ANP1106 Midterm 2 2014

1. Which of the following would help to determine if the oculomotor nerve (III) was damaged?

   A. Have the patient distinguish between green and red colors
   B. Have the patient read the letters on an eye chart
   C. Have the patient look superiorly and inferiorly
   D. Have the patient cry

2. Which of the following statements is/are TRUE?

   A. The right cerebral hemisphere is usually dominant for language and math.
   B. The primary visual cortex contains a map of visual space.
   C. One functional centre found within the medulla oblongata is a respiratory centre involved in regulating the rate and depth of breathing.
   D. Meningitis is the most accurate term for inflammation of neurons.
   E. Both B and C are true

3. The _____ ONLY contains motor fibers.

   A. dorsal root
   B. dorsal ramus
   C. dentral root
   D. dentral ramus

4. The _____ cranial nerves is exclusively sensory.

   A. optic (II)
   B. facial (VII)
   C. hypoglossal (XII)
   D. trochlear (IV)

5. Irritation of a major nerve in this plexus may cause hiccups (spasms of the diaphragm):

   A. Cervical plexus
   B. Lumbar plexus
   C. Sacral plexus
   D. Thoracic plexus

6. The flexor muscles in the anterior arm (biceps brachii and brachialis) are innervated by what nerve?

   A. Radial
   B. Median
   C. Ulnar
   D. Musculocutaneous

7. If your nose itches, which primary sensory area receives that information?

   A. Olfactory
   B. Gustatory
   C. Auditory
   D. Somatosensory

8. Damage to the cerebellum would result in:

A. loss of memory
B. uncoordinated movement
C. inability to dream
D. altered pituitary function

9. A patient who received a blow to the side of the skull is now unable to close his eye and the corner of his mouth droops. Which cranial nerve has been damaged?

A. Facial
B. Glossypharyngeal
C. Hypoglossal
D. Vagus

10. The thalamus does all of the following EXCEPT:

A. serves as a major sensory relay station
B. serves as the gateway to the cortex
C. gives precise location information for sensations of pain and touch
D. communicates with the hypothalamus

11. Which of the following structures is NOT associated with the diencephalon?

A. epithalamus
B. thalamus
C. third ventricle
D. hypothalamus
E. lentiform nucleus

12. Adductor magnus, adductor longus and gracilis are muscles that are associated with the:

A. lateral thigh
B. medial thigh
C. anterior thigh
D. posterior thigh

13. Which of the following muscles attaches to the 12th ribs and fixes their positions during expiration?

A. internal oblique
B. external oblique
C. rectus abdominis
D. quadratus lumborum

14. The sacral plexus is the origin of the:

A. axillary nerve
B. obturator nerve
C. femoral nerve
D. sciatic nerve

15. A tumor is growing in the left lateral horns of several segments of a patient's spinal cord. How might these tumors affect the patient?

A. The patient may not be able to feel somatic sensations from the chest down.
B. The patient may not be able to move the lower extremities.
C. The patient may have difficulty regulating cardiac and smooth muscle contractions.
D. Both A and B are correct

16. Which of the following statements is TRUE?

A. The "bi" in biceps refers to the number of insertions that a muscle has.
B. The chewing muscle covering the ramus of the mandible is the buccinator.
C. A prime mover of the arm that acts in adduction would be the deltoid muscle.
D. The calcaneal tendon is the common insertion tendon for the gastrocnemius and soleus muscles.

17. _____ is/are the muscle(s) involved in crossing one leg over the other while in a sitting position?

A. Gastrocnemius
B. Sartorius
C. All of the hamstrings
D. The quadriceps femoris

18. Which of the following muscles does *not* act in plantar flexion?

A. Popliteus
B. Ttibialis posterior
C. Flexor digitorum longus
D. Gastrocnemius and soleus

19. In a pennate muscle pattern:

A. muscles appear to be strap-like
B. there is a narrow origin diverging to a broad insertion
C. there is a broad origin and fascicles converge toward a single tendon
D. muscles look like a feather

20. Which of the following is paired correctly?

A. Erector spinae // prime mover of head flexion
B. Association fibers // link areas WITHIN a cerebral hemisphere
C. Adductor magnus muscle // lateral compartment of the thigh
D. Biceps brachii // antagonist during arm flexion

21. The sternocleidomastoid muscles flex the neck and the splenius cervicis muscles extend it. What is the relationship between these muscles when bowing your head to look at your toes?

A. The sternocleidomastoid is the prime mover and the spleinus cervicis is the fixator.
B. The sternocleidomastoid is the prime mover and the spleinus cervicis is the synergist.
C. The sternocleidomastoid is the prime mover and the spleinus cervicis is the antagonist.
D. The sternocleidomastoid is the fixator and the spleinus cervicis is the prime mover.

22. Paralysis of which of the following would make an individual unable to flex the thigh?

A. biceps
B. soleus
C. vastus medialis
D. iliopsoas and rectus femoris

23. Which of the following statements is FALSE?

A. Movements of the thigh are accomplished by muscles anchored to the pelvic girdle.
B. The chewing muscle covering the ramus of the mandible is the masseter.
C. The broadest muscle of the back is the latissimus dorsi.
D. The internal oblique muscles are deep to the transversus abdominis muscles.

24. The extensor carpi radialis brevis:

A. extends and abducts the wrist and is short
B. extends and abducts the wrist and has a small tendon
C. supinates the forearm and is a superficial muscle
D. extends the thumb and is a deep muscle

25. An individual who could trace a picture of a bicycle with his or her finger but could not recognize it as a bicycle is most likely to have sustained damage to the:

A. primary visual area
B. Broca's area
C. Wernicke's area
D. visual association area

26. When neurons in Wernicke's area send impulses to neurons in Broca's area, the white matter tracts utilized are:

A. commisural fibers
B. projection fibers
C. association fibers
D. anterior funiculus fibers

27. Which of the following statements regarding spinal nerves is TRUE?

A. The dorsal ramus carries only sensory information while the ventral ramus carries only motor information.
B. The dorsal root carries information only toward the spinal cord while the ventral root carries information away from the spinal cord.
C. The dorsal ramus only carries information toward the posterior compartment of the body while the ventral ramus only carries information toward the anterior compartment of the body.
D. The dorsal root is equivalent to the dorsal ramus.

28. Paralysis of which of the following muscles would make an individual unable to flex the knee?

A. hamstring muscles
B. gluteal muscles
C. brachioradialis
D. soleus

29. Muscles of facial expression:

A. generally originate from bones of the facial skull
B. generally insert into the skin or into other muscles, rather than bones
C. are innervated by the facial (VII) nerve
D. A and B are correct
E. A, B and C are correct

30. To produce horizontal wrinkles in the forehead, which of the following muscles is involved?

A. Medial pterygoid
B. Zygomaticus
C. Frontalis
D. Temporalis

31. A cute, little curly-haired child is sitting behind you in church. You turn around for a moment and she sticks her tongue out at you. Which tongue muscle did she use?

