



SSIP April – May 2020

LIFE SCIENCES

Topic(s) : Nervous System

Venue:

SSIP AIMS/GOALS

The four interconnected outcomes that drive the professional development activities for SSIP are:

1. Enhancing Teachers knowledge: deep understanding of subject matter knowledge and students ideas on the content
2. Enhancing quality teaching and assessment for learning: effective instructional approaches that teachers may use to ensure improved understanding by most learners.
3. Developing ICT integration skills :Use of ICT to improve teaching and learning
4. Building professional learning communities: allow teachers to start collaborating and form professional networks in non-formal settings in context of their schools

PROGRAMME

DAY THREE			
SESSION	TIME ALLOCATION	ACTIVITY	RESOURCES
SESSION ONE	08:00 – 10:30	Module 2: Unit 1: Structure and functions of the parts of the human eye, using a diagram. Unit 2: Binocular vision and its importance. Unit 3: Changes that occur in the human eye during accommodation and pupillary reflex, using diagrams. Unit 4: The nature and treatment of visual defects, using diagrams. Activity 2.1 – 2.6 Module 3: Unit 1: Structure of the human ear and the functions of the different parts, using a diagram. Unit 2: Functioning of the human ear in hearing and balance. Unit 3: The nature and treatment of hearing defects. Activity 3.1 – 3.3	Course material Power point Video clips
	10:30 – 10:45	TEA BREAK	

ATP FOR TERM 2

14/04 – 17/04 (4 days)	13	Life processes in Plants & Animals	Responding to environment	Introduction □ The nervous system (involving nerves) and endocrine system (involving hormones) are two components that help us respond to the environment Human nervous system □ The need for a nervous system in humans: • Reaction to stimuli (stimuli can be external and internal) • Co-ordination of the various activities of the body		52		
				Central Nervous System: □ The brain and spinal cord are protected by meninges □ Location and functions of the following parts: • Brain – Cerebrum – Cerebellum – Corpus callosum – Medulla oblongata • Spinal cord Peripheral Nervous System: □ Location and functions of the peripheral nervous system (cranial and spinal nerves) Autonomic Nervous System: □ Location and functions of the autonomic nervous system (sympathetic and parasympathetic sections) Structure and functioning of a nerve: □ Functions of sensory and motor neurons □ Structure and functions of parts of sensory and motor neurons, using diagrams: nucleus, cell body, cytoplasm, myelin sheath, axon and				

ATP FOR TERM 2

20/04 – 24/04	14
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Reflex arc: ☐ Definition of reflex action and a reflex arc ☐ Structure of a reflex arc and functions of each part, using a diagram: receptor, sensory neuron, dorsal root of spinal nerve, spinal cord, inter-neuron, motor neuron, ventral root of spinal nerve, effector ☐ Functioning of a simple reflex action, using an example ☐ Significance of a reflex action ☐ Significance of synapses Disorders of the CNS ☐ Causes and symptoms of the following disorders of the nervous system: • Alzheimer's disease • Multiple sclerosis <i>Practical worksheet 6</i>

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MODULE 2

Overview of Module 2

In this module we will look at the concept of 'The Human nervous system'

Content

You will study this module through the following units:

Unit 1: Responding to the environment and coordination of activities
in the body

Unit 2: Structure of the Nervous System

Unit 3: Structure of the Central Nervous System

Unit 4: Location and functions of the Peripheral Nervous System

Unit 5: Location and functions of the Autonomic Nervous System

Unit 6: Structure and functioning of a nerve

Unit 7: Structure and function of a simple reflex arc

Unit 8: Disorders of the CNS

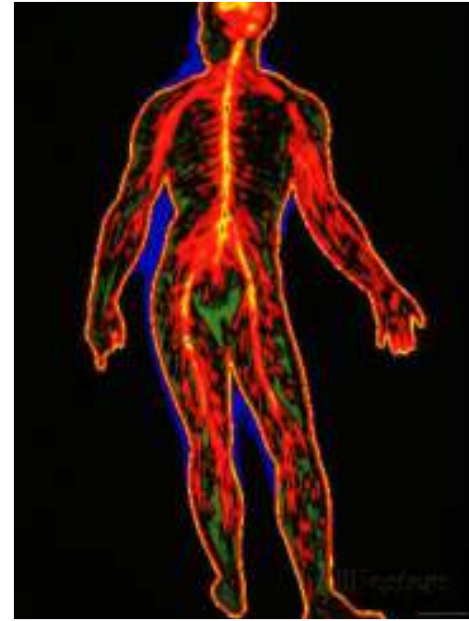
OUTCOMES OF THIS MODULE

Statement of the learning outcomes/objectives

When you complete this module you will be able to:

- Identify the different parts of the nervous system
- Identify the different structures of the brain.
- Describe the functions of the different parts.
- Draw and label the parts of the reflex arc.
- Briefly explain the events occurring during a reflex action.
- Carryout an investigation on reaction time.

The nervous system

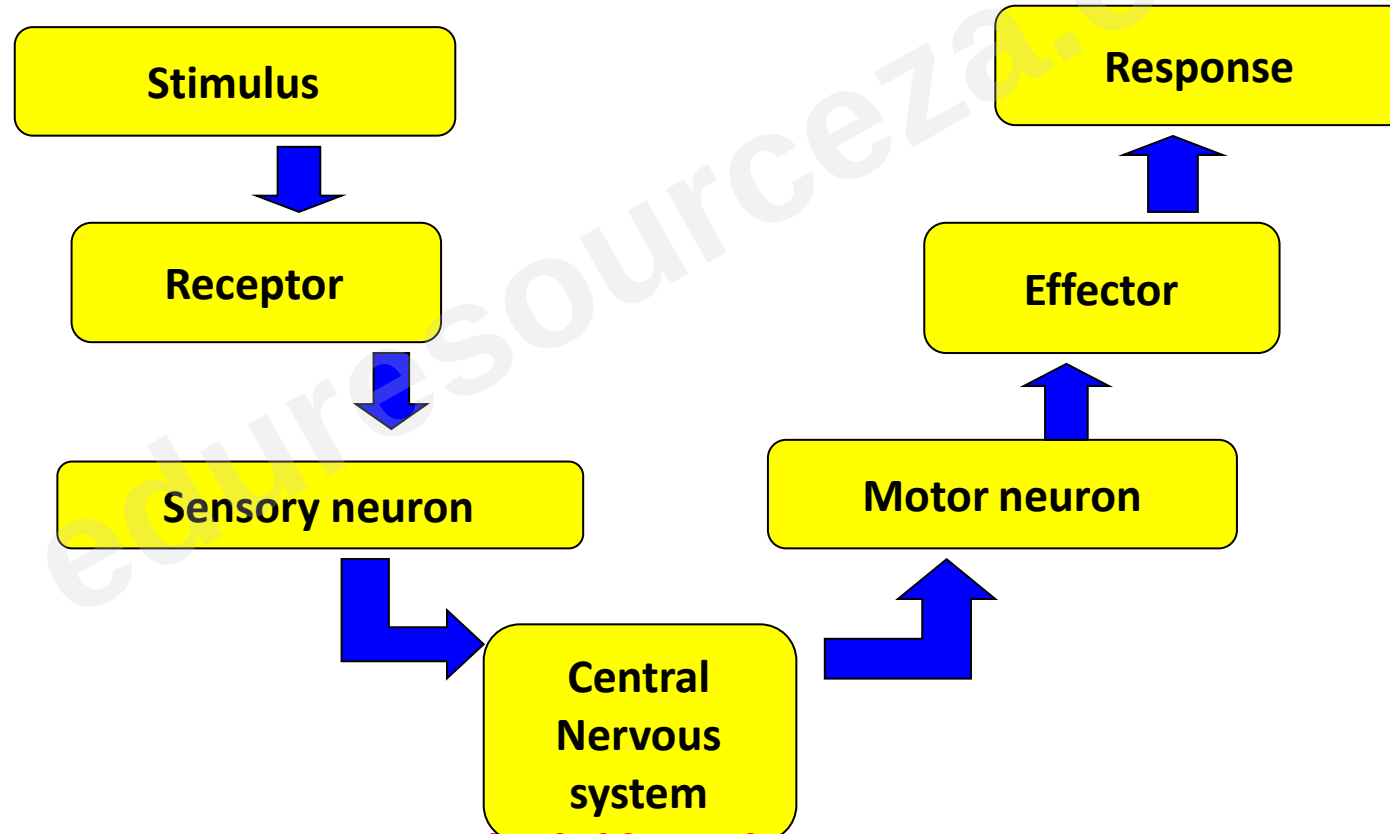


Nervous co-ordination

- To survive, all organisms need to be able to sense changes in their environment and to control their responses to these changes.
- The nervous system and the endocrine system are important communication systems that co-ordinate, intergrade and carry out the activity of body cells, tissues, organs and the organism.
- They maintain a constant internal balance, while reacting to the changes that occur in both the external and internal environment

The Nervous system

How does our nervous system work?

