

Nervous System

I. Functions:

- A. Sensory receptors gather information
- B. Integrated in the brain
- C. Mental Activity - Conscious or subconscious decisions
- D. Effectors maintain homeostasis or control movements

II. Divisions:

- A. Central nervous system (CNS), brain and spinal cord
- B. Peripheral nervous system (PNS), radiating nerves, connects to the rest of the body.
 - 1. Afferent Division – conducts action potential (AP) from sensory receptors to CNS
 - 2. Efferent Division – AP from CNS to organs
 - a. Somatic Motor Neurons – CNS to skeletal muscle
 - b. Automatic Neurons – CNS to cardiac, smooth muscle
 - i. Sympathetic Division – prepare for physical activity, including heart rate, blood pressure...
 - prepares for Fight-or-Flight
 - ii. Parasympathetic Division – activates digestion and rest functions, defecation, urination....
 - iii. Symp & Parasymp often innervate same organs and act in opposition

III. Cell Types

- A. Neurons - transmit nerve impulses
- B. Neuroglia carry out a variety of functions to aid and protect other components

IV. Nueron parts:

- A. Cell body - cell organelles, nuclei
- B. Dendrites – branched extensions that receive information from other neurons or receptors
- C. Axon – tube that carries action potential
- D. Myelin Sheath – insulation along axon, made by Schwann cells
 - 1. Nodes of Ranvier – gaps between Myelin
 - 2. White matter –
 - a. cells with myelin,
 - b. conduction pathways in CNS
 - 3. Gray matter
 - a. very little myelin
 - b. cortex of brain
 - c. processing of the sensory and motor information, control of emotions, memory and intellect
- E. Synapse – junction of axon and another nueron
- F. Nuerotransmitter

1. chemicals released in response to AP
2. Bind to receptor, cause new AP
3. ex. Norepinephrine, acetylcholine

V. Cell Membrane Potential

- A. Resting Potential (polarized)
 1. Higher concentration of Na^+ ions outside the cell
 2. Higher concentration of K^+ ions inside.
 3. Caused by Na-K pump
 4. Membrane is permeable to K^+ which moves out until concentration is balanced by negative attraction.
 5. Inside is -, outside is +
- B. Action Potential
 1. Stimulus opens Na^+ ion channels, Na^+ rushes in and inside becomes more positive
 2. If it reaches a threshold, will cause more channels to open.
 3. Inside becomes +, outside -
- C. Repolarization – return to resting potential
- D. AP opens another set of channels which continues to pass on the impulse
- E. Myelinated axons – AP jumps from one node of Ranvier to next = faster impulse

VI. CNS Protection

- A. Skull and vertebrae
- B. Meninges – 3 layers of connective tissue that lie between the bone and the soft tissues.
- C. Cerebrospinal fluid – bathes the CNS to cushion

VII. Spinal Cord

- A. Begins at the base of the brain and extends to the second lumbar vertebrae.
- B. Conducts nerve impulses and spinal reflexes
- C. Spinal nerves – mixed(afferent and efferent neurons) 31 pairs
- D. Pathways– Ascending tracts(sensory up) and Descending Tracts(to muscles/glands)

VIII. Reflex

- A. Automatic, subconscious response.
- B. A reflex arc includes a sensory neuron, an interneuron in the spinal cord, a motor neuron.

IX. Spinal Cord

- A. Begins at the base of the brain and extends to the second lumbar vertebrae.

X. Brain Stem

- A. Connects the brain to the spinal cord.
- B. Medulla Oblongata – connects brain, regulates heart rate, breathing, swallowing
- C. Pons – connects brain, bridges cerebrum + cerebellum, regulates rate and depth of breathing
- D. Midbrain – relays auditory and visual reflexes
- E. Reticular Formation – scattered in brain stem, maintain consciousness, regulates sleep-wake cycle

XI. Diencephalon

- A. Above the brain stem.
- B. Thalamus – relay sensory, influences mood
- C. Epithalamus – emotional + visceral response to odors
- D. Hypothalamus – maintain homeostasis, ex. body temp, hunger, thirst, rage fear

XII. Cerebrum

- A. Largest portion.
- B. Divided into right and left hemispheres by longitudinal fissure
- C. Corpus callosum connects the hemispheres.
- D. Ridges are convolutions or gyri
- E. Grooves are sulci and fissures.
- F. Frontal Lobe – voluntary motor functions, motivation, aggression, mood, smell, concentration, planning
- G. Parietal Lobe – touch, pain, temp. balance, taste, speech
- H. Occipital Lobe – visual
- I. Temporal Lobe – olfactory, auditory, memory, abstract thought and judgment

XIII. Cerebellum

- A. skeletal muscle activity, posture, coordination

XIV. Memory

- A. Sensory –
 - 1. brief retention, last a sec
 - 2. temporal
- B. Short Term (working) –
 - 1. seconds to few min.
 - 2. 7 bits can be stored
- C. Long Term –
 - 1. min. to perm
 - 2. may include physical change in neuron
 - 3. rehearsal assists in making short term → long