main gland of the endocrine system because it secretes hormones that control the secretion of other endocrine glands

- » The pituitary gland is located at the bottom of the hypothalamus in the brain
- » The pituitary gland is made up of two lobes, which are the anterior lobe and the posterior lobe
- » Each lobe secretes hormones that have certain functions

## The functions of hormones that are secreted by the posterior lobe of the pituitary gland

| HORMONE            | TARGET TISSUE / ORGANS  | FUNCTION   |
|--------------------|---|--|
| Antidiuretic (ADH) | Kidney tubule   | Stimulates the reabsorption of water   |
| Oxytocin           | <ul style="list-style-type: none"> <li>⊕ Uterine muscles</li> <li>⊕ Mammary glands</li> </ul> | <ul style="list-style-type: none"> <li>▪ Stimulates the contraction of uterine muscles during birth</li> <li>▪ Stimulates the production of milk from the mammary gland</li> </ul> |

## The functions of hormones that are secreted by the anterior lobe of the pituitary gland

| HORMONE                             | TARGET TISSUE / ORGANS  | FUNCTIONS   |
|-------------------------------------|---|---|
| Luteinizing hormone (LH)            | <ul style="list-style-type: none"> <li>• Ovary</li> <li>• Testis</li> </ul> | <ul style="list-style-type: none"> <li>○ Stimulates ovulation, development of corpus luteum, and secretion of oestrogen and progesterone</li> <li>○ Stimulates secretion of testosterone</li> </ul> |
| Growth hormone (GH)                 | Soft tissue, bone   | Stimulates growth, protein synthesis and fat metabolism   |
| Adrenocorticotrophic hormone (ACTH) | Adrenal cortex  | Stimulates the adrenal cortex to secrete hormones   |
| Thyroid-stimulating hormone (TSH)   | Thyroid gland   | Stimulates thyroid to secrete thyroxine   |
| Follicle-stimulating hormone (FSH)  | <ul style="list-style-type: none"> <li>➤ Ovary</li> <li>➤ Testis</li> </ul> | <ul style="list-style-type: none"> <li>✓ Stimulates the development of follicles in the ovary</li> <li>✓ Stimulates spermatogenesis</li> </ul>  |

### STIMULATING HORMONE

- ⇒ The hormone that **regulates** the **secretion of other hormones** is known as the **stimulating hormone**
- ⇒ This includes thyroid-stimulating hormone (TSH) and adrenocorticotrophic hormone (ACTH)
- ⇒ For example, TSH **stimulates** the thyroid gland to secrete thyroxine

### TARGET ORGANS

- Hormones that **act directly on target organs** include growth hormone, oxytocin and antidiuretic hormone (ADH)
- For example, GH **acts directly** on the bone

### GONADOTROPHIN-RELEASING HORMONE (GnRH)

- ↳ The **hypothalamus secretes** gonadotrophin-releasing hormone (GnRH)
- ↳ GnRH **stimulates** the pituitary gland to secrete FSH and LH into the blood

*The functions of hormones secreted by other endocrine glands*

### ADRENAL GLAND

- ⊞ **Hormone:** Aldosterone
- ⊞ **Target tissues/organs:** Kidney
- ⊞ **Function:**
  - i) Increase the reabsorption of salt in kidneys
- ⊞ **Hormone:** Adrenaline

- ⊞ **Target tissues/organs:** muscle tissues, liver and heart
- ⊞ **Function:**
  - a. Increases the level of sugar and fatty acids in the blood
  - b. Increases the respiratory rate and heartbeat
  - c. Increases the rate of metabolism and contracts blood vessels

### THYROID GLAND

- ⊞ **Hormone:** Thyroxine
- ⊞ **Target tissues/organs:** All tissues
- ⊞ **Function:**
  - 1. Increases the metabolism rate
  - 2. Increases body temperature
  - 3. Regulates growth and development

