Component I: Core

Module B: Terminology, Anatomy and Physiology

Topic 5: The Nervous System

Statement of Purpose
To prepare the learner with basic knowledge of the nervous system.

Student Learning Outcomes
Upon completion of this topic, the learner will be able to:
1. Spell and define key terms.
2. Identify two main divisions of the nervous system.
3. Describe the function of the autonomic nervous system.
4. Differentiate the three coverings (meninges) of the brain and spinal cord.
5. Identify the main parts of the brain and state functions.
6. Explain the function of cerebrospinal fluid.
7. Name the functional units of the nervous system.
8. List and define the cranial nerves.
9. Discuss neurological testing.

Terminology

1.	Abducens	26.	Glossopharyngeal
2.	Accessory nerves	27.	Gyri
3.	Arachnoid	28.	Hypoglossal
4.	Ascending tracts	29.	Hypothalamus
5.	Autonomic nervous system (ANS)	30.	Integrative function
6.	Axons	31.	Inter neurons
7.	Brain	32.	Lobes
8.	Brain stem	33.	Medulla oblongata
9.	Cell body	34.	Memory
10.	Cell membrane potential	35.	Meninges
11.	Central nervous system (CNS)	36.	Midbrain
12.	Cerebellum	37.	Motor neurons
13.	Cerebrospinal fluid	38.	Myelinated
14.	Cerebrum	39.	Neurological exam
15.	Convolution	40.	Neuron
16.	Corpus collosum	41.	Occipital
17.	Cortex	42.	Oculomotor
18.	Cranial nerves	43.	Olfactory
19.	Cranium	44.	Optic nerves
20.	Dendrite	45.	Parietal
21.	Diencephalon	46.	Peripheral nervous system
22.	Descending tracts	47.	Pia mater
23.	Dorsal horn	48.	Pons
24.	Dura mater	49.	Reflex
25.	Facial nerves	50.	Sensory neurons
51.	Spinal cord	54.	Temporal
52.	Sulci	55.	Thalamus
53.	Synapse	56.	Trigeminal

57.	Trochlear	61.	Unconscious
58.	Vagus		
59.	Ventricle		
60.	Vestibulocochlear		

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Websites

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Content Outline/Theory Objectives	Suggested Learning Activities
Objective 1 **Spell and define key terms.** A. Review the terms listed in the terminology section. B. Spell the listed terms accurately. C. Pronounce the terms correctly. D. Use the terms in their proper contexts.	A. Games: word searches, crossword puzzles, Family Feud, Jeopardy, bingo, spelling bee, hangman and concentration. B. Administer vocabulary pre-test and post-test. C. Discuss learning gaps and plan for applying vocabulary.

Objective 2
Identify main divisions of the nervous system.
 A. Central
    1. Brain.
    2. Spinal cord.
 B. The three functions of the nervous system
    1. Detect and interpret sensory information.
    2. Make decisions about the sensory information.
    3. Carry out motor functions based on the decisions made.
 C. Peripheral
    1. Nerves located outside the brain and spinal cord
      a. Cranial nerves
        1) Branches stem from the brain.
      b. Spinal nerves
        1) Branches off the spinal cord.
 D. Autonomic nervous system
    1. Regulates information and automatic responses of organs.
    2. Made up of sympathetic and parasympathetic.
	A. Lecture/Discussion
	B. Assigned Readings
	C. Use anatomical diagrams/ posters/videos/computer assisted learning/workbook activities.

Objective 3 **Describe the function of the autonomic nervous system.** A. Regulates unconscious, involuntary body functions that must work all the time. B. Connects the CNS with the organs and other structures not under voluntary control. C. Controls the action of smooth muscles in the blood vessels, digestive system, lungs and heart. D. Stimulates internal secretions. E. Sympathetic Nervous system, associated with concepts of fight or flight. F. Parasympathetic Nervous system: associated with concepts of preparing the body to rest and digest.	A. Lecture/Discussion B. Assigned Readings C. Use anatomical diagrams/ posters/videos/computer assisted learning/workbook activities.
Objective 4 **Differentiate the three coverings (meninges) of the brain and spinal cord.** A. Dura mater	A. Lecture/Discussion

1. Outermost layer.
2. Tough membrane.
3. Fibrous tissue.
  B. Arachnoid
     1. Middle layer.
     2. Delicate layer.
     3. Fine, spider web-like appearance.
  C. Pia mater
     1. Innermost layer.
     2. Adheres to brain and spinal cord.
	B. Assigned Readings
	C. Use anatomical diagrams/ posters/videos/computer assisted learning/workbook activities.
	D. Utilize a model of the brain to point out the three layers of the brain.