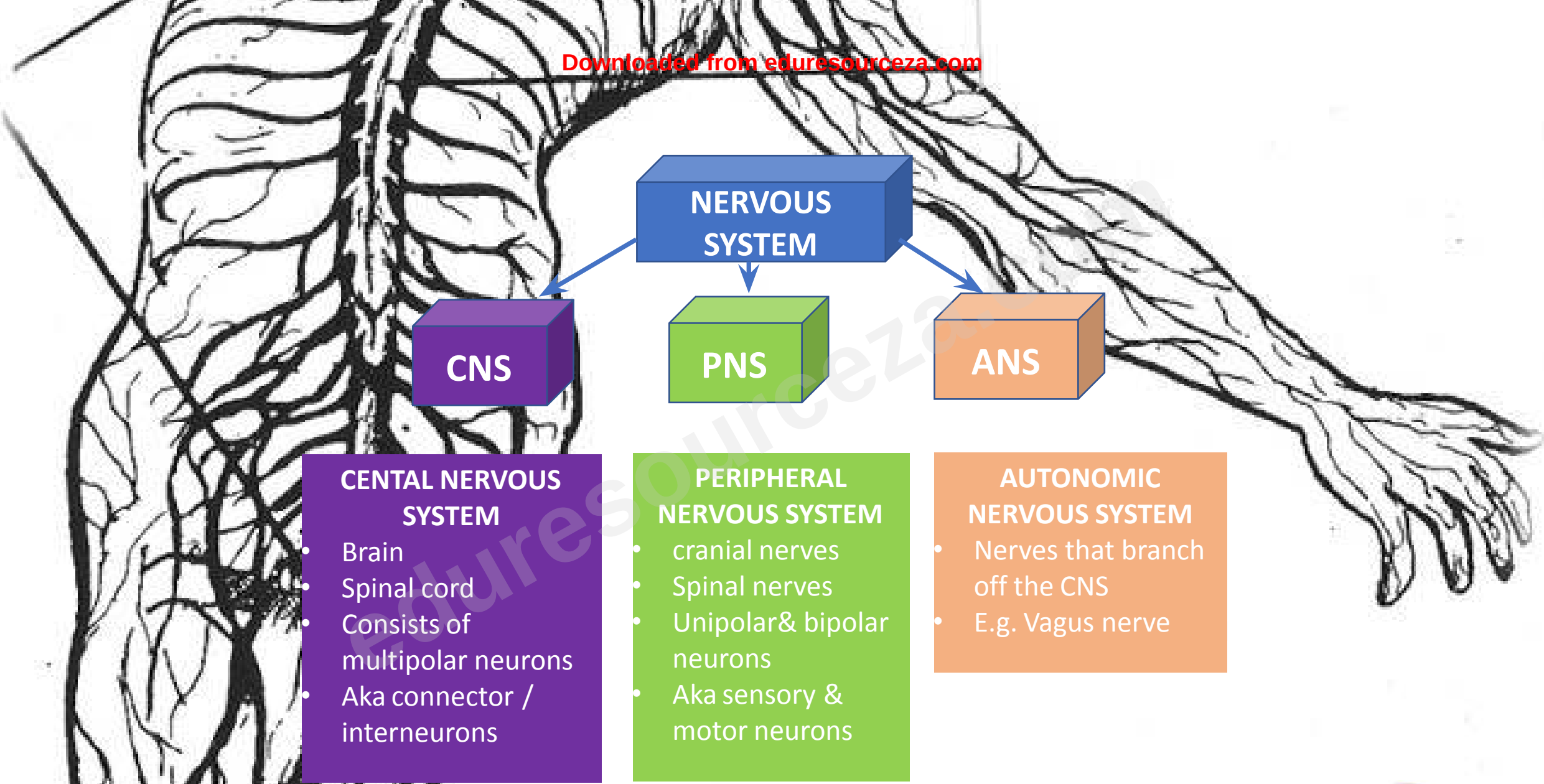


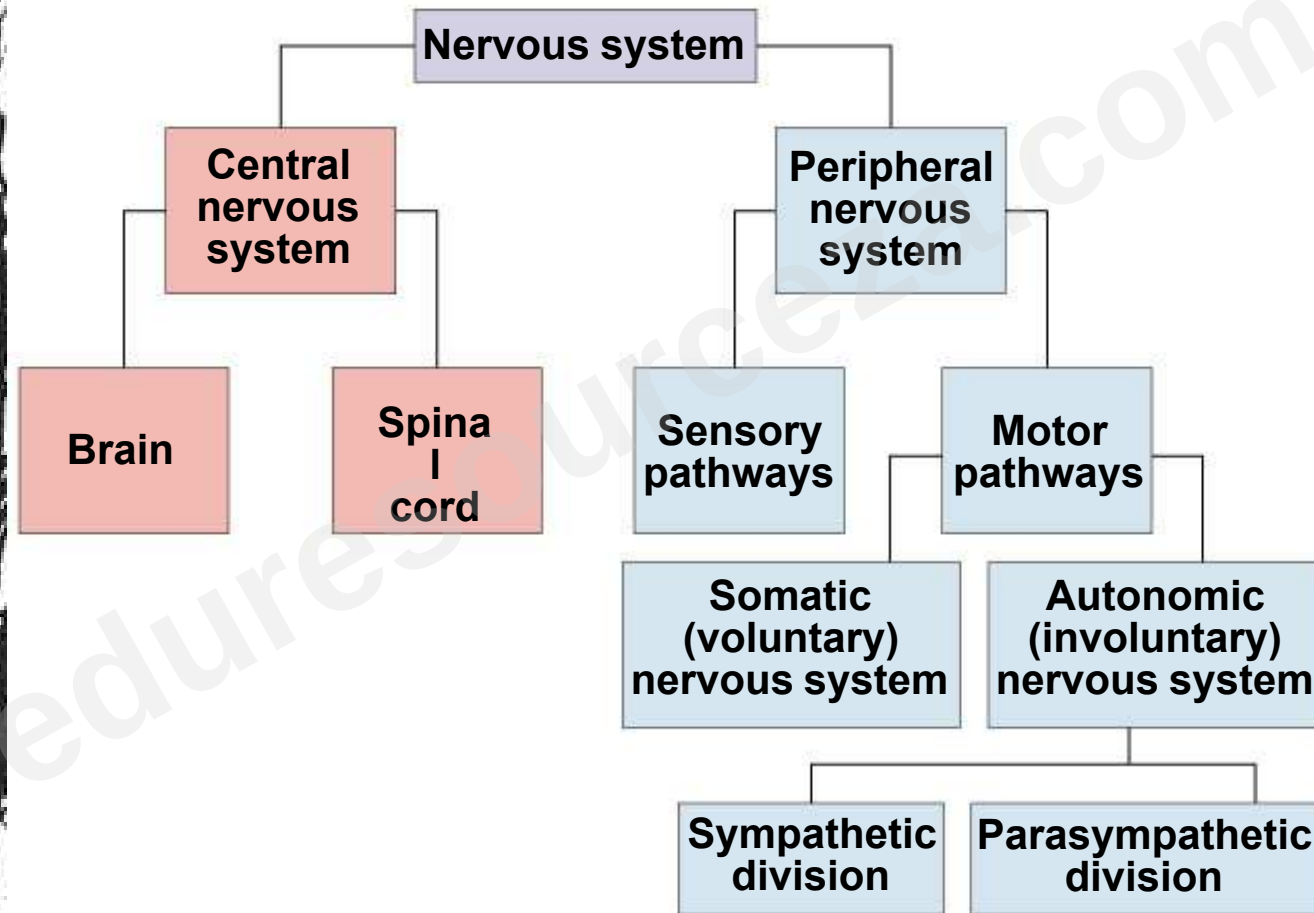
Reaction to stimuli in the environment

- The nervous system and sense organs play an important part in picking up **stimuli**, gathering information and responding **quickly** to **changes** from both the **external** and **internal** environment to maintain a **constant state**
- The nervous system in vertebrates performs five main functions
 1. Gathers information using the senses
 2. Transmits information to processing areas of the brain
 3. Processes information
 4. Formulates responses to stimuli
 5. Sends information back through the network of effector organs to execute the response

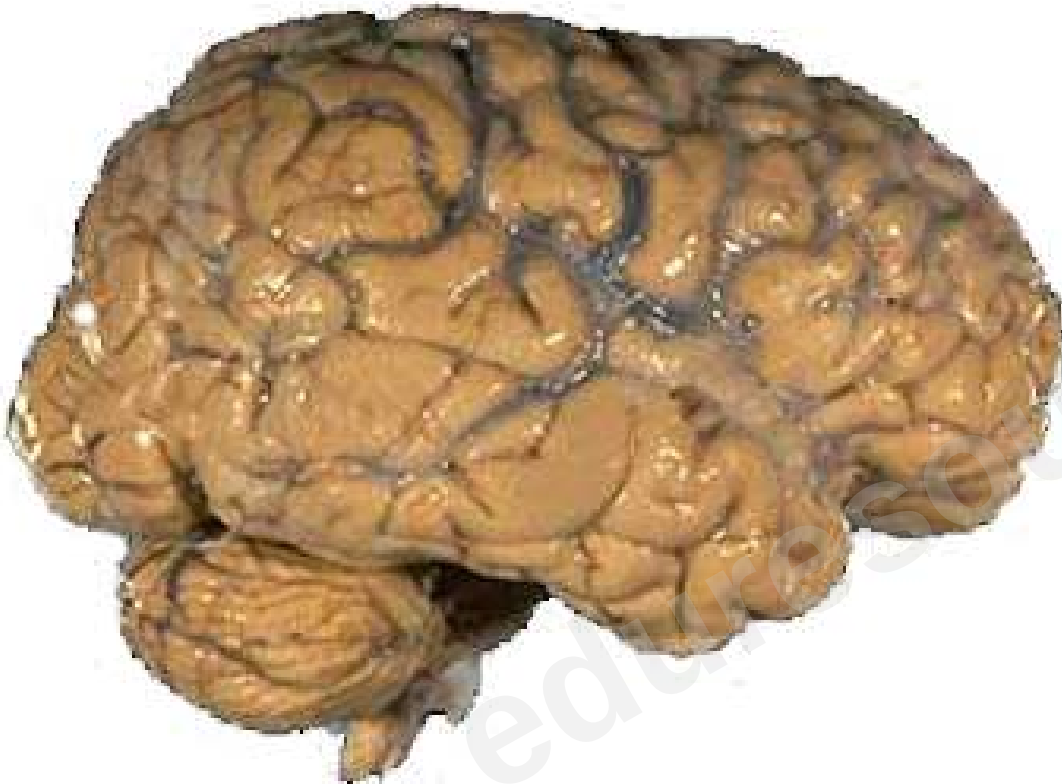
Name types of stimuli?