A. Orbicularis oris
B. Stylohyoid
C. Hyoglossus
D. Genioglossus

32. Which of the following muscle names and their naming descriptors are mismatched?

A. Adductor brevis // short muscle that moves a bone closer to the midline
B. Rectus abdominis // muscle with fibers parallel to the midline of the abdomen
C. Sternohyoid // muscle attached to the sternum and hyoid
D. None of the above

33. When your friend asks you a question, you shrug your shoulders because you really don't know the answer. Which muscle are you using?

A. Latissimus dorsi
B. Spinalis
C. Iliocostalis

X Disgarded.

34. Which one of the following structures allows CSF to pass from the subarachnoid space to the superior sagittal sinus?

A. inter-vertebral foramina
B. choroid plexuses
C. corpus callosum
D. arachnoid villi

35. The part of the brain responsible for the regulation of body temperature and hunger is the:

A. superior colliculus
B. epithalamus
C. medulla oblongata
D. hypothalamus

36. Damage to which area results in devastating loss of the ability to comprehend virtually all types of sensory input?

A. Wernicke's area
B. General interpretation area
C. Broca's area
D. Affective language area

37. Which of the following statements concerning the brainstem is TRUE?

A. The brainstem consists of the medulla, pons, and the cerebellum.
B. The brainstem is responsible for higher levels of thinking.
C. Damage to the brainstem is usually fatal.
D. All twelve pairs of cranial nerves enter or leave the brain from the brainstem.

38. Cerebellar peduncles attach the cerebellum to the:

A. medulla oblongata
B. pons
C. thalamus
D. cerebral hemispheres

39. Spinocerebellar tracts _____.

A. terminate in the spinal cord
B. carry proprioceptive inputs to the cerebellum
C. give rise to conscious experience of perception
D. are found in the dorsal columns of the spinal cord

40. If the ventral root of a spinal nerve were cut, what would be the result in the tissue or region that nerve supplies?

A. complete loss of sensation
B. complete loss of voluntary movement
C. loss of neither sensation nor movement, but only of autonomic control
D. complete loss of sensation and voluntary movement

41. Which of the following statements is FALSE?

A. The primary visual cortex contains a map of visual space.
B. As with the cerebral cortex, the two sides of the cerebellum communicate with the opposite sides of the body.
C. The hypothalamus houses the thermostat of the body.
D. The visual sensory area of the cerebral cortex is located in the occipital lobe.

42. A professor unexpectedly dropped a heavy textbook in his anatomy class and all his students looked up, startled. These reflexive movements of their neck and eye muscles were mediated by the:

A. inferior olivary nuclei
B. superior colliculi
C. inferior colliculi
D. cerebral cortex

43. The vital centres for the control of heart rate, respiration, and blood pressure are located in the:

A. pons
B. medulla
C. midbrain
D. cerebrum

44. Striking the "funny bone" is actually stimulation of the:

A. radial nerve
B. sciatic nerve
C. ulnar nerve
D. median nerve

45. Which spinal nerves go directly to the tissues they supply without forming a plexus?

A. C1 through C4
B. C4 through T1
C. T2 through T12
D. L1 through L5

UNIVERSITY OF OTTAWA
ANP1106B
Midterm 2

Date: March 9, 2015 Instructor: J. Savory
Time: 11:30 AM
Duration: 1hr, 20 min

1. A person with a damaged visual association area may be
   A) unable to see rows of letters
   B) declared legally blind
   C) unable to recognize letters but able to identify whole words and their meanings
   D) able to see letters but unable to associate them into words
   E) unable to understand spoken words

2. Which is the following statements regarding spinal nerves is TRUE?
   A) The dorsal ramus carries only sensory information while the ventral rams carries only motor information
   B) The dorsal root carries information only toward the spinal cord while the ventral root carries information away from the spinal cord
   C) The dorsal ramus carries information toward the posterior compartment of the body while the ventral ramus carries information toward the anterior compartment of the body
   D) The dorsal root is equivalent to the dorsal rams
   E) The dorsal ramus carries only motor information while the ventral rams carries only sensory information

3. Choose the muscle(s) that retract the jaw:
   A) temporalis
   B) masseter
   C) medial pterygoid
   D) both A and B are correct
   E) all three muscles retract the jaw

4. The action of the pectoralis major muscle is to:
   A) abduct the arm and rotate the arm laterally
   B) flex, adduct and rotate the arm medially
   C) adduct the arm and rotate the arm laterally
   D) abduct the arm and rotate the arm medially
   E) abduct and raise the arm

5. The tensor fasciae latae performs all of the following *except*:
   A) stabilizes the hip joint
   B) stabilizes the knee joint
   C) abducts the thigh
   D) extends the thigh

6. Muscles of which group share a common origin on the ischium and act to extend the thigh and flex the leg?
   A) Gluteal muscles
   B) Adductor muscles
   C) Peroneal muscles
   D) Quadriceps muscles
   E) Hamstrings muscles

7. The _____ connects the two cerebral hemispheres
   A) association fibers
   B) internal capsules
   C) commissures
   D) projection fibers

8. Spinal nerves are all classified as:
   A) mixed nerves
   B) sensory nerves
   C) afferent nerves
   D) motor nerves

9. The pectineus, psoas major, adductor longs, and iliac us muscles have one action in common. They _____ the thigh.
   A) flex
   B) extend
   C) abduct
   D) laterally rotate

10. The body's main parasympathetic nerve is the
   A) glossopharyngeal nerve
   B) soles and gracilis
   C) vagus nerve
   D) accessory nerve

11. Two muscles that utilize the calcaneal tendon to insert on the calcaneus are the
   A) gastrocnemius and sartorius
   B) soleus and gracilis
   C) gastrocnemius and soleus
   D) gastrocnemius and tensor fasciae latae

12. Which of the following is not a function of the neuroglia?
   A) support
   B) memory
   C) secretion of cerebrospinal fluid
   D) maintenance of the blood-brain barrier
   E) phagocytosis

13. The sternocleidomastoid inserts on the
   A) occipital bone
   B) clavicle
   C) mastoid process
   D) sternum
   E) none of the above

14. Which of the following muscles has its origin on the hyoid bone and inserts on the tongue?
   A) hypoglossus
   B) lateral pterygoid
   C) sternohyoid
   D) thyrohyoid

15. During abdominal surgery, the surgeon makes a cut lateral to the linea alba. The muscle that would be cut is the _____
    A) splenius
    B) external abdominal oblique
    C) rectus abdominis
    D) scalenes