Objective 5
Identify the main parts of the brain and state functions.
  A. Cerebrum
     1. Largest part of the brain, occupying most of the cranium.
     2. Divided into nearly symmetrical left and right hemispheres.
     3. Outermost layer is the cerebral cortex.
     4. Cerebral cortex consists of four lobes
         a. Frontal—attention, behavior, personality.
         b. Parietal—memory, hearing, language.
         c. Temporal—visual memory, verbal memory, language.
         d. Occipital—vision, color recognition, movement.
     5. Corpus callosum is the thick bundle of nerve fibers which connect the two hemispheres.
     6. Cerebral cortex appears wrinkled due to
         a. Sulci—small grooves.
         b. Fissures—larger grooves.
         c. Gyri—bulges between the grooves.
  B. Brainstem
     1. Connects the Cerebrum to the spinal cord.
     2. Provides a pathway for information.
     3. Consists of 3 structures
         a. Medulla Oblongata—controls breathing, blood pressure, swallowing.
         b. Pons—regulation center for breathing, reflex center for chewing and tasting.
         c. Midbrain—control center for reflex movement of eyes.
  C. Cerebellum
     1. Coordinates complex skeletal muscle contractions, used for body movements.
     2. Located in back of brain.
     3. Controls muscular activity and maintains balance.
  D. Thalamus/Hypothalamus/Pituitary Gland
     1. Lie between the cerebrum and the brainstem.
     2. Thalamus—regulates consciousness, sleep, and alertness.
	A. Lecture/Discussion
	B. Assigned Readings
	C. Use anatomical diagrams/ posters/videos/computer assisted learning/workbook activities.

3. Hypothalamus—connects the nervous system to the endocrine system. 4. Pituitary Gland—called the "master gland" because it controls hormone secretion.	

Objective 6
Explain the function of the cerebrospinal fluid.
  A. Sterile, watery fluid that acts as a cushion or shock absorber for the brain and spinal cord.
  B. Cerebrospinal fluid consists of:
    1. Proteins
    2. Glucose
    3. Chlorides
    4. Lymphocytes
	A. Lecture/Discussion
	B. Assigned Readings
	C. Use anatomical diagrams/ posters/videos/computer assisted learning/workbook activities.

Objective 7
Name the functional unit of the nervous system.
  A. Neuron
    1. Axon (also known as the nerve fiber) is long and branches far from the cell body and connects with other neurons.
    2. Dendrites are nerve fibers that are short and branch near the cell body that receives information.
    3. Neuron cell body is the center for receiving and sending nerve impulses.
    4. Neuron cell membranes have a cell membrane potential
      a. Polarized just like a battery.
      b. Inside is negative and outside is positive.
      c. Potassium and sodium ions are positively charged and important in generating nerve impulses.
      d. Polarized when at rest.
      e. Depolarized when it responds to stimuli; eventually repolarizes so it can fire again.
      f. Myelinated sheath is a fatty substance that insulates the axon. The main purpose of a myelin layer (or sheath) is to increase the speed at which impulses propagate along the myelinated fiber.
      g. Synapse (post-synaptic) gap is between the dendrites and axon (nerve fiber). Information must "leap" over the gap with the help of hormones to continue its travel down the nervous pathway.
      h. Neurotransmitters are chemicals that are released into the synaptic junction.
    5. Sensory neuron (afferent)
      a. Detects and interprets sensory information.
      b. Make decisions (integrative function) about the sensory information received.
	A. Lecture/Discussion
	B. Assigned Readings
	C. Use anatomical diagrams/ posters/videos/computer assisted learning/workbook activities.
	D. Library research
	E. Discuss the consequences of spinal cord injuries.
	F. Create a poster that describes prevention tips for brain and spinal cord injuries.

c. Information about the internal and external environment.
       d. Goes to cerebral cortex for interpretation.
  6. Inter-neuron
       a. Links sensory and motor together.
       b. Transmits impulses from one part of the spinal cord to another.
  7. Motor neuron (efferent)
       a. Carry information from the CNS to effectors (muscles or glands) in the peripheral nervous system.
       b. Responsible for stimulating muscles to contract or for glands to secrete their products.	