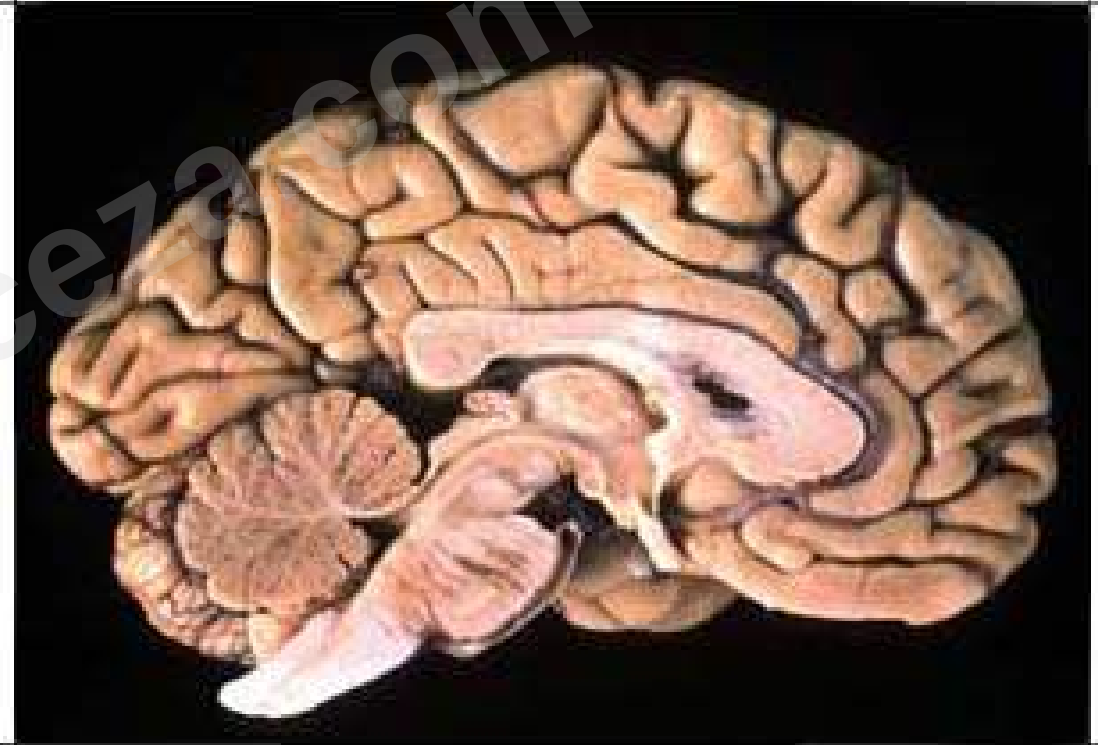




The Brain

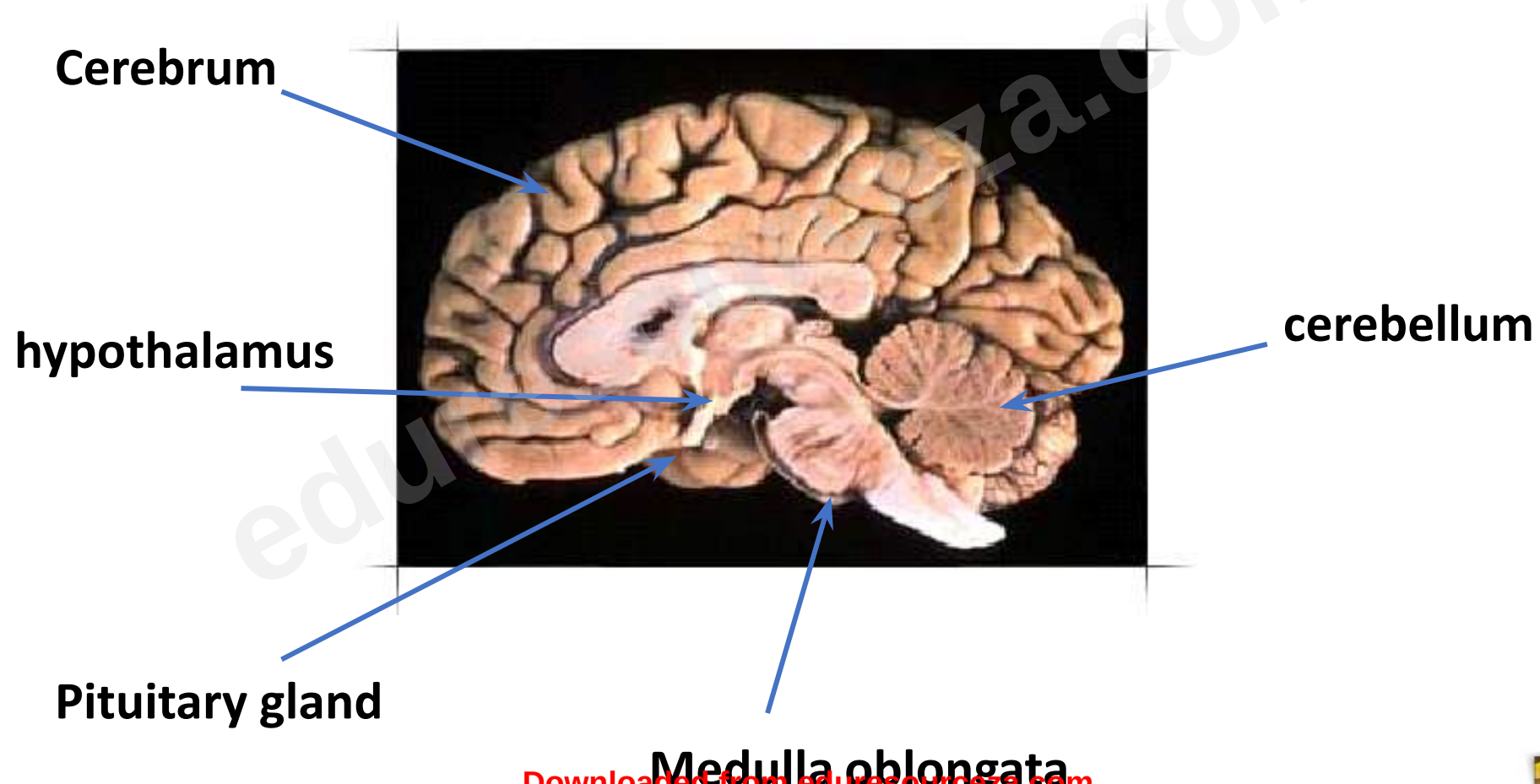


External structure of the brain



Internal structure of the brain

Brain structure



Structure of the brain and the functions

Cerebrum

- Controls voluntary actions
- Receives and interprets sensations from sense organs
- Higher thought processes

Corpus callosum

- Connects the left and right hemispheres of the brain – allowing communication between both hemispheres

Cerebellum

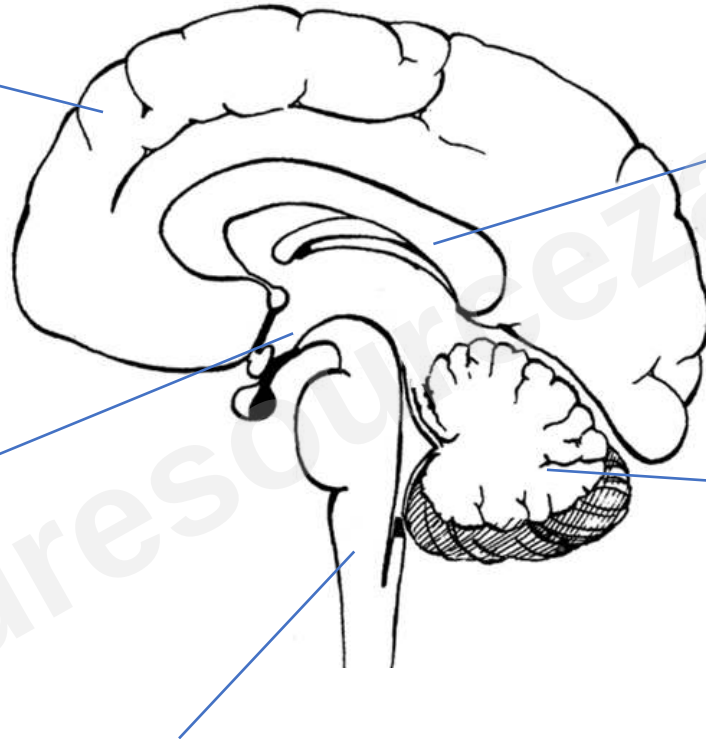
- Coordinates all voluntary movements
- Controls muscle tension to maintain balance

Medulla oblongata

- Transmits nerve impulses between the spinal cord and the brain
- Controls involuntary actions such as heartbeat and breathing

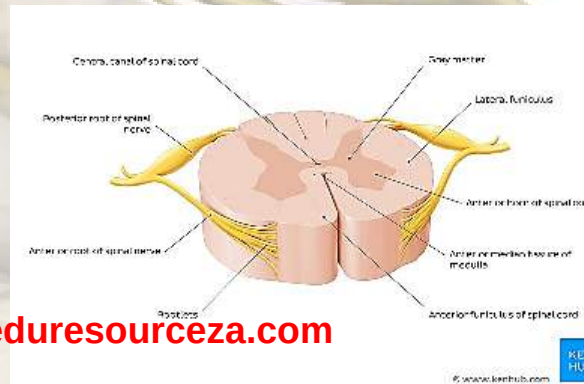
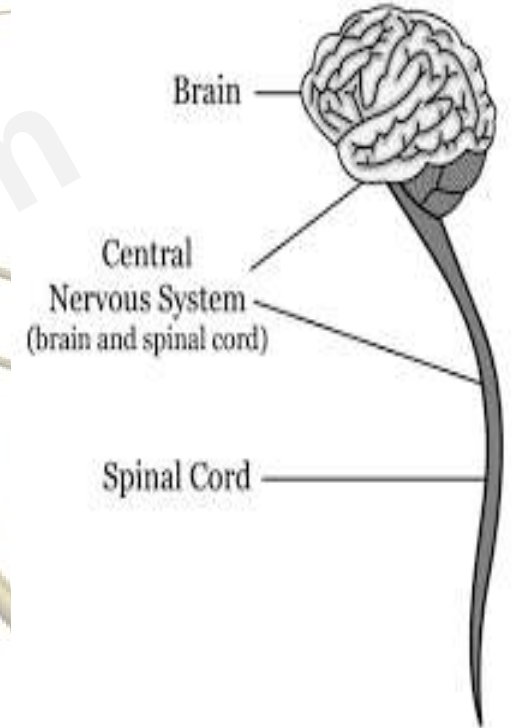
Hypothalamus

- Control centre for hunger, thirst, sleep, body temperature and emotions



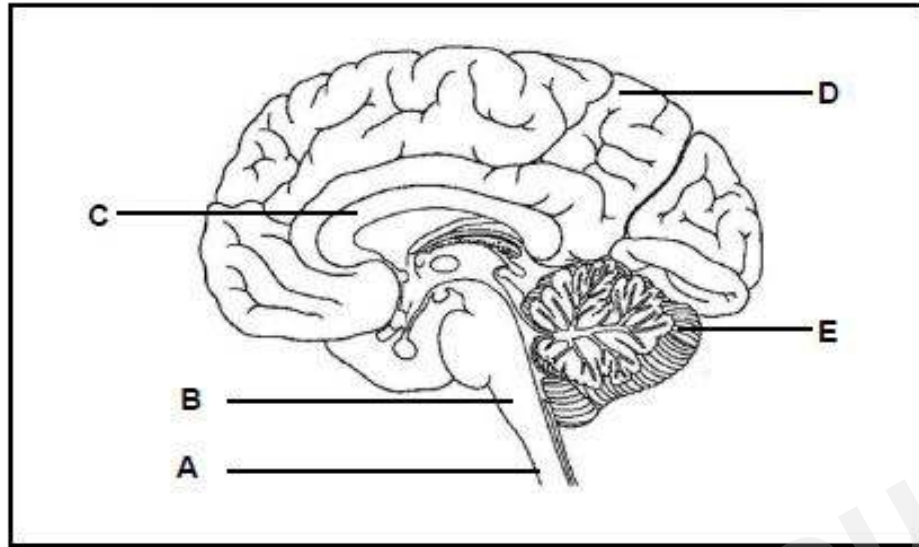
The Spinal Cord

- The spinal cord is inside the vertebral canal and is an extension of the brain
Protection: vertebrae, meninges and cerebrospinal fluid.
- From each side of the cord **31 pairs** of spinal nerves arise from ventral and dorsal roots.
- Function:
 - The spinal cord is the pathway for all impulses conducted to and from the brain.
 - The grey matter lies on the inside in the shape of an 'H'
 - The white matter lies on the outside (opposite to the cerebrum).
 - The spinal cord processes all reflex actions.
 - The spinal cord functions automatically and is not controlled by the will.
 - Sympathetic and parasympathetic nerve impulses are conducted along the spinal cord to all organs.