16. The levator ani and coccygeus muscles insert on the _____
    A) iliac crest
    B) coccyx
    C) ischial spine
    D) sacrum

17. Muscles that insert on the olecranon process of the ulna act to
    A) flex the forearm
    B) extend the forearm
    C) abduct the forearm
    D) adduct the forearm

18. The muscle that medially rotates and flexes (unlocks) the knee joint is the
    A) iliacus
    B) gracilis
    C) sartorius
    D) popliteus

19. Muscles of the rotator cuff include all of the following, except the
    A) supraspinatus
    B) infraspinatus
    C) teres major
    D) rhomboid

20. The powerful abductor muscle of the upper arm is the
    A) pectoralis major
    B) brachioradialis
    C) deltoid
    D) coracobrachialis
21. Damage to the somatic motor association area of the frontal lobe would interfere with the ability to
    A) understand written words
    B) understand spoken words
    C) understand visual images
    D) play the piano

22. If the ventral root of a spinal nerve were cut, what would be the result in the tissue or region that nerve supplies?
    A) a complete loss of voluntary movement
    B) complete loss of sensation
    C) a complete loss of sensation and movement
    D) loss of neither sensation nor movement, but only of autonomic control

23. Which of these muscles is a member of the quadriceps group?
    A) vastus lateralis
    B) vastus medialis
    C) vastus intermedius

D) rectus femoris
E) all of the above

24. An antagonist to the gastrocnemius muscle is the _____ muscle.
A) tibialis anterior
B) extensor digitorum longus
C) soleus
D) tibialis posterior

25. Which of the following is incorrectly paired?
A) spinocerebellar tracts // proprioceptive inputs to the cerebellum
B) spinothalamic tract // information to the brain about burning pain
C) pyramidal and corticospinal tracts // motor tracts serving voluntary movements
D) extrapyramidal tracts // sensory information to the brain

26. The flax cerebri is:
A) the deep groove between the pre central and postcentral gyro
B) the lobe of the cerebrum not visible on the surface
C) an extension of the dura mater separating the cerebral hemispheres
D) an extension of the dura mater separating the cerebellar hemispheres
E) an extension of the dura mater separating the cerebrum form the cerebellum

27. Which of the following is a function of the thalamus?
A) secrete cerebrospinal fluid
B) secrete melatonin
C) process sensory information and relay it to the cerebrum
D) store memories

28. Spinal nerves _____ go directly to the tissues they supply without forming a plexus.
A) C1 through C4
B) C4 through T1
C) T2 through T12
D) L1 through L5
E) S1 through S5

29. The action(s) of the extensor digitorum longus muscle is to _____
A) flex the digits
B) assist with plantar flexion of the foot
C) extend digits
D) assist with dorsiflexion of the foot
E) both C and D

30. The _____ nerve is *not* a branch of the trigeminal nerve:
A) mandibular
B) opthalmic
C) cervical
D) maxillary

31. Problems in balance may follow trauma to which nerve?
A) abducens
B) vestibulocochlear

C) trigeminal
D) accessory

32. The flexor muscles in the anterior arm (biceps brachii and brachialis are innervated by what nerve?
A) radial
B) median
C) ulnar
D) musculocutaneous

33. If a person has a crush injury to the C3-C5 spinal segments, you would expect that he:
A) might be unable to breathe on his own
B) could would without difficulty
C) would have full range of motion in all extremities
D) would be in a coma
E) would exhibit none of the above

34. The brachial plexus gives rise to all of the following nerves, except the
A) radial
B) median
C) ulnar
D) musculocutaneous
E) phrenic

35. Cerebrospinal fluid flows from the 3rd ventricle to the 4th ventricle through the
A) subarachnoid space
B) lateral ventricle
C) cerebral aqueduct
D) interventricular foramen

36. Overseeing the postural muscles of the body and making rapid adjustments to maintain balance and equilibrium are functions of the _____.
A) cerebrum
B) midbrain
C) cerebellum
D) pons
E) medulla oblongata

37. Stimulation of the reticular formation results in
A) increased consciousness
B) sleep
C) coma
D) all of the above

38. Which of the following is not a property of the limbic system?
A) contains cerebral and diencephalic components
B) functions in maintaining homeostasis in cold weather
C) located between the border of the cerebrum and diencephalon
D) functions in emotions, learning, and memory

39. The surface of the postcentral gyrus contains the _____ cortex.
A) primary sensory
B) primary motor
C) visual

D) olfactory
E) auditory

40. After suffering a stroke, Mary finds that she cannot move her right arm. This would suggest that the stroke damage is in the area of the _____ lobe.
A) right frontal
B) left frontal
C) right temporal
D) left temporal

41. The basal nuclei
A) plan and coordinate voluntary muscle activity
B) provide the general pattern and rhythm for movements such as walking
C) coordinate sensory information
D) control respiration and blood pressure

42. Tom, a trumpet player, asks you which muscles he should develop in order to be a better trumpeter. What would you tell him?
A) the masseter and buccinator
B) the buccinator and orbicularis oris
C) the orbicularis oris and risorius
D) the buccinator and zygomaticus

43. A tumor is growing in the left lateral horns of several segments of a patient's spinal cord. How might these tumors affect the patient?
A) the patient may not be able to feel somatic sensations from the chest down
B) the patient may not be able to move the lower extremities
C) the patient may have difficulty regulating cardiac and smooth muscle contractions
D) A and B are correct

44. Paralysis of which of the following would make an individual unable to flex the thigh?
A) biceps
B) soleus
C) vastus medialis
D) iliopsoas and rectus femurs
E) none of the above

45. Neurons can be classified structurally by the number of processes extending from their cell body. Which is the most common neuron type in humans?
A) tripolar
B) bipolar
C) unipolar
D) multipolar

ANP1106 Midterm 2 – Dr. Carnegie – 2016

-45 multiple choice questions, plus 17 marks for diagram labeling and other written work

1. Neurons can be classified structurally by the number of processes extending from their cell body. Which is the most common neuron type in humans?
    a) tripolar
    b) bipolar
    c) unipolar
    d) all neurons have the same number of processes
    e) multipolar

2. To produce horizontal wrinkles in the forehead, which of the following muscles is involved?
    a) medial pterygoid
    b) zygomaticus
    c) frontalis
    d) temporalis

3. In flexing the forearm at the elbow, the:
    a) biceps brachii and brachialis act as prime movers
    b) triceps brachii acts as antagonist
    c) brachioradialis acts as antagonist
    d) a) and b)

4. Which of the following is NOT associated with the deltoid muscle?
    a) prime mover of arm flexion
    b) prime mover of arm abduction
    c) swinging arm movements when walking
    d) common site for IM injection
    e) permits lateral & medial arm rotations if only some fibers used