Objective 8
List and define the cranial nerves
  A. Cranial I – Olfactory (smell).
  B. Cranial II – Optic (visual information).
  C. Cranial III – Oculomotor – movement of eyelids, eyeballs, and iris.
  D. Cranial IV – Trochlear – muscles that move the eyeball.
  E. Cranial V – Trigeminal – sensory information from the scalp, facial skin, lining of the gums and palate to brain for interpretation.
  F. Cranial VI – Abducens – muscles that move eyeball.
  G. Cranial VII – Facial nerves – muscles of facial expression, salivary, tear gland, and tongue.
  H. Cranial VIII – Vestibulocochlear – hearing and equilibrium from the inner ear to the brain.
  I. Cranial IX – Glossopharyngeal – sensory information from throat, tongue and muscles in throat to the brain for interpretation.
  J. Cranial X – Vagus – sensory information from the thoracic and abdominal organs to the brain.
  K. Cranial XI – Accessory – found within the muscles of throat, neck, back and voice box.
  L. Cranial XII – Hypoglossal – tongue muscles.
	A. Lecture/Discussion
	B. Assigned Readings
	C. Use anatomical diagrams/ posters/videos/computer assisted learning/ workbook activities.
	D. Provide students with mnemonics to help aid in memorization.

Objective 9
Discuss neurological testing
  A. Signs and symptoms of nervous disease
    1. Headache.
    2. Muscle weakness.
    3. Paresthesia (sensation of tickling, tingling, burning, pricking, or numbness of a person's skin).
  B. Neurological exam
    1. Level of consciousness.
    2. Reflex activity; determine the health of the peripheral nervous system.
    3. Speech patterns, loss of ability to form words correctly or sentences that make sense.
	A. Lecture/Discussion
	B. Assigned Readings
	C. Use anatomical diagrams/ posters/videos/computer
	D. Students pick from a list a neurological procedure and demonstrate how they would teach a patient about that test. Student should be able to answer any patient questions.

      4.   Motor patterns; loss of balance, abnormal posture, inappropriate movements of body i.e., sudden jerking of a body part.

C. Diagnostic procedures
1. Lumbar puncture.
2. Magnetic resonance imaging (MRI).
3. Positron emission tomography (PET) scan.
4. Cerebral angiogram.
5. Computerized tomography (CT).
6. Electroencephalogram (EEG).
7. X-ray.

D. Cranial nerve tests
1. Olfactory I, this nerve controls the sense of smell. Place a strong smelling item under each nostril individually and ask the person to identify it.
2. CN II Optic, this nerve controls vision. Display an eye chart to the test subject, and hold items to the side of their head to test their peripheral vision.
3. CN III Oculomotor, this controls eye movement upward, downward and inward, as well as narrowing and dilation of the pupils in response to light. Have the test subject follow a moving target, such as the tester's finger. Then shine a light in each pupil to test reaction to light.
4. CN IV Trochlear, this controls the movement of the eye downward and inward. Have the test subject follow a moving target with their eye.
5. CN V Trigeminal, controls facial sensation and chewing. Gently test areas of the face using the pin and the wisp of cotton. Subject should clench their teeth and then open their jaw against resistance.
6. CN VI Abducens, this controls the abductor muscles of the eye, which move the eye outward. Have the person look to the side.
7. CN VII Facial, this nerve controls the muscles of facial expression, plus taste on the front two-thirds of the tongue. Test the muscles by having the subject open and close their mouth, open their eyes and squeeze their eyes shut. Use the sweet, salty, sour and bitter items to test taste.
8. CN VIII Vestibulocochlear, this nerve controls hearing and balance. Test hearing with a tuning fork and have the test subject walk a straight line.
9. CN IX Glossopharyngeal/CN X Vagus, both of these nerves control swallowing, gag reflex and speech and are tested the same way. (The vagus nerve also controls internal organs such as the heart and digestive tract.) Have the test subject swallow and say "ah." The tester can touch the back of the person's throat with a tongue depressor to check the gag reflex.

10. CN XI Accessory, this nerve innervates the sternocleidomastoid and trapezius muscles, which control neck turning and shoulder shrugging. The test subject should turn their head and lift their shoulders against resistance. 11. CN XII Hypoglossal, this nerve controls tongue movement. The test subject should stick out their tongue.	