ANATOMY I, CHAPTER 12a CNS - BRAIN

2 Protection and coverings of brain
Cranial ________(menix): ________ that ________ the ________ and are __________ with ________ meninges.
_______ layers: ________, ________, ________ matter &_______ matter
   1. ______ matter (________________) - ________ ________ ________ layer (leather like) and a ________ ________ meningeal layer
   2. ________ layer (________ web-like): ________ ________ layer

3 ________ Matter: Very ________ ________ layer that is attached to ________ of the ________ and follows brain ________ ________ ________ layer and ________ matter is the __________ layer and ________ matter is the __________ space which contains __________

4 Figure 12.24: page 460

5 Brain- Largest and most complex portion of the nervous system – ________ ________ ________.
   ________ Development
1. At _____ weeks embryo develops a ________ ________
2. Plate __________ to form ________ ________
3. Superior ________ of grove ________ and form a___________.
4. ________portion of tube ________ but ________ ________ it into ___ separate ________ that become ________

6. Figure: 12.1; pg. 430

7. Figure: 12.1; pg. 430
11 ____________ ________: Fluid that circulates ________ and ________ the ________ and ________ ________
__________ (4): ________ ________ in ________ filled with ________ ________.
__________ ventricles: located in________ ____________ of the brain __________ __
__________ ventricle: ________ slit in the ________
__________ventricle: Lies in the________

12 About ________ of cerebrospinal fluid produced each ______
by the ________ ________
normally, that amount is __________into the _________. If ________ occurs the_______ ________ up. ________ ________ in ________.
__________ acts as a ________ and ________ the brain
Serves as a source of ________ ________, ________ and removal of ________

13 Figure: 12.26; pg. 462 CSF Circulation

14 Figures 12.5a; pg.433 ventricles

15. Figures 12.5b; pg.433 ventricles

16 Figure: 12.27; pg. 463 Hydrocephalus

17 Brain is divided into ___ main sections:
________, _____________, ______ _____, & ____________
part of the brain consisting of____
______ ___________ and __________ by a __________
______(deep groove)
______ of brain mass
______ _______ are__________ by nerve fibers called
________ ______

18 Cortex________ _______ where ________ _______ is
found – _____________ – _____ of brain _____
_____ layers: __________ – __________ __________; inner – __________
________
The cortex has ____________ (elevated ridges or convolutions)
and _____________ (shallow groves)

19 Figure 12.6, Pg.434
20 Figure 12.6 a, Pg, 434

21 Figure: 12.6a, pg. 436 corpus callosum

22 Cortex ________ by prominent ________ into _________ –
named according to overlying ________ ________
________ sulcus separates the_______ & ________ (2)
_______ (2) seperated from ________ by the ________ sulcus
___________ lobes(2) separated from ________ & ________ bt the
__________ sulcus
Fifth lobe, __________, is ________ ________ within the ________
sulcus

23 Figure: 12.6a; pg. 434
24 Figure 12.6c: pg. 434
25 Fig. 12.6 b: pg. 434
26 Cortex contains _______ of _________ _________:
   1. ________, ________ & ________ areas
   2. Each hemisphere is concerned w/ _________ & _________
      function of the ________ (opposite) side of the body
      (ipsilateral – same side)
   3. Function _________ totally equal bilaterally – some
      “specialization” ______________
   4. Areas are never totally __________ always some _________

27 Digress:
   Nuclei: mass of neurons (cell bodies) in CNS
   Ganglia: mass of neurons (cell bodies) in PNS

28 Primary motor (________) cortex
   Found in __________ _________ of _________ lobe
   _________ control of ________ (skeletal) muscles
   Contains large ________ ________* with long _________
   ________* (________ tracts) to the _________ _________

   Control of ________ body structures are controlled by pyramidal
   cells in a _________ region of the primary motor cortex
   _________: mapping of regions

29 Figure: 12.8 a; Pg. 436

30 Figure 12.9; pg. 438 (motor homunculus)

31___________: ________ _________ of brain – three parts
   ________, _________ & _________
   _________: (________ room) ________ in middle of brain –
   ________ ________ of the ___ ventricle
   ________ ________ for _________ coming ______ the cerebral
cortex – ________, ________, ________ – sent to _________ area
   of the __________
_________: ________ the ________ – ________ walls of the third ventricle main ________ ________ center and subsequently controls body ____________