1.5

The diagram below shows some parts of the human central nervous system.



Activity 2.2

- 1.5. 1.5.1 (a) spinal cord ✓ (1)
 (b) corpus collosum ✓ (1)
- 1.5.2 (a) D ✓ Cerebellum ✓ (2)
 (b) B ✓ Medulla oblongata ✓ (2)
 (c) E ✓ Cerebellum ✓ (2)
- (8)**

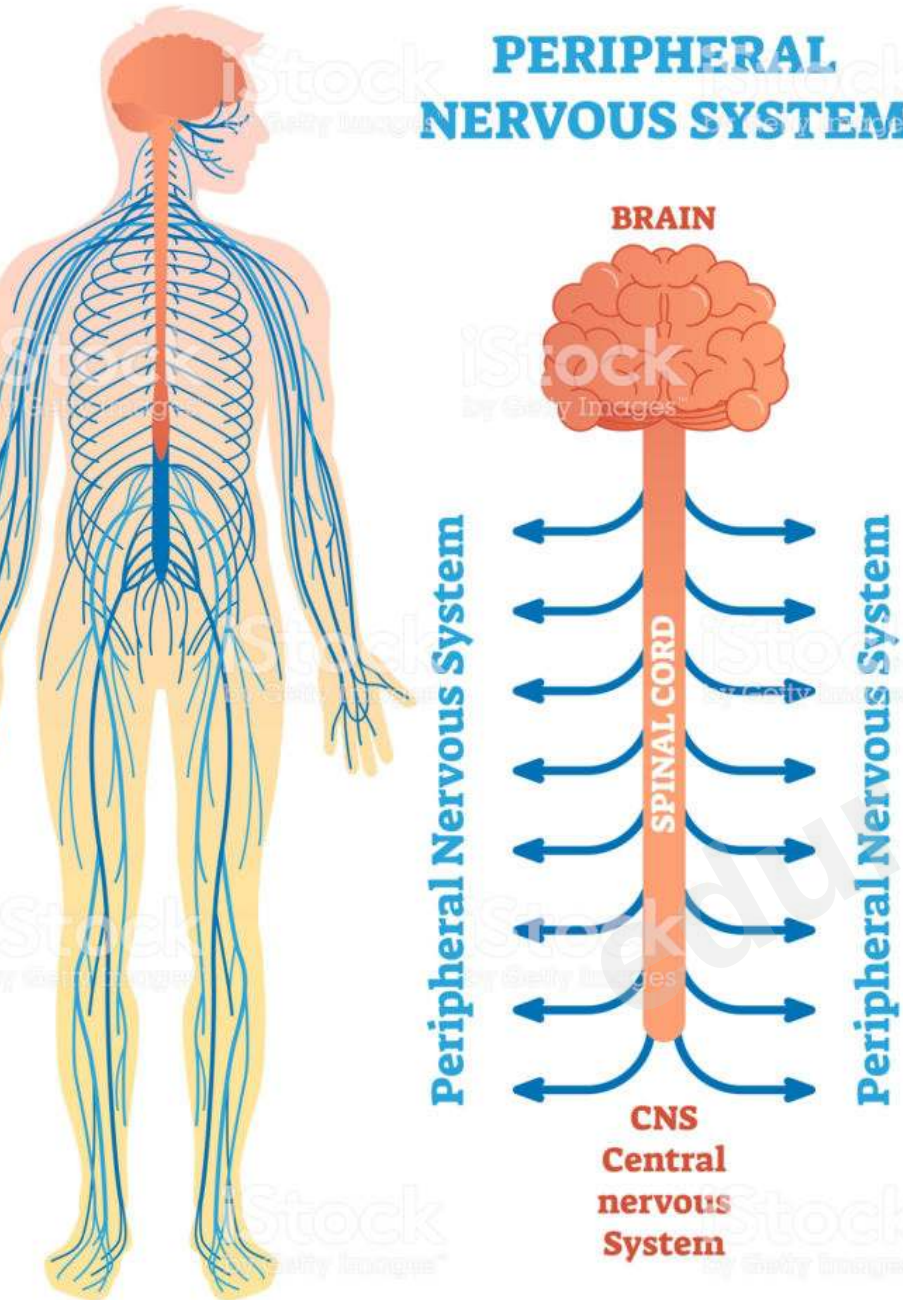
1.5.1 Identify part:

- (a) A (1)
 (b) C (1)

1.5.2 Write down the LETTER and NAME of the part that:

- (a) Has the centre for interpreting taste (2)
 (b) Regulates the heart rate (2)
 (c) Is responsible for motor coordination (2)
- (8)**

PERIPHERAL NERVOUS SYSTEM



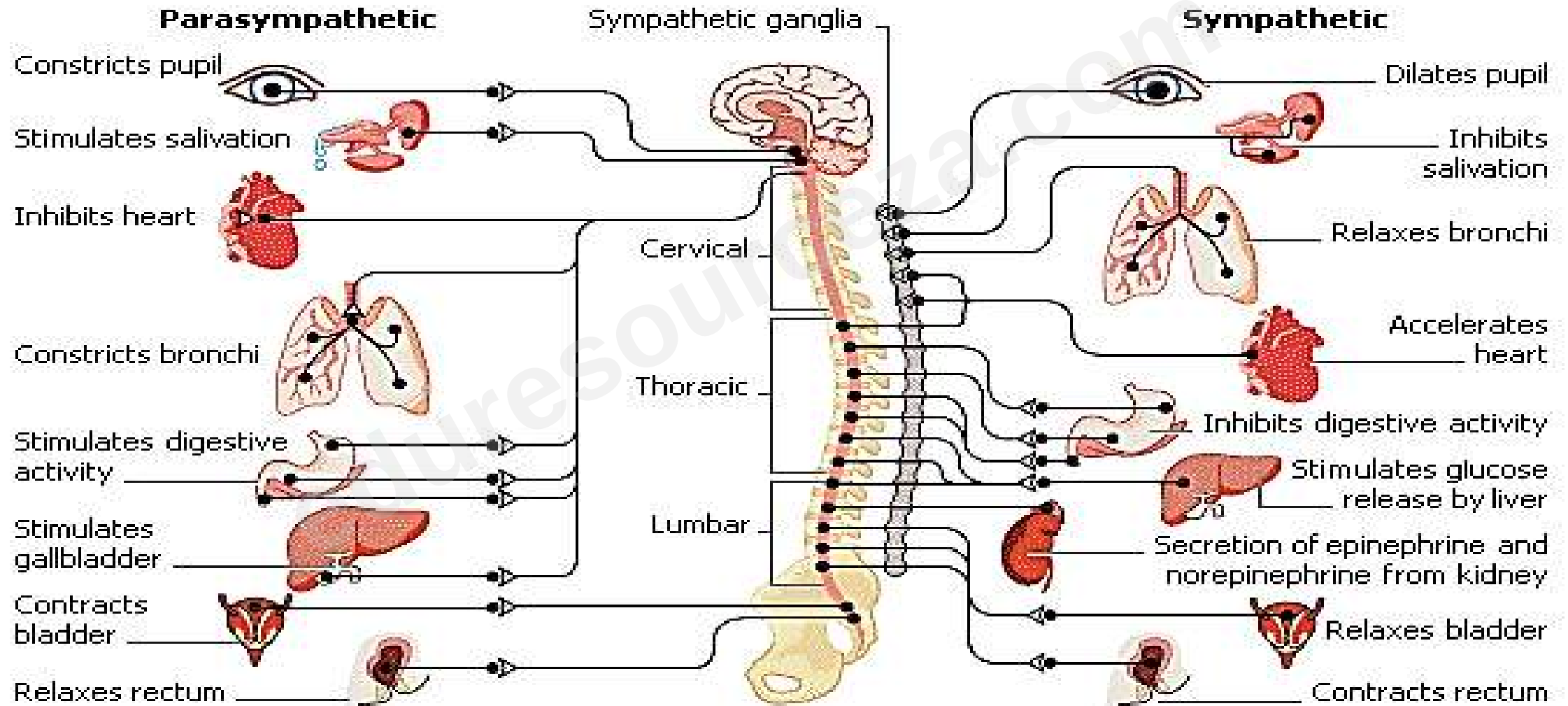
Peripheral nervous system

- The peripheral nervous system (PNS) is all the nervous tissue outside the central nervous system (CNS).
- It is divided into the **somatic nervous system** and **autonomic nervous system** and is made of 43 pairs of nerves:
 - 12 pairs of cranial nerves
 - 31 pairs of spinal nerves
- **Function:** the somatic nervous system received information from **receptors** and conveys the information to the CNS.
- It also transmits the impulses from the CNS to **effector organs**.

AUTONOMIC NERVOUS SYSTEM

- The autonomic nervous system (ANS) controls the heart rate, breathing, digestion and gland functions e.g. salivary glands secreting saliva
- The autonomic nervous system HAS two branches.
- The sympathetic branch prepares the body for energy-expending, stressful, or emergency situations.
- The parasympathetic branch is active under ordinary, restful conditions
- The two systems have an opposite effect: one stimulates, the other inhibits i. e. each organ in the body is **innervated** by the sympathetic nerve and parasympathetic nerve.
- This is known as **double innervation**
- E.g. the sympathetic nerve causes the iris to **dilate** and the parasympathetic nerve causes the iris to **constrict**