5. The “smiling” muscle is the:
    a) orbicularis orbis
    b) mentalis
    c) zygomaticus
    d) buccinator
    e) none of the above

6. The pectoralis major muscle:
    a) abducts the humerus
    b) adducts the humerus
    c) retracts the scapula
    d) protracts the scapula
    e) rotates the radius

7. A nursing infant develops a powerful sucking muscle that adults also use for whistling called the:
    a) platysma
    b) masseter
    c) zygomaticus
    d) buccinator

8. When the term biceps, triceps or quadriceps forms part of a muscle's name, you can assume that:

a) the muscle has two, three, or four origins, respectively
b) the muscle is able to change direction twice, three times, or four times faster than other muscles, respectively
c) the muscle has two, three, or four functions, respectively
d) the muscle has two, three, or four insertions, respectively
e) the muscle is composed of two, three or four fascicles, respectively

9. Which of the following muscles would NOT influence lip movement?
a) zygomaticus
b) mentalis
c) orbicularis oculi
d) buccinator
e) all of the above would influence lip movement

10. Which of the following is NOT a member of the hamstrings?
a) gracilis
b) semitendinosus
c) semimembranosus
d) biceps femoris

11. Which of the following muscles is NOT a part of the quadriceps femoris?
a) rectus femoris
b) biceps femoris
c) vastus medialis
d) vastus lateralis
e) vastus intermedius

12. The muscles that flex the leg and extend the thigh:
a) are found in the posterior compartment of the thigh
b) include the semimembranosus and the semitendinosus
c) are collectively called the hamstrings
d) a) and b) are correct
e) a), b) and c) are correct

13. Which of the following statements is TRUE?
a) The “bi” in biceps refers to the number of insertions that a muscle has.
b) The chewing muscle covering the ramus of the mandible is the buccinator.
c) A prime mover of the arm that acts in adduction would be the deltoid muscle.
d) The calcaneal tendon is the common instertion tendon for the gastrocnemius and soleus muscles.
e) During inspiration, the first rib is fixed in place by the splenius muscle.

14. The names of muscles often indicate the action of the muscle. What does the term *levator* mean?
a) The muscle flexes and rotates a region.
b) The muscle is a fixator and stabilizes a bone or joint.
c) The muscle elevates a region.
d) The muscle functions as a synergist.

15. Tennis players often complain about pain in the arm (forearm) that swings the racquet. What muscle is usually strained under these conditions?

a) the triceps brachii
b) the anoconeus
c) the brachioradialis
d) the flexor digitorum profundus

16. What do genioglossus, hyoglossus, and styloglossus have in common?
a) All names indicate the relative size of the muscle.
b) All names reflect direction of muscle fibers.
c) Each acts synergistically to elevate the jaw.
d) All act on the tongue.

17. Which of the following is paired correctly?
a) deltoid muscle // prime mover of arm abduction
b) erector spinae // prime mover of head flexion
c) commissural fibers // link areas WITHIN a cerbral hemisphere
d) adductor magnus muscle // lateral compartment of the thigh
e) biceps brachii // antagonist during arm flexion

18. Ciliated CND neuroglia that play an active role in moving the cerebrospinal fluid are:
a) ependymal cells
b) Schwann cells
c) oligodendrocytes
d) astrocytes
e) microglia

19. Loss of the ability to perform motor activities such as piano playing, with no paralysis or weakness in specific muscles, might suggest damage to the:
a) spinal cord
b) premotor cortex
c) primary motor cortex
d) Broca's area

20. The subarachnoid space lies between what two layers of meninges?
a) arachnoid mater and pia mater
b) arachnoid mater and dura mater
c) dura mater and epidura mater
d) arachnoid mater and epidura mater

21. The hypothalamus:
a) is the thermostat of the body since it regulates temperature
b) contains feeding and hunger centres
c) contains neurons sensitive to the hydration level of the blood
d) all of the above are correct

22. Problems in balance may follow trauma to which nerve?
a) abducens
b) vestibulocochlear
c) trigeminal
d) accessory
e) vagal

23. A patient who has received a blow to the side of the skull is now unable to close his eye and the corner of his mouth droops. Which cranial nerve has been damaged?
a) facial
b) glossopharyngeal
c) hypoglossal
d) vagus

24. When neurons in Wernicke's area send impulses to neurons in Broca's area, the white matter tracts utilized are:
a) commissural fibers
b) progection fibers
c) association fibers
d) anterior funiculus fibers

25. The basal nuclei include:
a) hippocampus
b) lentiform nucleus
c) red nucleus
d) mammillary bodies
e) b) and c)

26. The primary motor area of the cerebral cortex is located in the:
a) precentral gyrus
b) postcentral gyrus
c) temporal lobe
d) occipital lobe
e) insula

27. The fissure separating the left and right cerebral hemispheres is the:
a) central fissure
b) longitudinal fissure
c) parieto-occipital fissure
d) lateral fissure
e) none of the above

28. The cerebrospinal fluid:
a) is secreted by the arachnoid villi
b) enters the ventricles after filling and circulating through the subarachnoid space
c) is completely renewed about once every 48 hours
d) is formed by the choroid plexuses
e) c) and d)

29. The abducens nerve regulates the movement of the:
a) medial rectus muscle
b) lateral rectus muscle
c) superior rectus muscle
d) inferior rectus muscle

30. The _____ nerve is NOT a branch of the trigeminal nerve.
a) ophthalmic

b) maxillary
c) cervical
d) mandibular

31. The cranial nerve with a dual origin (brain and spinal cord) is the:
a) hypoglossal
b) accessory
c) vagus
d) glossopharyngeal

32. The brainstem includes all of the following EXCEPT the:
a) medulla oblongata
b) pons
c) midbrain
d) diencephalon
e) reticular formation

33. A six-year-old is at the edge of the outfield watching jets take off from a nearby military base instead of paying attention to the softball game in which his older sister is playing. A strongly hit softball strikes him in the back of the head with considerable force. Which association area is most likely to be damaged in this accident?
a) auditory
b) visual
c) somatosensory
d) posterior language
e) common integrative

34. Astrocytes function to:
a) form myelin in the central nervous system
b) form myelin in the peripheral nervous system
c) maintain the ionic environment of the central nervous system
d) absorb cerebrospinal fluid and return it to the venous system
e) form cerebrospinal fluid

35. Which of the following statements is/are TRUE?
a) The left cerebral hemisphere is usually dominant for language and math.
b) The primary visual cortex contains a map of visual space.
c) Brodmann numbers refers to the dimensions of CNS neurons.
d) Meningitis is the most accurate term for inflammation of neurons.
e) a) and b)

