

The Importance of the Nervous System

- The Nervous System is an elaborate communication system that contains more than 100 billion nerve cells in the brain alone
- It controls receiving information from the environment (physical condition, temperature, light, colour, sound, pain, pressure) as well as more complex functions, like memory, learning and language (most advanced in humans)

Vertebrate Nervous System

- The nervous system has two main divisions: the central nervous system (CNS), and the peripheral nervous system (PNS)
- The CNS controls the nerves of the brain and spinal cord and acts as a coordinating centre for incoming and outgoing information
- The PNS consists of nerves that carry information between the organs of the body and the CNS (for a breakdown of the nervous systems, see Fig. 1, p.412)
- The PNS can be subdivided into the somatic and autonomic nerves
- The somatic nervous system controls the skeletal muscle, bones and skin
- Sensory somatic nerves relay information about the environment to the CNS while motor somatic nerves initiate an appropriate response
- The autonomic nervous system contains special motor nerves that control the internal organs of the body
- The two divisions of the autonomic nervous system are the sympathetic nervous system and the parasympathetic nervous system

Different Types of Nerve Cells

- Two different types of cells - glial cells and neurons - are found in the nervous system
- Glial cells or neuroglial cells are non-conducting cells and are important for the structural support and metabolism of the nerve cells
- Neurons are the functional units of the nervous system (see Fig. 2, p.413)
- These specialized nerve cells are categorized into three groups, sensory neurons, interneurons and motor neurons
- Sensory neurons (aka afferent neurons) sense and relay information (stimuli) from the envt to the CNS for processing (ex/ photoreceptors, chemoreceptors, thermoreceptors)
- Sensory neurons are located in clusters called ganglia (singular, ganglion) located outside the spinal cord
- Interneurons link neurons within the body (found throughout the brain and spinal cord)
- They integrate and interpret the sensory information and connect neurons to outgoing neurons
- Motor neurons (aka efferent neurons) relay information to the effector
- Muscles, organs, and glands are classified as effectors because they produce responses

The Anatomy of a Nerve Cell

- All neurons contain dendrites, cell bodies and axons
- The dendrites receive information, either from sensory receptors or from other nerve cells
- Like all living cells, nerve cells contain a cell body with a nucleus
- Dendrites conduct nerve impulses toward the cell body

- An extension of cytoplasm, called the axon, projects nerve impulses from the cell body
- In humans, the axon is extremely thin (100 could fit in a single hair)
- The axon carries the nerve impulse toward other neurons or to effectors
- Most nerves consist of many neurons held together (see Fig. 3, p.414)
- Many axons are covered with a glistening white coat of a fatty protein called the myelin sheath, which acts as insulation for the neurons (the same way plastic or rubber coats electrical wires)
- Axons that have myelin coating are said to be myelinated
- Formed by special glial cells called Schwann cells, the myelin sheath insulates by preventing the loss of charged ions from the nerve cell
- The areas between the sections of myelin are called the nodes of Ranvier
- Nerve impulses jump from one node to another, speeding up the movement of nerve impulses
- Nerve impulses move much faster along myelinated nerve fibres than nonmyelinated ones
- The diameter of the axon also influences speed, the smaller the diameter, the faster the speed of the nerve impulse
- All nerve fibres found within the PNS contain a thin membrane called the neurilemma, which surrounds the axon and promotes the regeneration of damaged axons
- Nerves within the brain that contain myelinated fibres and a neurilemma are called white matter, because the myelinated axons are whitish in appearance
- Other nerve cells within the brain and spinal cord, referred to as grey matter, lack a myelin sheath and a neurilemma, and do not regenerate after injury

Neural Circuits

- Some responses need to be so quick, that they actually bypass the brain
- If you touch something hot, the sensation of heat is detected by temperature receptors in your skin, and a nerve impulse is carried to the spinal cord
- The sensory neuron passes the impulse on to an interneuron, which in turn, relays the impulse to a motor neuron
- The motor neuron causes the muscles in the hand to contract and the hand to pull away
- All this happens in less than a second, before the information is carried to the brain, and is completely involuntary and unconscious
- The damage would be much worse if you had to wait for the sensation of pain before removing your hand
- The simplest nerve pathway is the reflex arc
- Most reflexes occur without brain coordination
- Reflex arcs contain five essential components: the receptor, the sensor neuron, the interneuron in the spinal cord, the motor neuron and the effector (see Fig.6, p.416)

Homework

Make notes on Frontiers of Technology: Reattaching and Regenerating Nerves
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