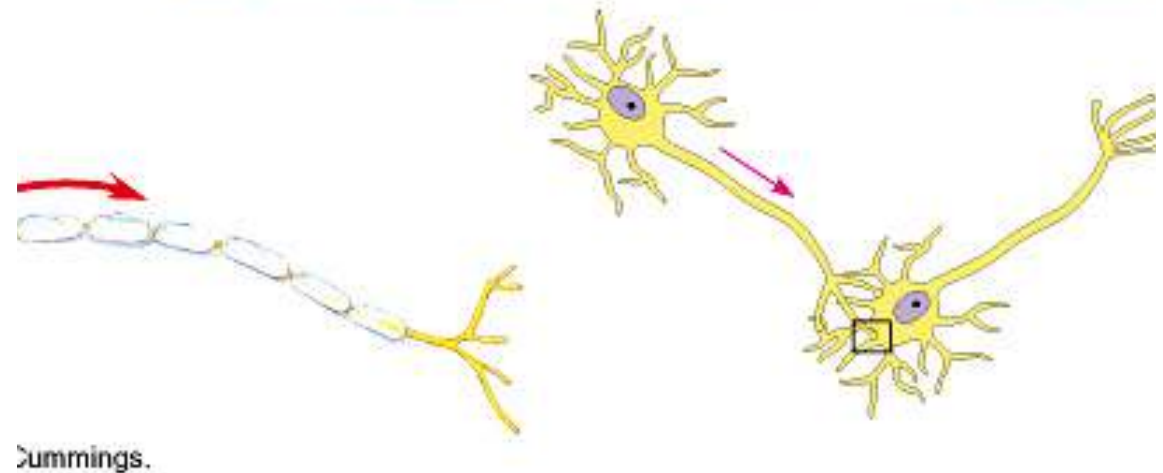
Autonomic nervous system



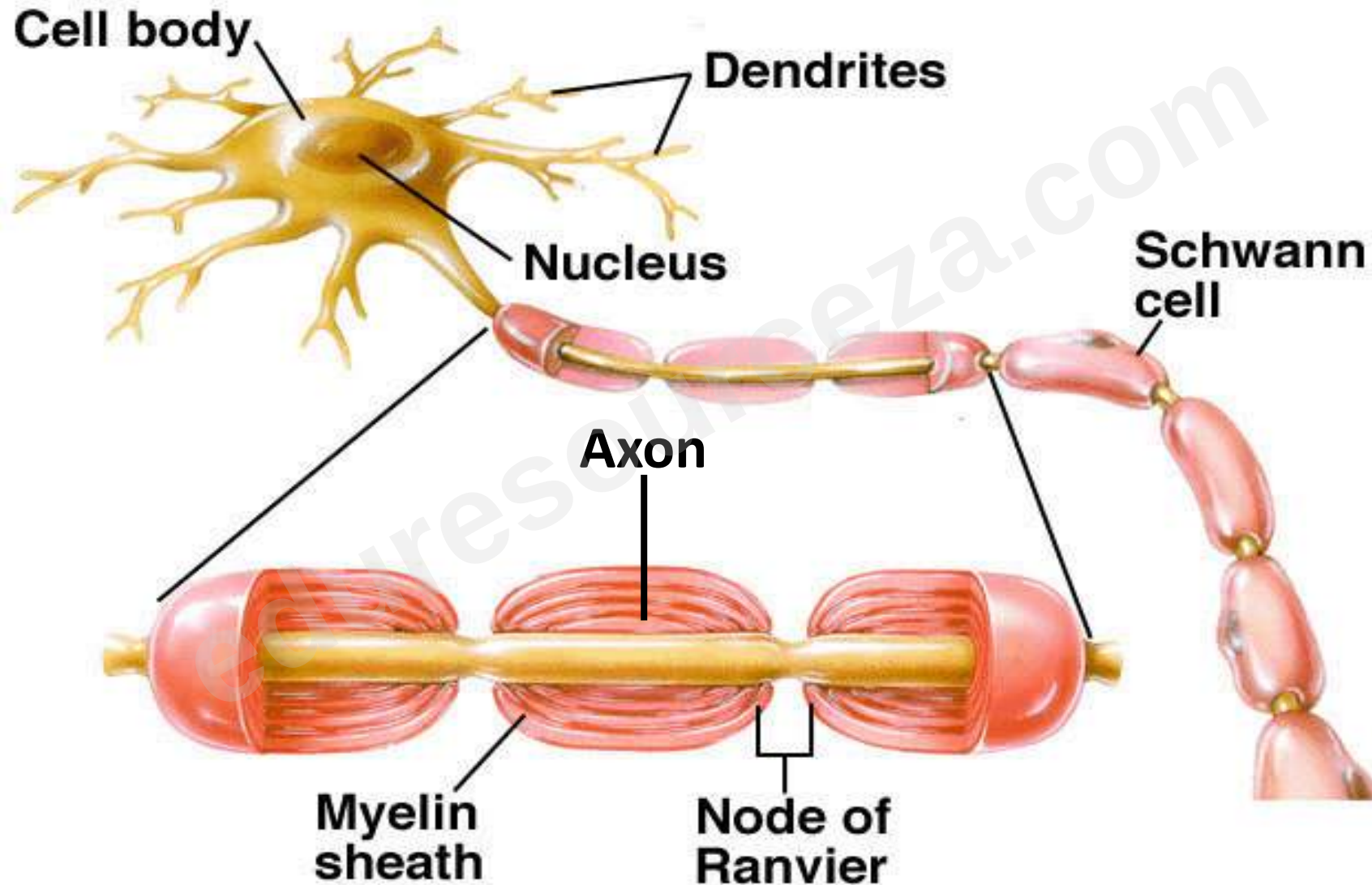
Sympathetic branch	Parasympathetic branch
1. Increases heart rate	1. Decreases heart rate
2. Relaxes walls of bladder	2. Contracts wall of bladder
3. Dilates pupils	3. Constricts pupils
4. Constricts many arteries	4. Dilates arteries
5. Increases blood pressure	5. Decreases blood pressure

Neurons – nerve cells

- Neurons are specialized cells which connect the **brain and spinal cord** to all other parts of the body.
- Each neuron has the following parts:
 1. Cell body
 2. Dendrites
 3. Axon
- The **dendrites always carry the impulse to** the cell body and the **axon always carries the impulse away** from the cell body

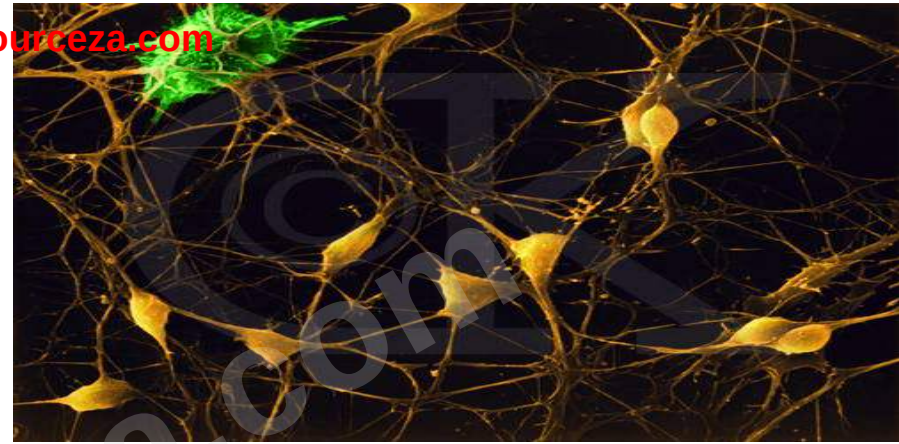


Neuron Structure



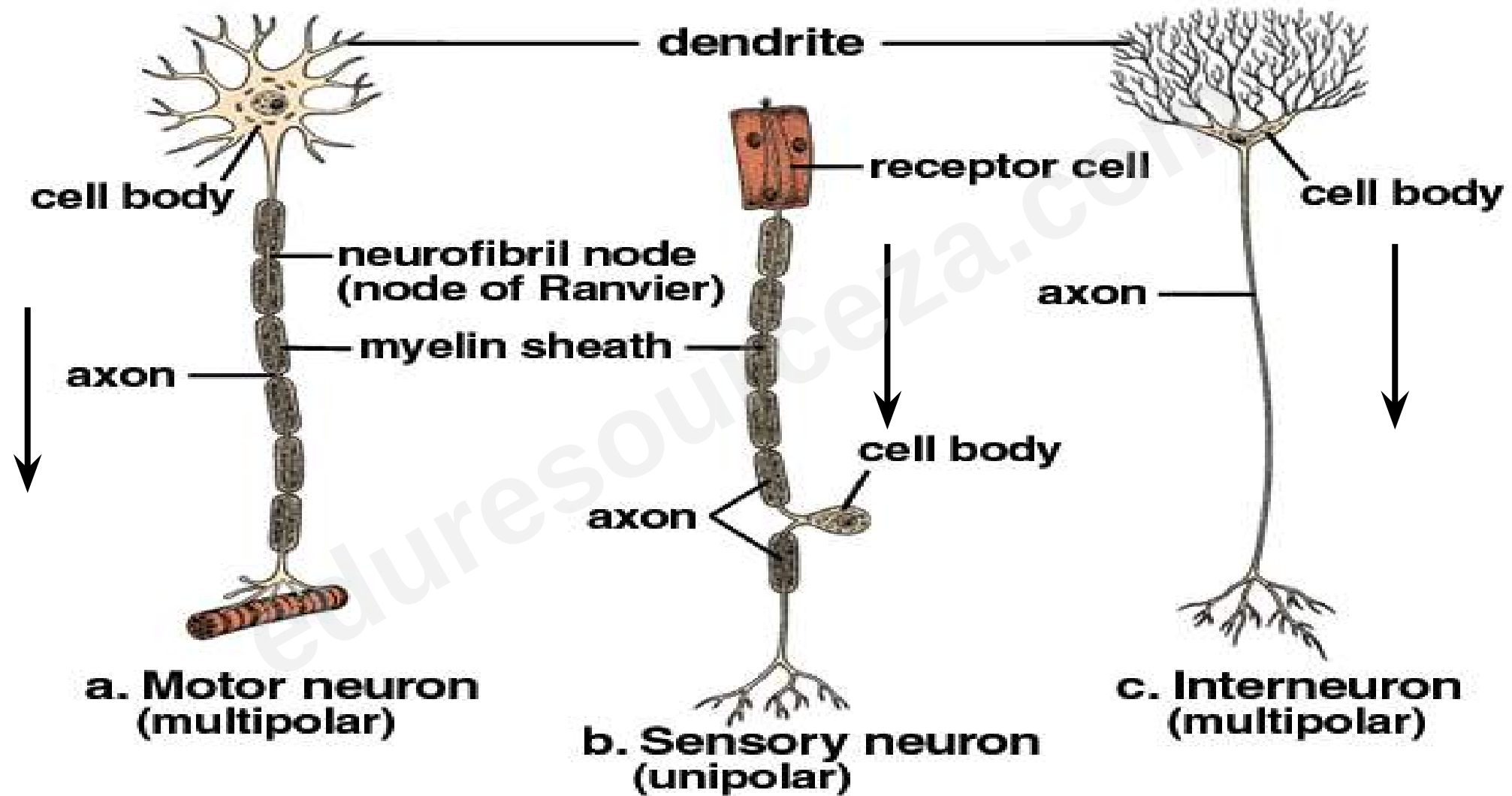
Neurons

- **Axons** and **dendrites** may be **myelinated** i.e. they have a fatty layer wrapped around them, which acts as insulation