32 ___________: _____ of ______________ that connects to ________ gland
__________ bodies: _____ shaped nuclei that relay impulses from ___________ (smell) sense

32 ROLES of hypothalamus
1. ________ NS control – blood pressure, heart rate, pipil size
2. Center for ________ response
3. Body ____________
4. ________ ________ regulation

33  5. Regulation of ________________cycles
6. Control ________hormone) system
__________ most ________ aspect of diencephalon – posterior boarder includes ________gland/body – produces ________, a ________ inducing hormone

34  Figure: 12.12; pg. 443

35 __________ ________
Group of structures located on the ________ aspect of the __________ and the ____________
It’s our ________ aspects of ________ or ________ relating to ________, ________, pain & memory
Two important parts: ____________ anterior cigulate gyrus
_________: __________ angry or fearfull facial expressions
________ ________: plays role in expressing ________ and ________ mental ________
36  Figure: 12.18; pg. 452  limbic system

37  ________ ________: Rigidly programmed ________
_______ necessary for ________ – contains all ________
_______ except I & II
Includes: __________, _____ & __________ ________

__________: located between ____________ and ______. Contains
the cerebral ________ which connects __________ ventricles
____ (bridge): conduction__________ – contains ________
__________: paired fibers in ventral portion, __________ upper
parts of ______ w/ ______ ______
________ ________: Communication w/ superior ______ ______

38  Figure: 12.15a; pg. 446  cerebral peduncles

39  ________ ________: _____, dorsal dome-like protrusions.
2 ________ ________: are ________ ________ for ________,
head & neck __________ from ________ stimuli.
2 ________ ________: reflex centers for ________ and ________
from ________ stimuli
________ ________: (pillars – “holding up”) (dorsal view) _____
______connecting ________ to ________

40  Figure: 12.15c dorsal–corpora quadrigemina

41  ________ ________: near cerebral peduncles –control
________ ________ – degeneration of ________
(neurotransmiter) releasing neurons of substantia nigra is ultimate
cause of ____________ disease
(red- iron) Ending place for fibers from cerebellum and cerebral cortex- deep in substantia nigra function in

42 Figure: 12.16a; pg. 448–red nucleus& substantia

43 ______: Neural _________ between ______ and _______ _______- Bulging portion of brain stem _______ midbrain & medulla oblongata – Pneumotaxic area & Apneustic area : nuclei in pons that controls breathing

44 Figure: 12.15b; pg. 446 pons lateral

45___________ ________: __________ w/ superior __________________ - ventral bulges w/ motor _________ from ________ cells in ________ cortex to spinal cord ________ of _________: region where ________ tracts ________ to _________ sides.

46 Figure: 12.15a; pg. 446 ventral –pyramid/decus

47 ____________:

______ _______ from ________ cortex, ______ _____nuclei and sensory ________ to provide precise ________ patterns of muscle ________ for smooth ________ _______ bilaterally symmetrical, apple sized _________ connected medially by a worm shaped ________
Surface has pleat-like ________ called folia (leaves)
Deep fissures divide the cerebellum into a __________, _________ and __________ lobes
48 _______ and _______ lobe function in ____________ movement
___________ lobe, on inferior surface, functions in sense of
___________ (balance)

49  Figure 12.17; pg. 451 cerebellum

50 ________ cortex: _______ layer of _______ matter
__________ : _______ _______ matter that has a _________ appearance so, gray matter reaches deep _______ white matter.
__________ peduncles
__________ peduncle: connects _______ to _______
__________ peduncle: connects _______ to _______
__________ peduncle: connects _______ to _______

51  Figure: 12.17a&b; pg. 451

52  Figure: 12.17a&b; pg. 451
NERVOUS SYSTEM—Central Nervous System (CN)

Brain—Mid sagittal view

To recall the parts of the diencephalon, use the mnemonic:

"Expect Total Harmony!"

Epithalamus
Thalamus
Hypothalamus

To recall the parts of the brainstem, use the mnemonic:

"Make Peace Monday!"

Midbrain
Pons
Medulla oblongata

12
The mid sagittal section of the brain reveals many different structures. It is especially good for viewing the structural relationships between the brain stem, diencephalon, cerebrum, and cerebellum. The tables below summarize key information about the brain stem and diencephalon.