36. A tumor is growing in the left lateral horns of several segments of a patient's spinal cord. How might these tumors affect the patient?
a) The patient may not be able to feel somatic sensations from the chest down.
b) The patient may not be able to move the lower extremities.
c) The patient may have difficulty regulating cardiac and smooth muscle contractions.
d) a) and b)

37. Which spinal nerves go directly to the tissues they supply without forming a plexus?
a) C1 through C4
b) C4 through T1
c) T2 through T12

d) L1 through L5
e) S1 through S5

38. Which of the following statements regarding spinal nerves is TRUE?
a) The dorsal ramus carries only sensory information while the ventral ramus carries only motor information.
b) The dorsal root carries information only toward the spinal cord while the ventral root carries information away from the spinal cord.
c) The dorsal ramus only carries information toward the posterior compartment of the body while the ventral ramus only carries information toward the anterior compartment of the body.
d) The dorsal root is equivalent to the dorsal ramus.
e) The dorsal ramus carries only motor information while the ventral ramus carries only sensory information.

39. The main function of Schwann cells is to:
a) form the myelin sheaths of neurons in the PNS
b) form the myeln sheaths of neurons in the CNS
c) act as part of the blood-brain barrier
d) act as interneurons
e) produce cerebrospinal fluid

40. The primary auditory cortex is located in:
a) the lateral surface of the frontal lobe
b) the lateral surface of the occipital love
c) the superior surface of the temporal lobe
d) the inferior surface of the temperal lobe
e) the postcentral gyrus of the parietal love

41. A spinal nerve is covered from the inside out with a:
a) myelin sheath, endoneurium, perineurium, epineurium
b) myelin sheath, epineurium, perineurium, endoneurium
c) myelin sheath, perineurium, epineurium, endoneurium
d) epineurium, perineurium, endoneurium

42. The sacral plexus is the origin of the:
a) axillary nerve
b) obturator nerve
c) femoral nerve
d) sciatic nerve
e) both c) and d)

43. The postcentral gyrus is the:
a) primary somatosensory area
b) primary motor area
c) somatosensory association area
d) primary auditory area
e) all of the above

44. As a result of the brain injury suffered by Kevin Chappell in the article I assigned to you to read, Kevin was no longer able to:

a) link names with faces
b) recognize people he used to know
c) recognize objects
d) draw an object from memory
e) see

45. All of the following are structures of the limbic system except the _____.
a) hippocampus
b) cingulate gyrus
c) amygdaloid nucleus
d) caudate nucleus

Fill in the Blank Answers

Brodmann's # premotor cortex – #4
sciatic nerve branches to the tibial and – common fibular nerve
constricts urethra – urogenital diaphragm
maintains jaw at rest – temporalis

Diagrams

- orbicularis oris (lips)
- dura mater (5th layer)
- splenius (A & P Flix)
- deltoid, gastrocnemius, brachioradialis
- trochlear (top of eye nerve)
- third ventricle
- external oblique

1. Which of the following muscles inserts via the calcaneal tendon'?
A. semitendinosus
B. sartorius
C. tibialis anterior
D. gastrocnemius

2. Which of the following statements is TRUE?
A. Cerebrospinal fluid is secreted by the arachnoid villi.
B. The brainstem consists of the pons, medulla and cerebellum.
C. Meningitis is the most accurate term for inflammation of neurons.
D. The primary motor area of the cerebral cortex is located in the postcentral gyrus.
E. The primary visual cortex contains a map of visual space.

3. The names of muscles often indicate the action of the muscle. What does the term levator mean?
A. The muscle flexes and rotates a region.
B. The muscle is a fixator and stabilizes a bone or joint.
C. The muscle elevates a region.
D. The muscle functions as a synergist.

4. As a result of the brain injury suffered by Kevin Chappell in the article I assigned to you to read, Kevin:
A. has difficulty recognizing his children
B. can read only by tracing each letter first
C. is unable to draw what he sees
D. cannot understand words when hearing them
E. has very poor short-term memory

5. White matter of the nervous system is composed of:
A. aggregations of myelinated axons
B. aggregations of neuron cell bodies
C. aggregations of nuclei of cell bodies
D. aggregations of ganglia
E. none of the above

6. Which of the following statements is TRUE?
A. The corpora quadrigemina superior colliculi are auditory reflex centres.
B. The optic cranial nerve is a mixed nerve.
C. A first-order neuron extends from the sensory receptor to the central nervous system.
D. In the nervous system, the term nucleus means a collection of nerve cells outside the CNS.
E. The canal connecting the third and fourth ventricles and running through the midbrain is the foramen of Monro.

7. The names of the muscles can indicate all of the following EXCEPT:
A. structural characteristics of the muscle
B. fat content of the muscle
C. direction of the muscle relative to the long axis of the body
D. action of the muscle
E. region of the body where the muscle is inserted

8. Which of the following statements is/are TRUE?
A. The left cerebral hemisphere is usually dominant for language and math.
B. The primary visual cortex contains a map of visual space.
C. Brodmann numbers refers to the dimensions of CNS neurons.
D. Meningitis is the most accurate term for inflammation of neurons.
E. A) and B)

9. Ridges of tissue on the surface of the cerebral hemispheres are called
A. gyrii
B. sulci
C. fissures
D. ganglia

10. The area of the cortex that is responsible for sensations of the full bladder and the feeling that your lungs will burst when you hold your breath too long is the
A. olfactory cortex
B. gustatory cortex
C. vestibular cortex
D. visceral sensory area

11. Which of the following statements concerning the prefrontal cortex is FALSE?
A. it is a complicated region associated with complex learning
B. its development is very dependent on positive and negative feedback from the environment
C. it is involved with the development of judgment, reasoning and conscience
D. it is not fully mature in children
E. it occupies the posterior portion of the frontal lobe

12. Cell bodies of the sensory neurons of the spinal nerves are located in
A. the dorsal root ganglia of the spinal cord
B. the ventral root ganglia of the spinal cord
C. the thalamus
D. sympathetic ganglia

13. Which of the following does not compress the abdomen?
A. internal oblique
B. external oblique
C. transverse abdominis
D. coccygeus

14. A cute, little curly-haired child is sitting behind you in church. You turn around for a moment and she sticks her tongue out at you. Which tongue muscle did she use?
A. orbicularis oris
B. stylohyoid
C. hyoglossus
D. genioglossus

15. The musculocutaneous nerve innervates which of the following muscles?
A. rectus femoris
B. biceps brachii
C. pectoralis major
D. gastrocnemius
E. levator scapulae

16. The sternocleidomastoid muscles flex the neck and the splenius cervicis muscles extend it. What is the relationship between these muscles when bowing your head to look at your toes?
A. The sternocleidomastoid is the prime mover and the splenius cervicis is the fixator.
B. The sternocleidomastoid is the prime mover and the splenius cervicis is the synergist.
C. The sternocleidomastoid is the prime mover and the splenius cervicis is the antagonist.
D. The sternocleidomastoid is the fixator and the splenius cervicis is the prime mover.
E. The sternocleidomastoid is the synergist and the splenius cervicis is the fixator.