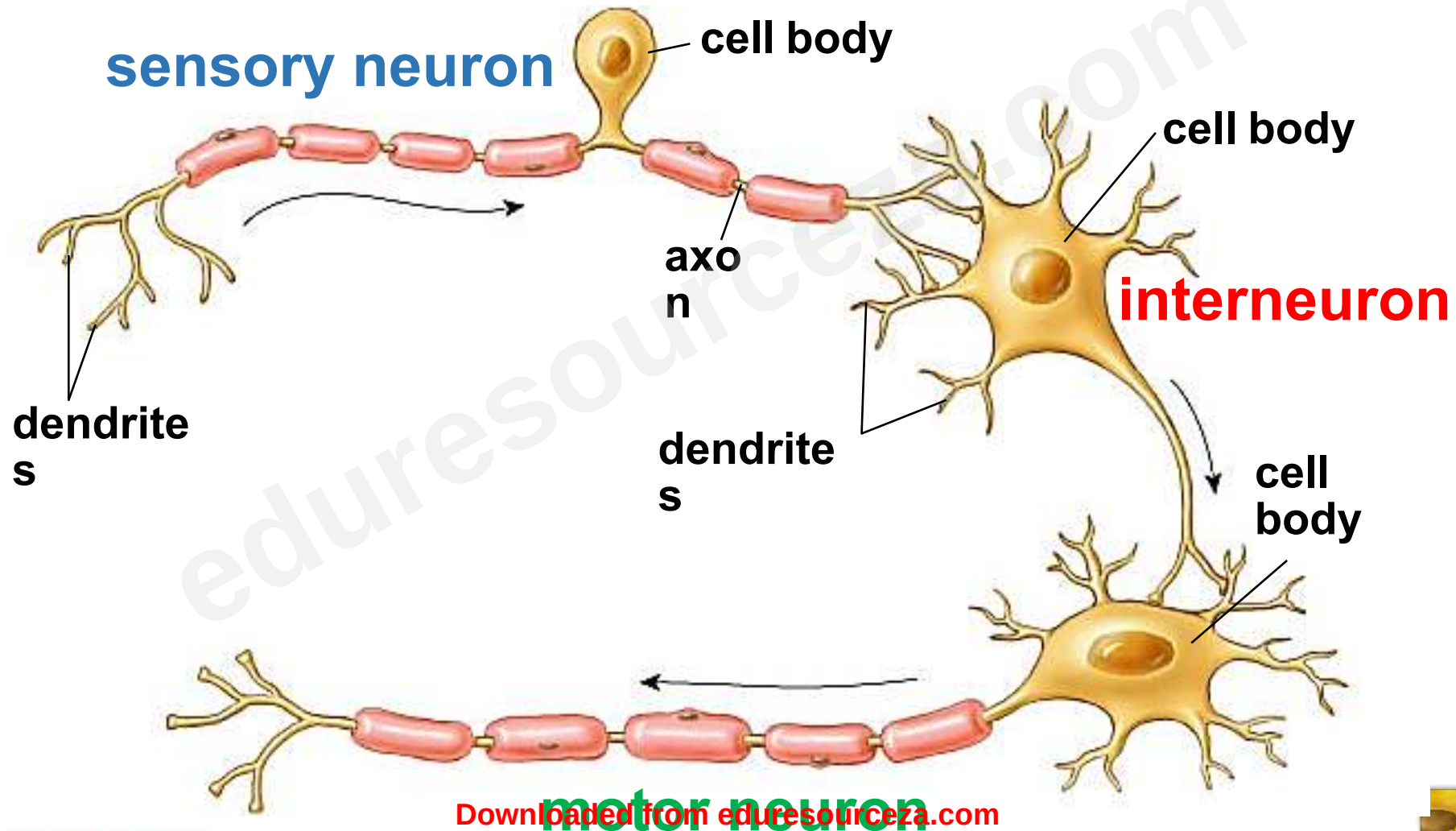


- **Bundles of neurons form nerves**

Neuron anatomy

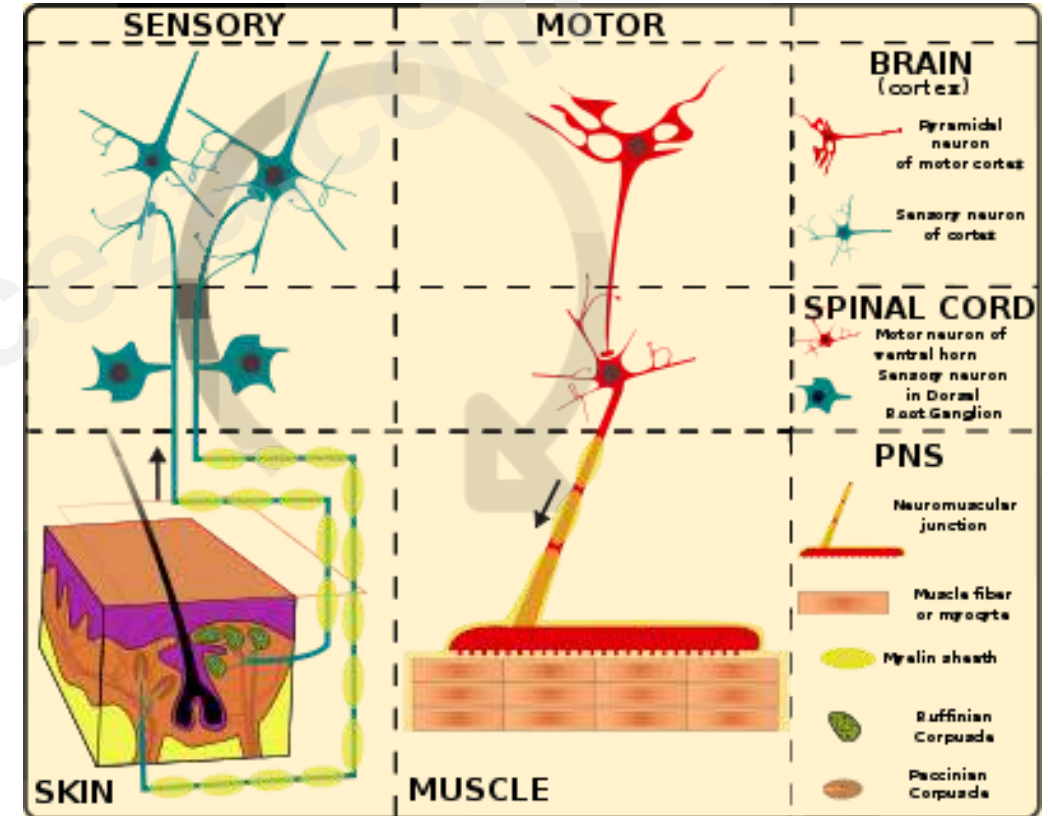


Types of neurons



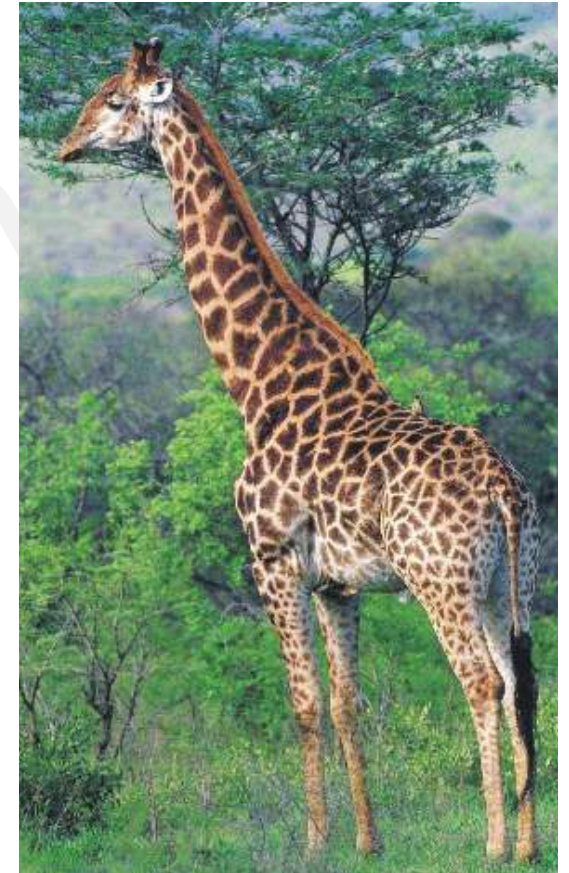
Functional neurons

- **Sensory neurons**
 - afferent neurons
 - carry impulses to CNS
 - either unipolar or bipolar
 - sensitive to stimuli in the environment
- **Connector/inter neurons**
 - receive impulse from sense organs
 - always multipolar
 - integrates or analyses information
 - effects a response
- **Motor neurons**
 - efferent neurons
 - carry impulses away from CNS
 - always multipolar
 - effect a response



Fun facts about neurons

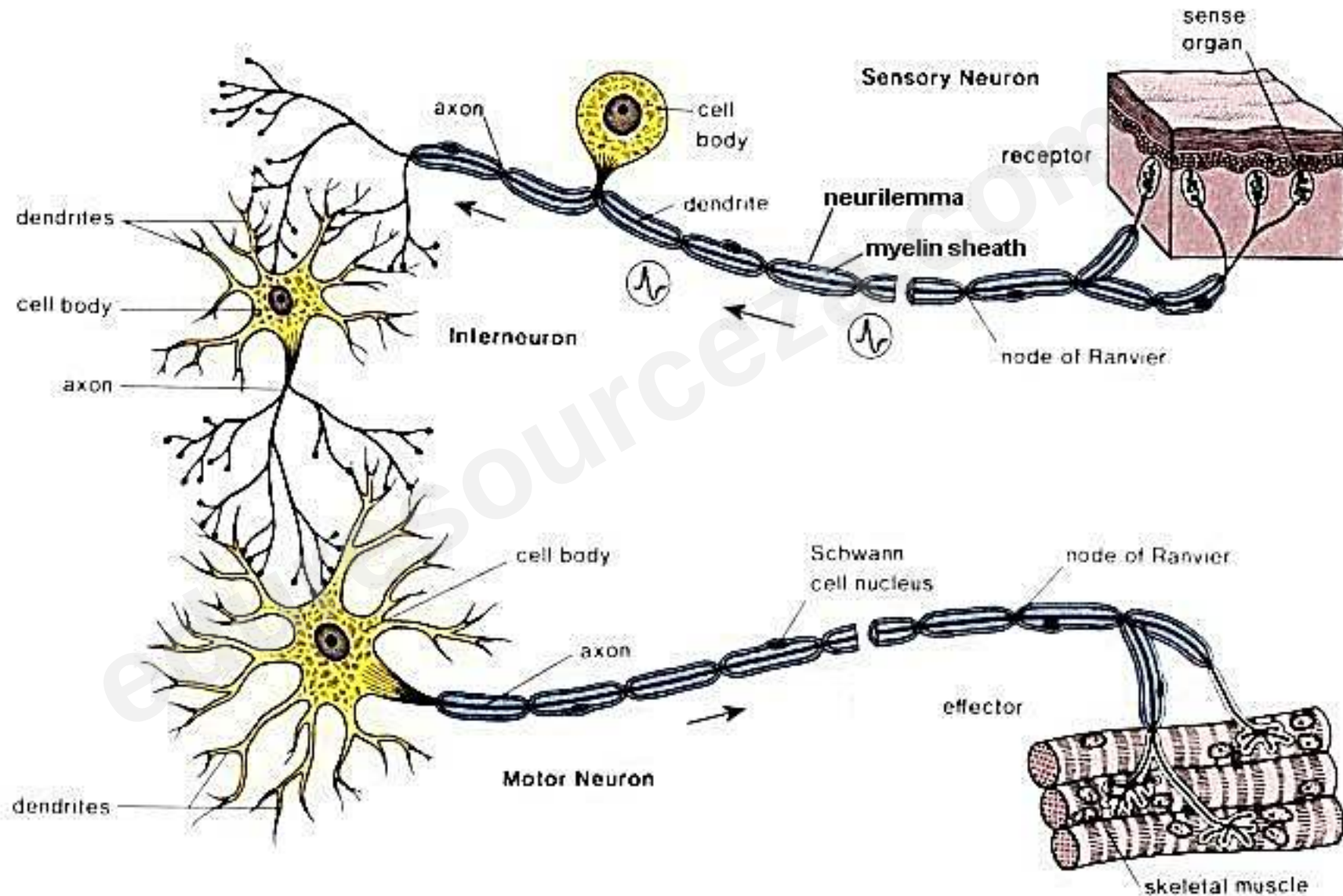
- Most specialized cell in animals
- Nervous system allows for 1 millisecond response time
- Longest cell
 - Blue whale neuron - 10-30 meters
 - Giraffe neuron - 5 meters
 - Human neuron - 1-2 meters