### PANCREAS

- Δ **Hormone:** Insulin
- Δ **Target tissues/organs:** Liver, muscles and adipose tissues
- Δ **Function:**
  - 1) Reduces blood glucose level
  - 2) Promotes the conversion of excess glucose to glycogen
- Δ **Hormone:** Glucagon
- Δ **Target tissues/organs:** Liver, muscles and adipose tissues
- Δ **Function:**
  - A. Increases the blood glucose level
  - B. Promotes the conversion of glycogen to glucose

### TESTIS

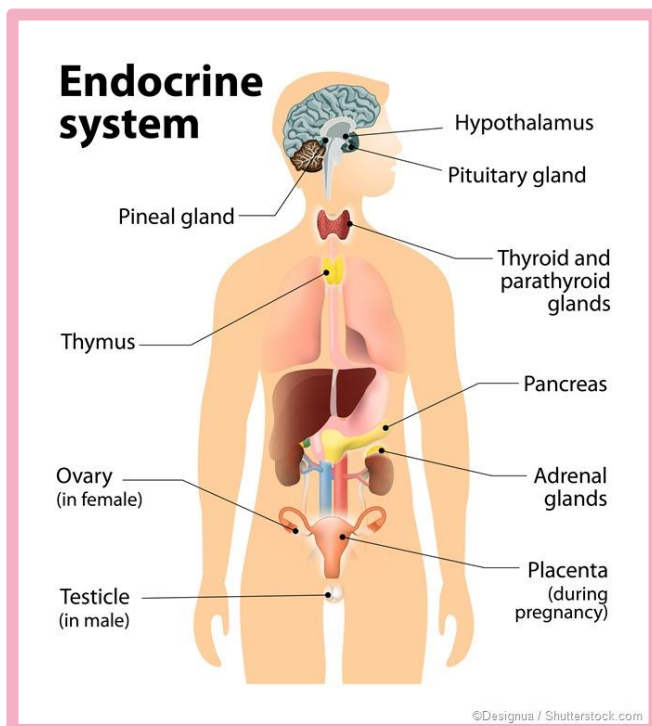
- ⊞ **Hormone:** Testosterone
- ⊞ **Target tissues/organs:** Gonad, skin, muscles and bones

### Function:

- 1 Stimulates the development of secondary sexual characteristics in the male and spermatogenesis

### OVARY

- ◇ **Hormone:** Oestrogen
- ◇ **Target tissues/organs:** Gonad, skin, muscles and bones
- ◇ **Function:**
  - a) Stimulates the development of secondary sexual characteristics in the female and maturity of the follicles
  - b) Repairs and stimulates the thickening of the uterus wall
- ◇ **Hormone:** Progesterone
- ◇ **Target tissues/organs:** Gonad
- ◇ **Function:**
  - i) Stimulates the development of the uterus wall and the formation of the placenta



## Involvement of the nervous system and endocrine system in a 'fight or flight' situation

- ❑ If you ever been chase by a dog or a goose, your heart will beat fast and your palms will sweat. What causes this condition?
- ❑ In an emergency or a 'fight or flight' situation, the hypothalamus transmits nerve impulses directly to the adrenal medulla and the adrenal medulla cells are stimulated to secrete adrenaline or noradrenaline
- ❑ These two hormones act quickly to produce the required responses in a 'fight or flight' situation
- ❑ This includes an increase in:
  - I. Heart rate
  - II. Respiratory rate
  - III. Blood pressure
  - IV. Blood glucose level
  - V. Metabolic activity
- ❑ The heart pumps more oxygen and glucose to the brain and skeletal muscles because additional energy is needed to fight or run quickly
- ❑ In an emergency, both the endocrine system and the nervous system work together to produce an immediate response to deal with the dangerous situation
- ❑ When this mechanism manages to control this 'fight or flight' situation, bodily changes that have occurred return to the normal range

# Similarities and differences between the nervous system and the endocrine system

## SIMILARITIES

| SIMILARITIES   |
|--|
| <ul style="list-style-type: none"> <li>⊕ Contains target tissues or organs</li> <li>⊕ Produces a response to a stimulus</li> <li>⊕ Functions to regulate all activities of the body</li> </ul> |

