

SUMMING-UP

1 How nerve cells function

- Nerve cells - **neurons** - carry an electrochemical impulse that is generated by the nature of the charge difference between the interior and exterior of the plasma membrane.

- This difference in ion concentrations generates a **resting membrane potential** that is maintained by the action of proteins in the membrane.
- In the moment of nerve stimulation this difference is rapidly reversed,

generating an **action potential**. Immediately after the depolarisation of the membrane, proteins restore the situation to rest.

2 Impulse transmission between neurons

- The nerve impulse is transferred from one nerve cell to another, or from one nerve cell to a muscle cell, across the **synapse**.
- Synapses are divided into:
 - **electrical synapses**, where the action

potential passes from one cell to the next one in contact with it, exhibit a mechanism that is similar to that of nerve impulse propagation.

- **chemical synapses**, where the transmission of nerve impulses is mediated by **neurotransmitters**: chemicals that are released from the

presynaptic neuron into the intersynaptic space. Neurotransmitters determine the opening of ion channels in the postsynaptic neuron. This causes the depolarisation of the postsynaptic neuron membrane and the initiation of nerve impulses.

3 The nervous system in animals

- The nervous system varies depending on the complexity and behaviour of the animal.
- The simplest animals have a nervous

network, i.e. a simple grid of nerve cells.

- In complex animals there is a progressive centralisation and cephalisation. The **brain** is comprised of a mass of nerve cells

located near the head of the animal.

- All vertebrates possess a **central nervous system**, comprising the encephalon and the spinal cord, and a **peripheral nervous system**, consisting of the nerves.

4 The central nervous system: the spinal cord

- The human central nervous system is responsible for processing data and for responses. It is comprised of the

encephalon and the spinal cord.

- The **spinal cord** carries the signals from the nerves to the brain and, in case of danger, makes an appropriate response known as a *simple reflex arc*.

- The central nervous system is surrounded and protected by three membranes called **meninges**.

5 The central nervous system: the human brain

- The **brain** is the most voluminous nervous mass in the human body and is composed of four regions: the

brain stem, the cerebellum, the diencephalon and telencephalon.

- The telencephalon forms the cerebral cortex, which is divided into two hemispheres. In the cortex,

different functional areas are associated with different functions, including the sensory and motor functions.

6 The human peripheral nervous system

- The human peripheral nervous system transmits impulses from sense organs to the central nervous system and vice versa. It consists of the nerves that are divided into cranial

and spinal nerves.

- Nerves are bundles of axons, neurons belonging to both sensory and motor neurons, wrapped in connective tissue.
- The peripheral nervous system is divided into the **somatic**, or

voluntary, and **autonomous**, or involuntary. Within the autonomous nervous system, the sympathetic system acts in stressful situations, and the **parasympathetic** acts in situations of relaxation.

7 Chemical messengers and the endocrine system

- Animals also regulate their functions through chemical messengers. There are three types of messengers: **pheromones**, which affect other

individuals of the same species; **hormones**, that are produced by specific organs and through the bloodstream reach the target cells; and **paracrine** messengers that act on cells that are in the immediate

vicinity of the cells from which they were produced.

- The human endocrine system consists of several glands under the control of the **hypothalamus**, a region of the brain.

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8 Hormonal regulation

- Hormones regulate many fundamental processes, such as body growth, reproductive activity, and help to maintain homeostasis.
- The **pancreas** is the endocrine gland

which produces two hormones, insulin and glucagon, which control the amount of glucose in the blood and therefore the energy supply to cells.

- **Antidiuretic hormones** regulate the

concentration of salts in the body.

- The failure of these hormonal regulatory mechanisms can cause quite serious damage.

9 Response to stimuli in plants

- Plants respond to environmental stimuli such as the presence of light, gravity, temperature and humidity.
- The tendency of a plant to orient itself in the direction from which a

stimulus comes is called **tropism**: *geotropism* is the ability to orient in the direction of gravity; *phototropism* is the tendency to orient oneself according to light.

- Plant responses are due to the production of some **plant hormones**,

belonging to five different classes. These hormones often act in combination and minor variations in their concentration are sufficient to trigger important processes.