A reflex arc

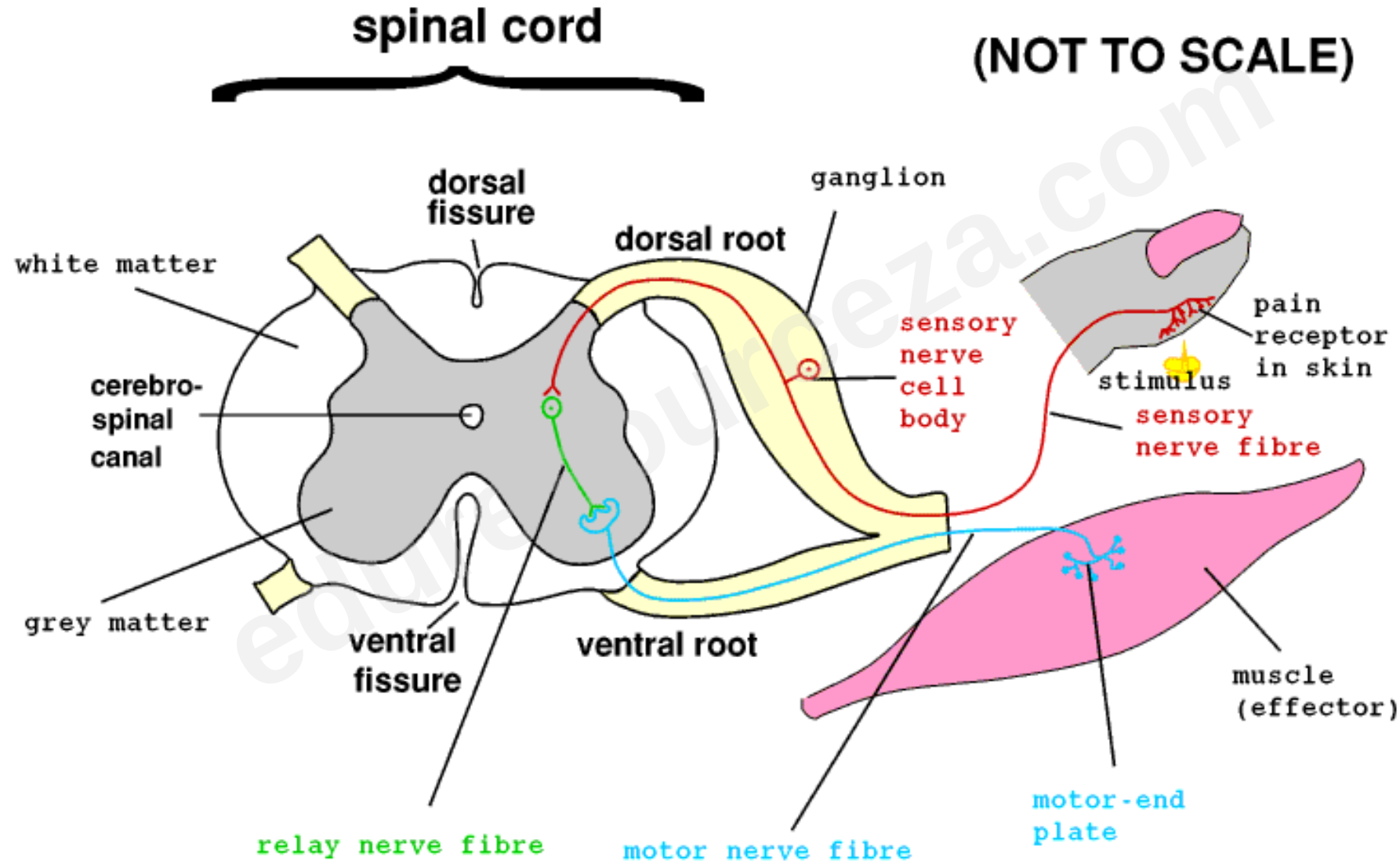
- The nerve pathway taken in a reflex action is called a **reflex arc**.
- The nervous message goes to the spinal cord, then a message passes from the spinal cord directly to an effector to give an immediate response.

Give observable reasons of why the impulse travels from the top right in an arc to the bottom right.



A reflex arc

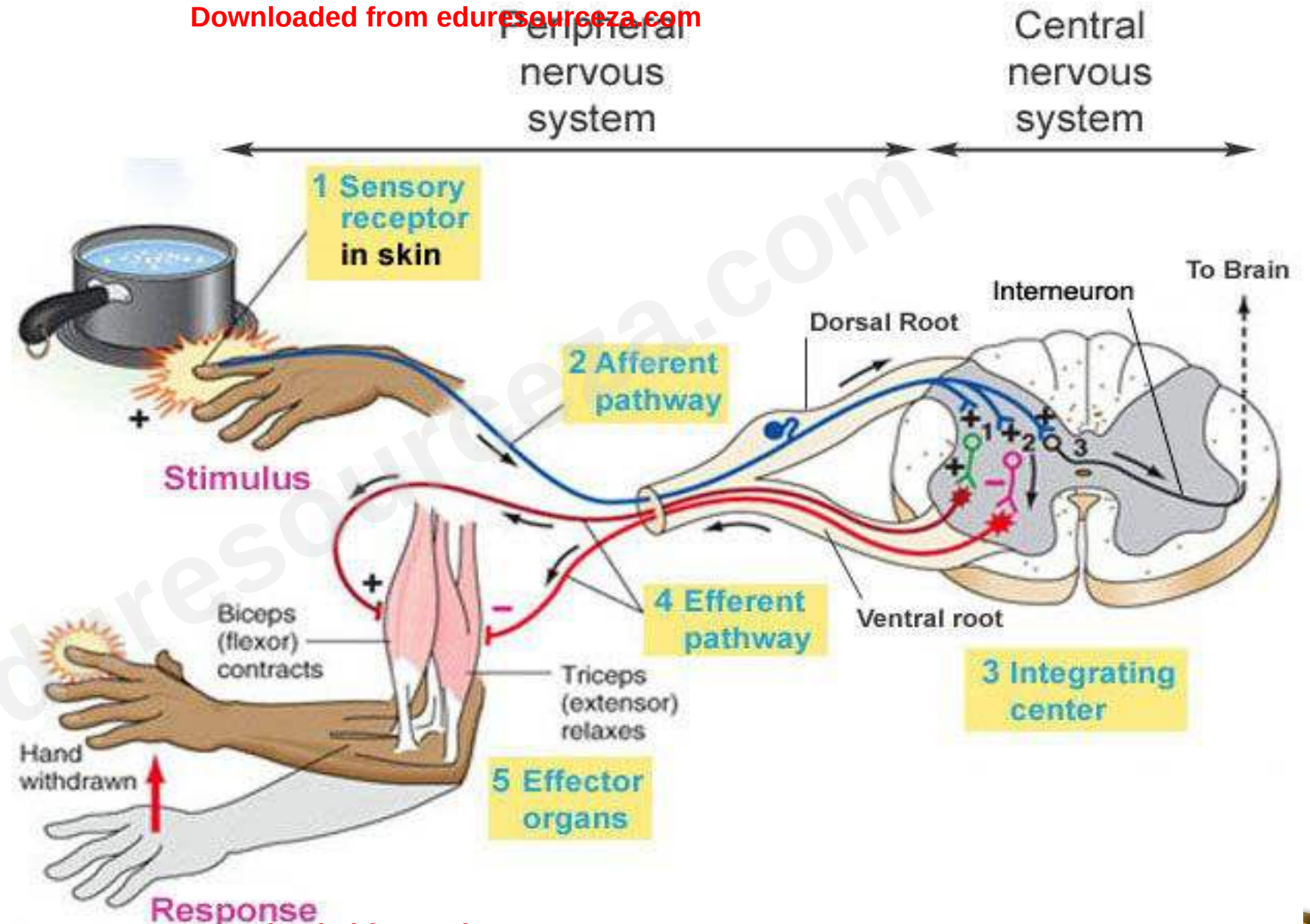
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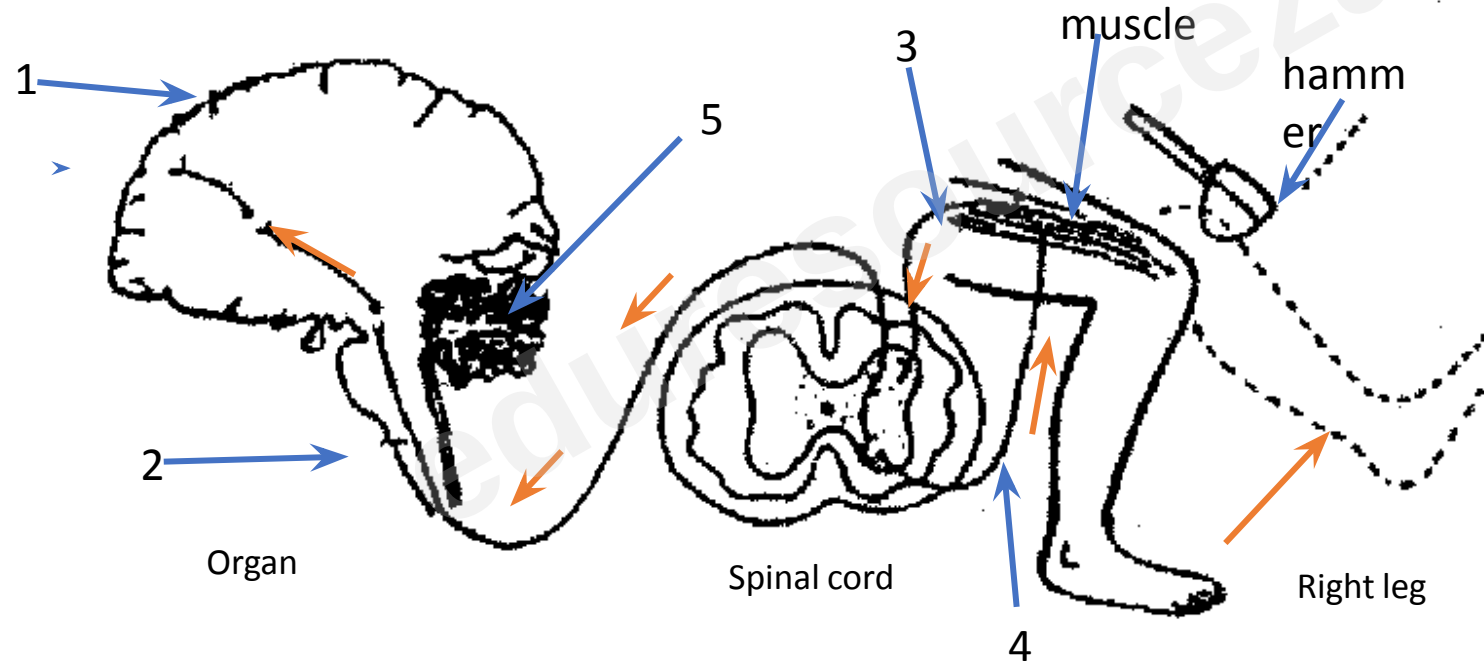
Describe the reflex action taking place in the picture.