## DIFFERENCES

| NERVOUS SYSTEM  | ENDOCRINE SYSTEM  |
|---|---|
| The duration of the effect is short                           | The duration of the effect is long  |
| It is made up of a network of millions of neurons             | Consists of ductless endocrine glands   |
| Signal is in the form of electrical impulses through neurones | Signals is delivered by organic chemical substances, which are hormones, through blood flow |
| Nerve response is quick and immediate                         | The response is slow and prolonged  |
| The effect of an impulse produces the response of an organ    | The effect of hormones produces responses in several organs                                 |

# CHAPTER 12.7 – HEALTH ISSUES RELATED TO THE HUMAN ENDOCRINE SYSTEM

## Health issues related to the human endocrine system

### DIABETES MELLITUS

- A diabetes mellitus patient does not produce enough insulin or cannot use the insulin produced
- As a result, the level of glucose in the blood is high
- The patient urinates frequently, is always thirsty, experiences numbness in the soles of the feet, has blurred vision, is tired and their wounds heal much slower
- Whereas, the excessive secretion of insulin causes hypoglycaemia where the blood glucose level is too low
- Among the symptoms of hypoglycaemia are fatigue, difficulties sleeping at night, disordered thoughts, fear, emotional instability, faints easily and headache

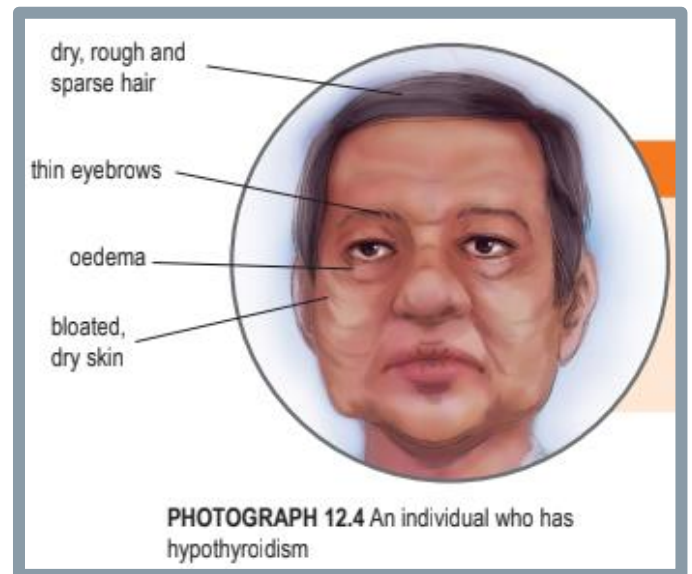
### DIABETES INSIPIDUS

- ⇒ For diabetes insipidus patients, the posterior lobe of the pituitary gland fails to secrete the antidiuretic hormone (ADH)
- ⇒ As a result, patients will produce a large amount of urine and often feel thirsty

- ⇒ Since a large amount of water is lost through urine, the individual will experience dehydration if they do not drink enough water every day

### HYPOTHYROIDISM

- ✚ An adult will experience hypothyroidism if there is inadequate thyroxine secretion
- ✚ Symptoms include extremely sensitive to cold, tiredness and gain weight easily



### HYPERTHYROIDISM

- ⇒ Hyperthyroidism refers to a situation that occurs when too much thyroxine is secreted
- ⇒ Symptoms include excessive sweating, heat intolerance and weight loss
- ⇒ Sometimes, the thyroid gland will grow two or three times larger than its original size



### GIGANTISM

- ⊞ Excessive secretion of the growth hormone (GH) during childhood causes gigantism which is a condition characterised by the abnormal elongation of bones
- ⊞ The individual grows to become extremely tall



### DWARFISM

- » Low secretion of the growth hormone (GH) during the period of growth delays the growth of bones and causes a condition called dwarfism
- » Organs also fail to develop and parts of the body ratio remain as that of a child