**BRAIN STEM**

<table>
<thead>
<tr>
<th>Brain Stem Region</th>
<th>Description</th>
<th>General Functions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Medulla oblongata</td>
<td>Between spinal cord and pons</td>
<td>Respiratory control center; cardiovascular control center</td>
</tr>
<tr>
<td>Pons</td>
<td>Between medulla and midbrain; bulges out as widest region in brain stem</td>
<td>Controls respiration along with medulla; relays information from cerebrum to cerebellum</td>
</tr>
<tr>
<td>Midbrain</td>
<td>Between diencephalon and pons; includes corpora quadrigemina and cerebral aqueduct</td>
<td>Visual and auditory reflex centers; provides pathway between brain stem and cerebrum</td>
</tr>
</tbody>
</table>

**Diencephalon**

<table>
<thead>
<tr>
<th>Diencephalon Region</th>
<th>Description</th>
<th>General Functions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Epithalamus</td>
<td>Roof of third ventricle; includes pineal gland; choroid plexus found here (forms cerebrospinal fluid)</td>
<td>Pineal gland makes hormone melatonin, which regulates day-night cycles;</td>
</tr>
<tr>
<td>Thalamus</td>
<td>Two egg-shaped bodies that surround the third ventricle</td>
<td>Relays sensory information to cerebral cortex; relays information for motor activities; information filter</td>
</tr>
<tr>
<td>Hypothalamus</td>
<td>Forms floor of third ventricle; between thalamus and optic chiasm</td>
<td>Controls autonomic centers for heart rate, blood pressure, respiration, digestion; hunger center; thirst center; regulation of body temperature; production of emotions</td>
</tr>
</tbody>
</table>

**Key to Illustration**

- Brain stem (B)
  - B1. Medulla oblongata
  - B2. Pons
  - B3. Midbrain
- Diencephalon (D)
  - D1. Epithalamus
  - D2. Thalamus
  - D3. Hypothalamus
- 1. Anterior commissure
- 2. Septum pellucidum
- 3. Fornix
- 4. Interthalamic adhesion (intermediate mass of thalamus)
- 5. Corpus callosum
- 6. Pineal gland (body)
- 7. Corpora quadrigemina
- 8. Cerebral aqueduct (aqueduct of Sylvius)
- 9. Transverse fissure
- 10. Arbor vitae
- 11. Fourth ventricle
- 12. Central canal
- 13. Mammillary body
- 14. Pituitary gland
- 15. Optic chiasm
Anatomy I, Notes: Chapter 12b – Spinal cord

2 The Spinal Cord - pg 466
- Enclosed by the__________ __________
- __________ long, _______ wide
- Goes from __________ __________ (distal end of brain stem) and __________ Figure: 14.1; page 526 at level of L2 as__________ __________
- Spinal nerve fibers continue __________ __________ __________ of the____ __________ holds __________ __________ __________ in a loose sac called __________ __________ – it’s anchored at bottom of neural canal

3 Function - ______ nerve impulse__________ ___ and _______the _______ by _______ and ________ nerve _______ - major__________ __________ __________ -

4 Figure 12.29; pg. 467

5 Fig. 12.29b; pg. 467

6 Fig. 12.29c; pg. 467

7 Fig. 12.29d; pg. 467

8 Fig. 12.29b; pg. 467
9 _______ _____ – same as _______ – _____ matter, 
________ matter & _______ matter

-Dura matter is _____ _______ to _____ wall of spinal 
column like the___________

-Arachnoid and pia matter extend down to____ – _________ the 
_____ layers is a ___ __________ ____ with ________ 
__________ fluid (Central canal)

________ bony _______ _______ and the__________
__________ is an _________ _______ filled with _____
__________ and _______ ________

10 Figure: 12.31b; pg. 469

11 Figure: 12.31a; pg. 469

12 _______ _______ /lumbar puncture – _________ fo 
________ ___ fluid for _________ purposes

________ ___-___ longer any_________ _________ just 
________ _______ ________ and these________away 
from puncturing _________

13 Figure: 12.30; pg. 468

14 Cross section Anatomy of Spinal Cord _______/___________
with a _________ /___________ _________ __________ and a 
posterior/dorsal _________ _________
15 Spinal cord consist of _______ & ________ ______. _______ ________ looks kind of like a ________ or an _______.
Both sides are _______ _______ and have a thin _______ called a _______ _______ which has a _______ _______ in the center (____________________). Each side has a _________, _________ horns – though the _________ and upper _________ region also has a _________ horn.