17. The pectoralis major muscle:
A. abducts the humerus
B. adducts the humerus .
C. retracts the scapula
D. protracts the scapula
E. rotates the radius

18. The function of a choroid plexus is to:
A. receive sensations from the visceral organs
B. send motor impulses to the diaphragm
C. transmit impulses from one cerebral hemisphere to the other
D. produce cerebrospinal fluid
E. reabsorb cerebrospinal fluid

19. Paralysis of which of the following muscles would make an individual unable to flex the knee?
A. hamstring muscles
B. gluteal muscles
C. brachioradialis
D. soleus

20. Damage to the cerebellum would result in:
A. loss of memory
B. uncoordinated movement
C. inability to dream
D. altered pituitary function
E. inability to control body temperature

21. The outermost layer of the meninges is the:
A. pia mater
B. arachnoid mater
C. choroid plexus
D. dura mater
E. ependyma

22. Cerebrospinal fluid in the ventricular space of the brain turns over:
A. about once a week
B. about once a day
C. about once every 8 hours
D. about once an hour
E. about once every 6 minutes

23. Broca's area:
A. is found in the occipital lobe
B. is usually found in the right hemisphere
C. is considered a motor speech area
D. is involved in spatial discrimination during somatosensory reception
E. A) and C)

24. Which of the following is the strongest forearm flexor?
A. deltoid
B. brachioradialis
C. triceps brachii
D. brachialis
E. biceps brachii

25. Which group of muscles flexes and rotates the neck?
A. the scalenes
B. the iliocostalis
C. the spinalis
D. the splenius

26. Paralysis of which of the following would make an individual unable to flex the thigh?
A. biceps
B. soleus
C. vastus medialis
D. iliopsoas and rectus femoris
E. none of the above

27. A patient who received a blow to the side of the skull is now unable to close his eye and the corner of his mouth droops. Which cranial nerve has been damaged?
A. facial
B. glossypharyngeal
C. hypoglossal
D. vagus

28. The subarachnoid space lies between what two layers of meninges?
A. arachnoid and epidura
B. arachnoid and pia
C. arachnoid and dura
D. dura and epidura

29. Which plexus supplies the skin and muscles of the shoulders and upper extremities?
A. brachial
B. cervical
C. coccygeal
D. lumbar

30. When the term biceps, triceps or quadriceps forms part of muscle's name, you can assume that:
A. the muscle has two, three, or four origins, respectively
B. the muscle is able to change direction twice, three times, or four times faster than other muscles, respectively.
C. the muscle has two, three, or four functions, respectively.
D. the muscle has two, three, or four insertions, respectively.
E. the muscle is composed of two, three or four fascicles, respectively.

31. The thalamus does all of the following EXCEPT:
A. serves as a major sensory relay station
B. serves as the gateway to the cortex
C. contributes to motor functions
D. gives precise location information for sensations of pain and touch
E. communicates with the hypothalamus

32. The part of the spinal nerve that contains only efferent fibers is the:
A. dorsal root
B. ventral root
C. dorsal ramus
D. ventral ramus
E. plexus

33. Spinal nerves are considered mixed, which means that:
A. they contain both nerves and tracts
C. they contain both gray and white matter
C. they contain both afferent and efferent nerves
D. they use multiple types of neurotransmitters
E. a single nerve arises from multiple segments of the spinal cord

34. In flexing the forearm at the elbow, the:
A. biceps brachii and brachialis act as prime movers
B. triceps brachii acts as antagonist
C. brachioradialis acts as antagonist ·
D. a) and b)

35. Loss of the ability to perform skilled motor activities such as piano playing, with no paralysis or weakness in specific muscles, might suggest damage to the:
A. spinal cord
B. premotor cortex
C. primary motor cortex
D. Broca's area

36. Which of the following structures is NOT associated with the diencephalon?
A. epithalamus
B. thalamus
C. third ventricle
D. hypothalamus
E. lentiform nucleus

37. Adductor magnus, adductor longus and gracilis are muscles that are associated with the:
A. lateral thigh
B. medial thigh
C. anterior thigh
D. posterior thigh

38. The cranial nerve with a dual origin (brain and spinal cord) is the:
A. hypoglossal
B. accessory
C. vagus
D. glossopharyngeal

39. The deltoid muscle can produce all of the following movements at the shoulder joint EXCEPT:
A. abduction
B. flexion
C. adduction
D. extension

40. The function of commissures is to connect:
A. adjacent areas of gray matter within a cerebral hemisphere
B. corresponding areas of the two cerebral hemispheres
C. areas of cortex with regions of the spinal cord
D. pyramidal cells with corresponding cerebellar cells .

41. The discrete correlation of body regions to CNS structures is:
A. spatial discrimination
B. somatotopy
C. lateralization
D. cephalization

42. Ciliated CNS neuroglia that play an active role in moving the cerebrospinal fluid are:
A. ependymal cells
B. Schwann cells
C. oligodendrocytes
D. astrocytes
E. microglia

For Questions 43-47, indicate whether each of the following statements is TRUE (T) or FALSE (F) in the space provided.
43. The sternohyoid muscle is named after its shape. FALSE
44. The occipitalis muscle anchors the scalp posteriorly. TRUE
45. The pelvic floor muscle that constricts the urethra is the urogenital diaphragm. TRUE
46. The chewing muscle covering the ramus of the mandible is the buccinators FALSE
47. Movements of the thigh are accomplished by muscles anchored to the pelvic girdle. TRUE

ANP1106 Midterm #2

1. **Which of the following is NOT a function of the sartorius muscle?**
    a. Lateral rotation of thigh
    b. Flexion of knee
    c. Adduction of thigh
    d. Flexion of hip
2. **Because you did not do well on your recent anatomy and physiology exam, you leave the classroom pouting. Which one of these muscles are you using?**
    a. Mentalis
    b. Orbicularis Oris
    c. Risorius
    d. Levator Labii Superficialis
    e. Occipitalis
3. **The extensor carpi radialis brevis:**
    a. Extends and abducts the wrist and is short
    b. Extends and abducts the wrist and has a small tendon
    c. Supinates the forearm and is a superficial muscle
    d. Extends the thumb and is a deep muscle
4. **Which of the following contains ONLY motor fibers?**
    a. Dorsal root
    b. Dorsal ramus
    c. Ventral root
    d. Ventral ramus
5. **The function of a choroid plexus is to:**
    a. Receive sensations from the visceral organs
    b. Send motor impulses to the diaphragm
    c. Transmit impulses from one cerebral hemisphere to the other
    d. Produce cerebrospinal fluid
    e. Reabsorb cerebrospinal fluid
6. **The primary auditory cortex is located in:**
    a. The lateral surface of the frontal lobe
    b. The lateral surface of the occipital lobe
    c. The superior surface of the temporal lobe
    d. The inferior surface of her temporal lobe
    e. The postcentral gyrus of the parietal lobe

