CHAPTER 13

CENTRAL NERVOUS SYSTEM

Approximately one hundred billion neurons make up the brain. Everything we are and everything we hope to become are centered in this structure, which is about the size of a small bowling ball. Our personality, communication skills, memory, and sensations depend upon the successful functioning of the brain. We are still in the infancy of our knowledge of this unique organ as it still holds many mysteries for scientists to yet uncover. We are fascinated by the fact that although all pain is felt and interpreted in the brain, the brain itself has no pain sensation—even when cut! This simple example illustrates the complexity of the brain and some of the challenges ahead in identifying and understanding its capabilities for our body.

I COVERINGS OF THE BRAIN AND SPINAL CORD

Multiple Choice — select the best answer.

1. From superficial to deep, which is the correct order of location of the meninges?
   a. dura mater, arachnoid membrane, pia mater
   b. pia mater, arachnoid membrane, dura mater
   c. arachnoid, pia mater, dura mater
   d. dura mater, pia mater, arachnoid membrane

2. The falx cerebri separates the:
   a. two hemispheres of the cerebellum.
   b. cerebellum from the cerebrum.
   c. two hemispheres of the cerebrum.
   d. dura mater from the arachnoid.

3. The cerebrospinal fluid resides in the:
   a. epidural space.
   b. subarachnoid space.
   c. subdural space.
   d. piaarachnoid space.

4. The layer of the meninges that serves as the inner periosteum of the cranial bones is the:
   a. pia mater.
   b. arachnoid membrane.
   c. dura mater.
II  CEREBROSPINAL FLUID

Multiple Choice — select the best answer.

5. Formation of the cerebrospinal fluid occurs mainly in the:
   a. cerebral aqueduct.
   b. superior sagittal sinus.
   c. choroid plexuses.
   d. median foramen.

6. The lateral ventricles are located within the:
   a. cerebrum.
   b. cerebellum.
   c. spinal cord.
   d. none of the above.

7. CSF is absorbed into the venous blood via the:
   a. cisterna magna.
   b. choroid plexus.
   c. falk cerebri.
   d. arachnoid villus.

8. Cerebrospinal fluid is NOT found in the:
   a. central canal.
   b. subarachnoid space.
   c. third ventricle.
   d. subdural space.

True or false

9. __________   The four large, fluid-filled spaces within the brain are called ventricles.

10. __________  Interference of the CSF circulation, causing the fluid to accumulate in the subarachnoid space, is referred to as external hydrocephalus.
Labeling — label the following illustration of the fluid spaces of the brain.

Labeling — label the following illustrations depicting the flow of cerebrospinal fluid and the layers of the brain.

***** If you had difficulty with this section, review pages 377-380
Matching — identify each ascending, or sensory, tract with its corresponding function.

11. _________ transmits impulses of crude touch and pressure
    a. lateral spinothalamic tract
    b. anterior spinothalamic tract
    c. fasciculi gracilis and cuneatus
    d. spinocerebellar tract

12. _________ transmits impulses of subconscious kinesthesia

13. _________ transmits impulses of crude touch, pain, and temperature
    cuneatus

14. _________ transmits impulses of discriminating touch and kinesthesia

Matching — identify each descending, or motor, tract with its corresponding function.

15. _________ transmits impulses that control voluntary movement of muscles on the same side of the body
    a. lateral corticospinal tract
    b. anterior corticospinal tract
    c. lateral reticulospinal tract
    d. medial reticulospinal tract
    e. rubrospinal tract

16. _________ transmits inhibitory impulses to skeletal muscles

17. _________ transmits facilitory impulses to skeletal muscles

18. _________ transmits impulses that control voluntary movement of muscles on the opposite side of the body

19. _________ transmits impulses that coordinate body movements and maintenance of posture
Labeling — match each spinal cord term with its corresponding number in the following illustration.

- White matter
- Anterior median fissure
- Cauda equina
- Spinal nerve
- Posterior column
- Gray matter
- Lumbar enlargement
- Cervical enlargement
- End of spinal cord
- Anterior column
- Central canal
- Dorsal nerve root
- Filum terminale
- Lateral column
Labeling — using the terms provided, label the major tracts of the spinal cord on the following diagram.