What is the difference between a reflex arc and a reflex action?



Activity

Questions



1. Identify the parts 1, 2 and 5. (3)
2. What will the effect on the body be if part 5 is damaged? (1)
3. Describe the reflex action shown in the diagram. (10)
4. Draw and label the type of neuron as indicated by number 4. (5)

Human Nervous system – MEMO

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2.1

- 1 - cerebrum/ brain ✓
- 2 - medulla oblongata ✓
- 5 – cerebellum ✓

(3)

2.2 Lack of muscle control ✓ /lack of co-ordination/ bad posture/
upset equilibrium Any (1)

2.3

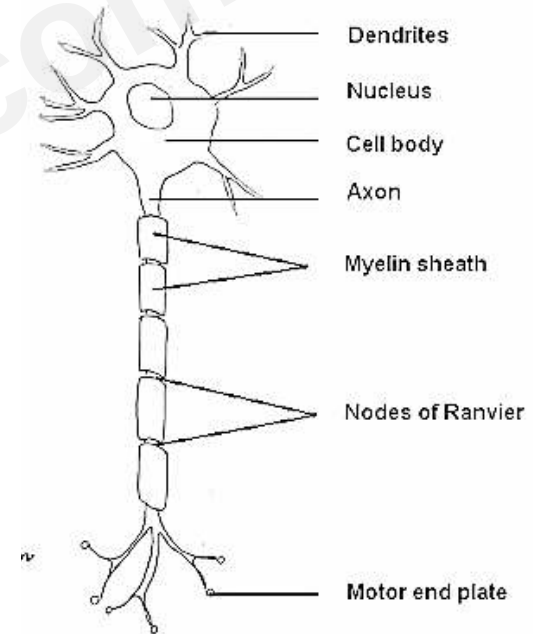
- Hammer strikes the knee ✓
- stimulating the touch corpuscles ✓ /receptors.
- This causes an impulse to be transmitted along the dorsal root ✓ to the dorsal horn
- where the sensory neuron ✓
- makes a synapse with an interneuron. ✓
- It moves along the motor neuron in the ventral horn , along the ventral root ✓
- to the effector ✓, the muscles in the leg. ✓
- The leg is raised upwards. ✓

(10)

Answers

2.4

Motor neuron



Caption ✓

Correct diagram ✓

Any 3 correct labels ✓ ✓

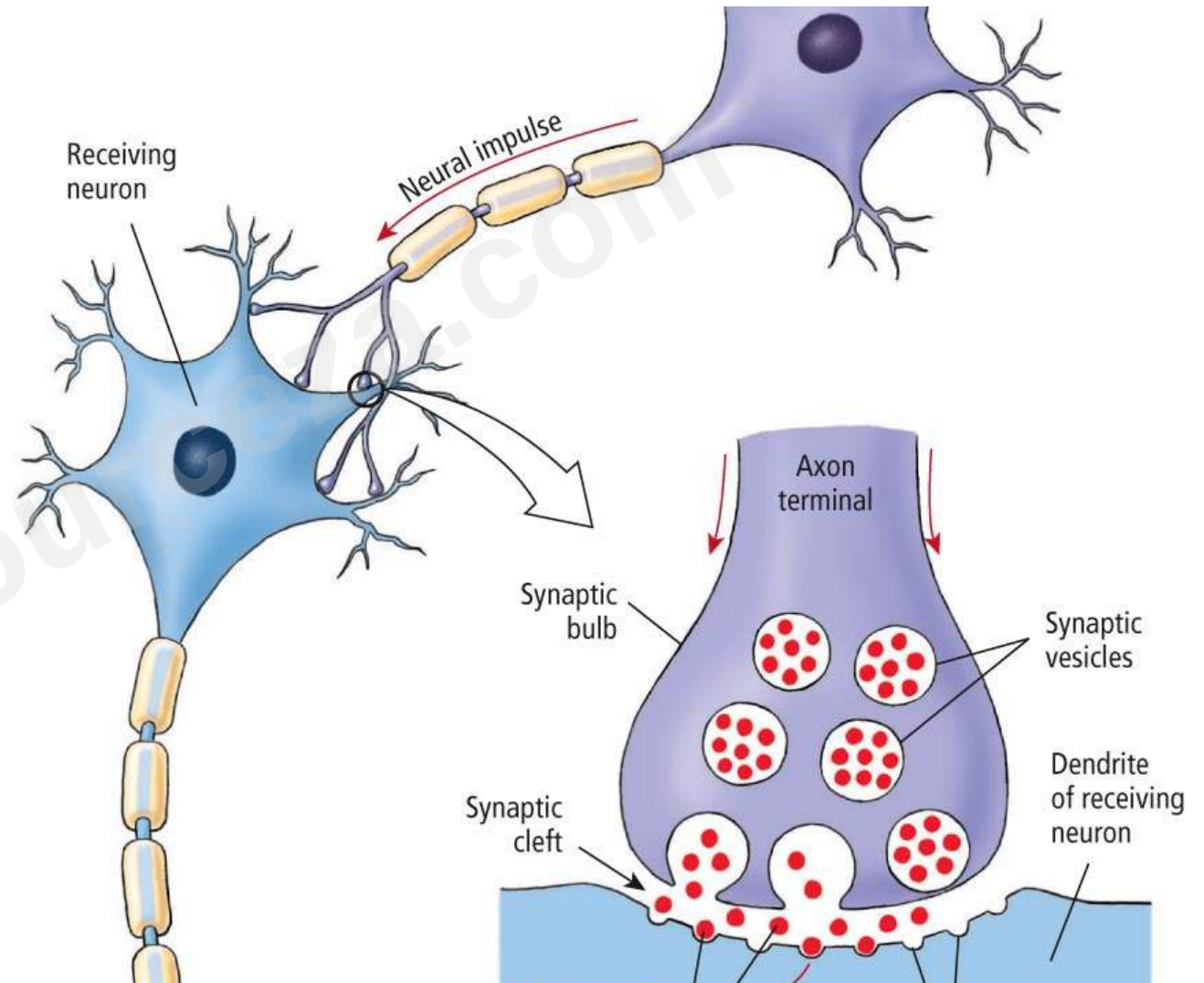
✓

(5)

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The Synapse

- A synapse is the point where an impulse passes from the **terminal branch** of the **axon** one neuron to the **dendrite** of the next neuron.
- The neurons **NEVER** touch each other.
- The gap between the two neurons is called the **synaptic gap**.
- **Chemical neurotransmitters** such as **acetylcholine/dopamine/serotonin** help to transmit the impulse from one neuron to the next across the synaptic gap.



Significance of a synapse

- Ensures that the impulse travels in one direction
- At the synapse a nerve impulse can either be speeded up slowed down or blocked
- Therefore it enables unnecessary or unimportant background stimuli be filtered out
- Channels impulses so that reactions are integrated and become part of learning and memory

Diseases of the Nervous system

- **Alzheimer's disease** (AD) is the most common form of dementia
- Usually affecting people over 65, although some people may develop early-onset AD.
- Characterized by a loss of neurons and synapses in the cortex of the brain, as well as the presence of clumps of proteins (amyloid plaques) and tangled bundles of fibers
- There is no cure for the disease, which is progressive and eventually leads to death
- Cause: unknown
- Symptoms: the loss of brain function results in
 - slower thinking
 - behaviour changes
 - confusion about events, time and place
 - Difficulty recognizing people they know
 - Difficulty speaking, swallowing and walking
- Cure: none
 - Researchers are trying to find better ways to treat the disease, delay its onset and prevent it from developing
 - Stem-cell research and therapeutic cloning hold great potential for providing a cure for Alzheimer's disease

Dementia: general term used for memory loss and loss of other intellectual abilities

Diseases of the Nervous system

- **Multiple sclerosis (MS)** is a progressive, degenerative disorder of the central nervous system (CNS), including the brain, optic nerve and spinal cord.
- MS commonly occurs between the ages of 20 – 40 and affects more women than men.
- Multiple sclerosis means 'many scars', resulting in damage to the axon-coating myelin sheath of nerve cells in communication pathways.
- Scattered patches of demyelination in the pathways make it impossible for messages to move these hard areas.
- Cause: auto-immune disease
- Symptoms: MS affects:
 - Movement, feeling and co-ordination and balance
 - Vision, tingling and numbness, muscle weakness and spasms,
 - Fatigue
 - Bladder and bowel problems
 - Pain
 - Concentration and memory loss
 - Mood swings
- Cure: none
- Management strategies:
 - Healthy lifestyle
- Stem-cell research and biologically engineered production of interferons slow down the progress of the disease