7. **Neurons can be classified structurally by the number of processes extending from their cell body. Which is the most common neuron type in humans?**
    a. Tripolar
    b. Bipolar
    c. Unipolar
    d. All neurons have the same number of processes
    e. Multipolar
8. **The fissure separating the left and right cerebral hemispheres is the:**
    a. Central fissure
    b. Longitudinal fissure
    c. Parieto-occipital fissure
    d. Lateral fissure
    e. None of the above
9. **Which nerve fibers link areas WITHIN a cerebral hemisphere?**
    a. Projection fibers
    b. Corpus callosum
    c. Association fibers
    d. Commissural fibers
    e. None of the above
10. **Which of the following statements concerning the prefrontal cortex is FALSE?**
    a. It is a complicated region associated with complex learning
    b. Its development is very dependent on positive and negative feedback from the environment
    c. It is involved with the development of judgment, reasoning and conscience
    d. It is not fully mature in children
    e. It occupies the posterior portion of the frontal lobe
11. **An individual who could trace a picture of a bicycle with his or her finger but could not recognize it as a bicycle is most likely to have sustained damage to the:**
    a. Primary visual area
    b. Broca's Area
    c. Wernicke's area
    d. Visual association area
12. **Problems in balance may follow trauma to which nerves?**

a. Abducens
b. Vestibulocochlear
c. Trigeminal
d. Accessory
e. Vagal

13. Which of the following would help to determine if the oculomotor nerve was damaged?

a. Have the patient distinguish between green and red colours
b. Have the patient read the letters on an eye chart
c. Have the patient looks superiorly and inferiorly
d. Have the patient cry

14. The discrete correlation of body regions to CNS structures is:

a. Spatial discrimination
b. Somatotopy
c. Lateralization
d. Cephalization

15. Broca's area:

a. Is found in the occipital lobe
b. Is usually found in the right hemisphere
c. Is considered a motor speech area
d. Is involved in spatial discrimination during somatosensory reception
e. A) and C)

16. The abducens nerve regulates the movement of the:

a. Medial rectus muscle
b. Lateral rectus muscle
c. Superior rectus muscle
d. Inferior rectus muscle

17. The brainstem includes all of the following EXCEPT the:

a. Medulla oblongata
b. Pons
c. Midbrain
d. Diencephalon
e. Reticular formation

18. Astrocytes function to:

a. Form myelin in the central nervous system
b. Form myelin in the peripheral nervous system

c. Maintain the ionic environment of the central nervous system
d. Absorb cerebrospinal fluid and return it to the venous system
e. Form cerebrospinal fluid

19. The cerebellum:

a. Is located posterior to the brain stem and inferior to the cerebral hemispheres
b. Directly stimulates voluntary skeletal muscle contractions
c. Communicates with the cerebral hemispheres through three pairs of cerebellar peduncles
d. Has a superficial layer of white matter
e. All of the above

20. A tumor is growing in the left lateral horns of several segments of a patient's spinal cord. How might these tumors affect the patient?

a. The patient may not be able to feel somatic sensations from the chest down
b. The patient may not be able to move the lower extremities
c. The patient may have difficulty regulating cardiac and smooth muscle contractions
d. A) and B)

21. The polio virus typically attacks:

a. Posterior root ganglia
b. Neurons in the anterior gray horns of the spinal cord
c. Only sensory neurons
d. Only interneurons
e. The connective tissues surrounding neurons

22. Which of the following statements is TRUE?

a. The biceps brachii inserts on the ulna
b. The deltoid is a prime mover of arm adduction
c. Movements of the thigh are accomplished by muscles anchored to the pelvic girdle
d. Severing the patellar tendon would inactivate the hamstring group
e. All of the above statements are true

23. When the term biceps, triceps or quadriceps forms part of a muscle's name, you can assume that:

a. The muscle has two, three, or four origins, respectively

b. The muscle is able to change direction twice, three times, or four times faster than other muscles, respectively
c. the muscle has two, three, or four functions, respectively
d. the muscle has two, three, or four insertions, respectively
e. the muscle is composed of two, three or four fascicles, respectively

24. A muscle that assists the muscle that is primarily responsible for a given action is a(n):

a. Antagonist
b. Originator
c. Prime mover
d. Synergist
e. Levator

25. Adductor magnus, adductor longus and adductor brevis are parts of a large muscle mass of the:

a. Anterior compartment of the thigh
b. Posterior compartment of the thigh
c. Medial compartment of the thigh
d. Lateral compartment of the thigh

26. Which of the following muscles attaches to the 12th ribs and fixes their positions during forced expiration?

a. Inferior intercostal
b. Internal oblique
c. External oblique
d. Rectus abdominis
e. Quadratus lumborum

27. An instructor raises his eyebrows because he is very surprised by a student's comment during class. Which of the following muscle is involved in this surprised expression?

a. Epicranius
b. Orbicularis oculi
c. Platysma
d. Temporalis
e. Levator scapulae

28. With regard to muscle fiber arrangement in a pennate muscle:

a. The fascicular pattern is circular
b. The fascicles form a triangle

c. The fascicles are short and attach obliquely to a central tendon that runs the length of the muscle
d. The long axes of the fascicles run parallel to the long axis of the muscle
e. None of the above

29. The names of muscles often indicate the action of the muscle. What does the term *levator* mean?

a. The muscle flexes and rotates a region
b. The muscle is a fixator and stabilizes a bone or joint
c. The muscle elevates a region
d. The muscle functions as a synergist

30. Which of the following muscles is part of the quadriceps femoris?

a. Biceps femoris
b. Vastus lateralis
c. Sartorius
d. Gracialis
e. Semimembranosus

Midterm review #2

Anatomy of the Nervous System
Part A:

- Connected as a single unit, but anatomically divided into 2 parts:

  The central nervous system – brain and spinal cord; integrating and command centre

  The peripheral Nervous system- cranial and spinal nerves; communication between CNS and all parts of body

  Sensory division: somatic and visceral fibers; from receptors to CNS

  Motor division: motor nerve fibers from CNS to effectors
  Two divisions:
  - ***somatic NS:*** voluntary; from CNS to skeletal muscle