- fasciculus gracilis
- anterior spinothalamic
- lateral spinothalamic
- lateral corticospinal
- anterior corticospinal
- rubrospinal
- reticulospinal fasciculus
- cuneatus posterior
- spinocerebellar
- anterior spinocerebellar
- spinotectal
- vestibulospinal
- tectospinal

If you had difficulty with this section, review pages 380-383

IV THE BRAIN

Multiple Choice — select the best answer.

20. Which of the following is NOT a part of the brainstem?
   a. medulla oblongata
   b. hypothalamus
   c. pons
   d. midbrain

21. Which of the following is NOT a component of the midbrain?
   a. cerebral peduncles
   b. corpora quadrigemina
   c. superior colliculi
   d. all of the above are part of the midbrain

22. The internal white matter of the cerebellum is
   a. arbor vitae.
   b. vermis.
   c. peduncle.
   d. none of the above.

23. The part of the brain that secretes releasing hormones is the:
   a. thalamus.  c. medulla.
   b. hypothalamus.  d. pons.

24. Regulation of the body's biological clock and production of melatonin is performed by the:
   a. pons.  c. cerebellum.
   b. thalamus.  d. pineal body.

25. The central sulcus divides the:
   a. temporal lobe and parietal lobe.
   b. cerebrum into two hemispheres.
   c. frontal lobe and parietal lobe.
   d. occipital lobe and parietal lobe.

26. The part of the cerebrum integral to consciousness is:
   a. Broca's area.
   b. the reticular activating system.
   c. the limbic system.
   d. the insula.
27. The two cerebral hemispheres are connected by the:
   a. corpus callosum.
   b. mammillary body.
   c. hippocampus.
   d. central sulcus.

28. Emotions involve the functioning of the cerebrum's:
   a. Broca's area.
   b. limbic system.
   c. reticular activating system.
   d. caudate nucleus.

29. The type of brain wave associated with deep sleep is:
   a. delta.
   b. beta.
   c. alpha.
   d. theta.

30. ________ The cerebellum is the second largest portion of the brain.

31. ________ Functions of the cerebellum include language, memory, and emotions.

32. ________ The vomiting reflex is mediated by the cerebellum.

33. ________ The shallow grooves of the cerebrum are called sulci.

34. ________ The islands of gray matter inside the hemispheres of the cerebrum are called the basal ganglia.

Labeling — label the following illustration of the left hemisphere of the cerebrum.
Labeling — label the functional areas of the cerebral cortex on the following illustration.

IV SOMATIC SENSORY AND MOTOR PATH WAYS

Multiple Choice — select the best answer.

35. Which of the following is NOT a pathway that produces sensations to touch and pressure?
   a. medial lemniscal system
   b. spinothalamic pathway
   c. rubrospinal tract

36. Axons from the anterior gray horn of the spinal cord terminate in:
   a. cerebral cortex.
   b. sensory receptors.
   c. skeletal muscle.
   d. none of the above.

37. Absence of reflexes is indicative of injury to:
   a. lower motor neurons.
   b. upper motor neurons.
   c. lower sensory neurons.
   d. upper sensory neurons.

If you had difficulty with this section, review pages 383-397
True or false

38. __________ Poliomyelitis results in flaccid paralysis via destruction of anterior horn neurons.

39. __________ Ascending tracts carry only motor information, whereas descending pathways carry only sensory information.

*****If you had difficulty with this section, review pages 381 and 400-403

VI MECHANISMS OF DISEASE

Matching — identify each disorder with its corresponding definition.