16 Figure: 12.31 b; page 469

17 _________ of _____ ________ is dependant on number of __________ _______.
Since the ______/_________ and ______/________ have a _______ of ________ there will be _______ amount of ________ ________ in the sections of the spinal cord that ________ these muscles. Therefore, the spinal cord is _________ in the _________ region that controls the __________ ________ as well as the _________ region that controls the __________ ________.
This produces the _________ and _________ ________.

18 Figure: 12.29; page: 467

19 _________ _________ - _________ _________ – provides _________ between different parts of _________ _________ & w/ the _________
3 columns or _________ / _________ _________, _________ & _________ _________
Will be _________ or _________ _______ (bundles of nerve fibers _________)
- _________ tracts are _________
- _________ tracts are _________
20 Figure: 12.31 b; page 469

21 Figure: 12.33; page: 471

22 Figure: 12.34; page: 471

23 Figure: 12.34; page: 47

24 __________ _________ – __________ and _________ horns
__________ Horns – __________ - they _________
__________ impulses from __________ nerves (__________)
bringing nerve ____ the spinal cord from nerve _________ in the
__________
From there the _________ will be sent to the__________ by the
__________ , __________ tracts
__________ __________ – __________- they send motor
impulses, received from the efferent descending tracts, ___ the
__________ in the body by the way of __________ nerves

25 Figure: 12.32; page: 470

26 The afferent__________ nerve impulses __________ the
__________ _____by __________
The efferent motor _______impulses_______ the __________
__________ by __________

27 Figure: 12.31b; page: 469

28 The__________ merge to form a__________ and the roots
__________ to form a__________ (bundle of ________/_______)
The nerve is__________ _________ _________ sensory fibers and
__________, motor fibers so, it is called a __________ nerve.

29 Figure: 12.31b; page: 470
An adult spinal cord is about the width of a pencil.

The gray matter in the middle of the spinal cord is shaped like a butterfly.
NERVOUS SYSTEM—Central Nervous System (CNS)

Description

The spinal cord is a long, slender structure that is the link between the body and the brain. Most of it is protected by the bony vertebrae because it runs through the vertebral canal of the vertebral column. Three layers of protective membranes called meninges surround the spinal cord and brain. The outermost meninge is called the dura mater. It is the thickest and strongest and contains fibrous connective tissue. The middle layer is the arachnoid which is made of simple squamous epithelium. The innermost layer is the delicate pia mater which adheres tightly to the spinal cord and follows every surface feature. It supplies many blood vessels directly to the spinal cord. Below the arachnoid is a potential space called the subarachnoid space, which is filled with cerebrospinal fluid. This serves as a cushion to protect the spinal cord and functions as a medium through which to deliver nutrients and remove wastes. Extending laterally off the spinal cord are 31 pairs of spinal nerves. These become the various peripheral nerves that spread throughout the body. The spinal cord contains areas of gray matter and white matter. The white matter is located in the outer portion of the spinal cord and consists of myelinated axons that run along its length. The gray matter is in the center of the spinal cord and includes short neurons called interneurons along with cell bodies, dendrites, and axon terminals of other neurons. Regions of gray matter are referred to as “horns.” In the center of the spinal cord is a small passageway called the central canal, which also contains cerebrospinal fluid.

Analogy

The gray matter in the middle of the spinal cord looks like a butterfly (this analogy works better for some regions of the spinal cord than others since the overall shape of the gray matter is not constant).

Key to Illustration

1. Gray matter
2. Central canal
3. White matter
4. Dorsal root - posterior ganglion
5. Dorsal root ganglion
6. Dorsal rami
7. Spinal nerves
8. Rami communicantes
9. Ventral root ventral motor
10. Pia mater
11. Arachnoid
12. Dura mater
13. Posterior sulcus
14. Posterior gray commissure
15. Central canal
16. Anterior gray commissure
17. Anterior median sulcus
18. Anterior horn
19. Lateral horn
20. Posterior horn