40. __________ an inherited form of dementia in which the symptoms first appear between 30 and 40 years of age
   a. Alzheimer's disease
   b. cerebrovascular accident
   c. epilepsy
   d. Huntington's disease

41. __________ a hemorrhage from or cessation of blood flow to the cerebral vessels, which destroys neurons

42. __________ a degenerative disease that affects memory, generally developing during the middle to late adult years and causing characteristic lesions in the cortex

43. __________ recurring or chronic seizure episodes involving sudden bursts of abnormal neuron activity

*****If you had difficulty with this section, review pages 404-405
Crossword Puzzle

Across
1. _______ formation consisting of gray and white matter located in medulla
4. Largest division of the brain
8. Contains midbrain, pons, and medulla
9. Helps maintain normal body temperature
10. Electroencephalogram (abbrev.)
11. Cerebrospinal fluid (abbrev.)
12. Second largest part of the brain

Down
2. "Emotional brain" (two words)
3. "Between brain"
5. Part of diencephalon
6. Large, fluid-filled spaces within the brain
7. Membranous coverings of brain

APPLYING WHAT YOU KNOW

44. Baby Dania was born with an excessive accumulation of cerebrospinal fluid in the ventricles. A catheter was placed in the ventricle and the fluid was drained by means of a shunt into the circulating bloodstream. What condition does this medical history describe?

45. Julius is exhibiting loss of memory, increasingly limited attention span, deteriorating motor control, and changes in his personality. What is the general term that can be used to describe his condition? What specific condition may he be suffering from?
DID YOU KNOW?

- The short-term memory capacity for most people is between five and nine items or digits. This is one reason that phone numbers were kept to seven digits (not including the area code).
- The soft mass of the adult brain is motionless. Though it consumes up to 24% of the blood's oxygen supply, it does not grow, divide, or contract.

ONE LAST QUICK CHECK

Matching — select the best choice and insert the correct letter in the answer blank.

46. _______ Stroke
47. _______ paralysis
48. _______ a crippling disease that involves permanent, nonprogressive damage to motor control areas of the brain
49. _______ an imaging technique for the brain that involves scanning the head with a revolving x-ray generator
50. _______ a scanning method that determines the functional characteristics of the brain by introducing a radioactive substance into the blood supply of the brain
51. _______ used to visualize blood flow in the brain
52. _______ a scanning method that uses a magnetic field to induce brain tissues to emit radio waves
53. _______ measurement of electrical activity of the brain
54. _______ characteristic of Alzheimer's disease
55. _______ caused by the HIV virus

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Multiple Choice — select the best answer.

56. The portion of the brain stem that joins the spinal cord to the brain is the:
   a. pons.        d. hypothalamus.
   b. cerebellum.  e. medulla.
   c. diencephalon.

57. Which one of the following is NOT a function of the brain stem?
   a. conducts sensory impulses from the spinal cord to the higher centers of the brain
   b. conducts motor impulses from the cerebrum to the spinal cord
   c. conducts heartbeat, respiration, and blood vessel diameter
   d. contains centers for speech and memory

58. Which one of the following is NOT part of the diencephalon?
   a. cerebrum
   b. thalamus
   c. pituitary gland
   d. third ventricle gray matter

59. Which one of the following parts of the brain helps in the association of sensations with emotions, as well as aiding in the arousal or alerting mechanism?
   a. pons
   b. hypothalamus
   c. cerebellum
   d. thalamus
   e. none of the above is correct

60. Which one of the following is NOT a function of the cerebrum?
   a. language
   b. consciousness
   c. memory
   d. conscious awareness of sensations
   e. all of the above are functions of the cerebrum

61. The area of the cerebrum responsible for the perception of sound lies in the __________ lobe.
   a. frontal        c. occipital
   b. temporal       d. parietal

62. Visual perception is located in the __________ lobe.
   a. frontal        c. occipital
   b. temporal       d. parietal

63. Which one of the following is NOT a function of the cerebellum?
   a. maintains equilibrium
   b. helps produce smooth, coordinated movements
   c. helps maintain normal posture
   d. associates sensations with emotions

64. The largest section of the brain is the:
   a. cerebellum.  c. cerebrum.
   b. pons.       d. midbrain.

65. Which statement is false?
   a. The spinal cord performs two general functions.
   b. A lumbar puncture is performed to withdraw cerebrospinal fluid.
   c. The cardiac, vasomotor, and respiratory control centers are called the vital centers.
   d. REM sleep is almost always a dreamless sleep.

66. Parkinson's disease is a disease of the:
   a. myelin.            c. neuroglia.
   b. axons              d. cerebral nuclei.