  - ***Autonomic NS*:** involuntary; (visceral motor); from CNS to cardiac muscle, smooth muscle, glands:

    Sympathetic division: "fight or flight"

    Parasympathetic division: conserve energy at rest

Histology of Nervous Tissue

- Very cellular; minimal extracellular matrix
- 2 principle types of cells: *Neurons and supporting cells.*

6 types of supporting cells:

CNS:

1) **astrocytes:** star-shaped, most abundant; anchor neurons close to capillaries
   - roles in nutrient exchange, antigen presentation, control of environment

2) **microglia:** Protective; touch neurons to monitor well-being; can transform into macrophages

3) **Ependymal Cells:** Line cavities of brain and spinal cord as barrier between CSF and fluid bathing cells of CNS; cilia circulate CSF

4) **Oligodendrocytes: "**few branches"; provide myelin sheaths to CNS neurons

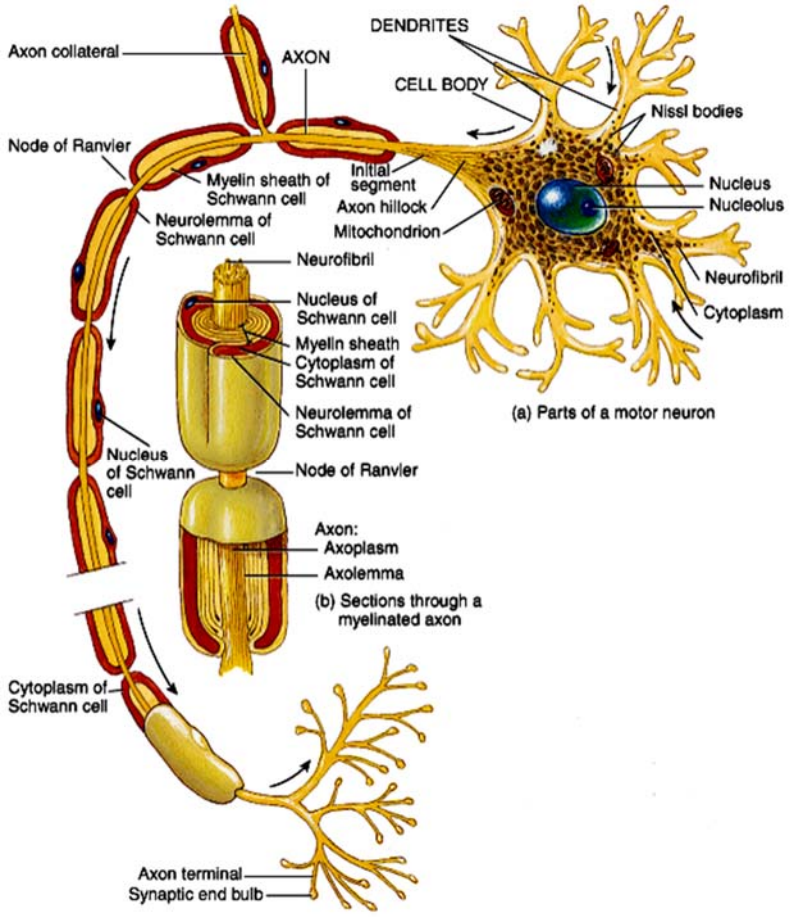
PNS:

5) **Satellite cells**: surround neuron cell bodies in ganglia – influence chemical environment of these neurons

6) **Schwann cells:** form myelin sheaths around larger neurons in PNS; vital to peripheral nerve cell regeneration

Neurons:

- Extreme longevity, amitotic, high MR
- Know: cell body, dendrites, axon, axon hillock, myelin sheath, node of Ranvier, terminal branches, axonal terminals



Functional classifications of Neurons

1. according to direction nerve impulse travels wrt CNS
2. sensory, motor and association neurons

Sensory: Toward CNS; primary, secondary, tertiary

- except bipolar neurons in some special sense organs, virt all primary sensory neurons are unipolar and cell bodies located in ganglia outside CNS
- higher order sensory neurons all multipolar and reside entirely within CNS – conduction to higher brain centres for interpretation.

Motor: away from CNS to effector organs like muscle and glands; multipolar; most cells bodies reside in CNS

Association (interneurons): Between sensory and motor neurons – integration of info; multipolar; most entirely within CNS; 99% of neurons of the body

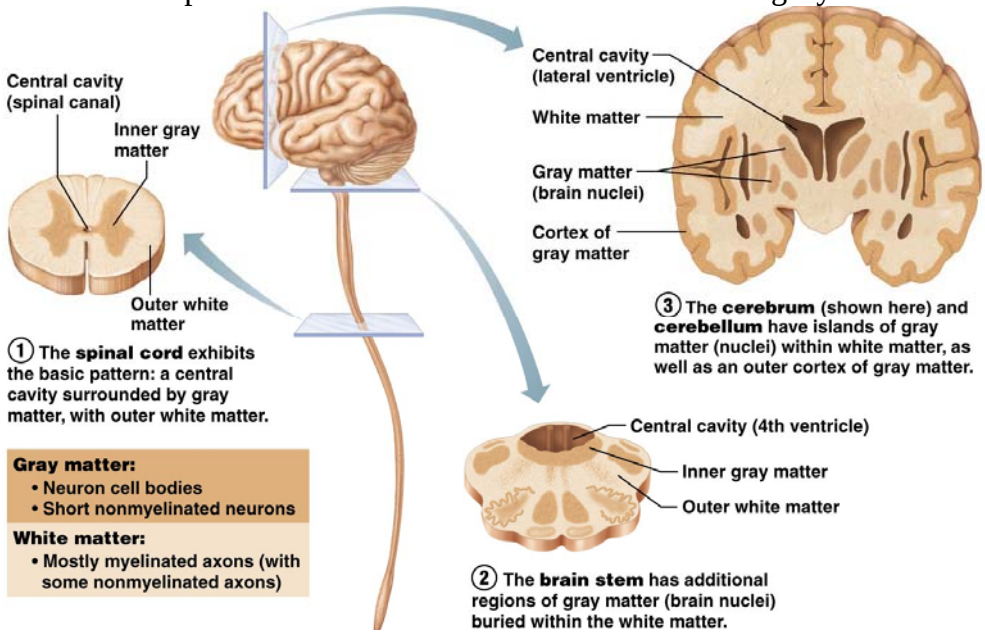
The Brain:

- complexity of wiring rather than size is what matters

Subdivisions:

cerebral hemispheres
diencephalon (thalamus, hypothalamus, epithalamus)
brain stem (midbrain, pons, medulla)
cerebellum

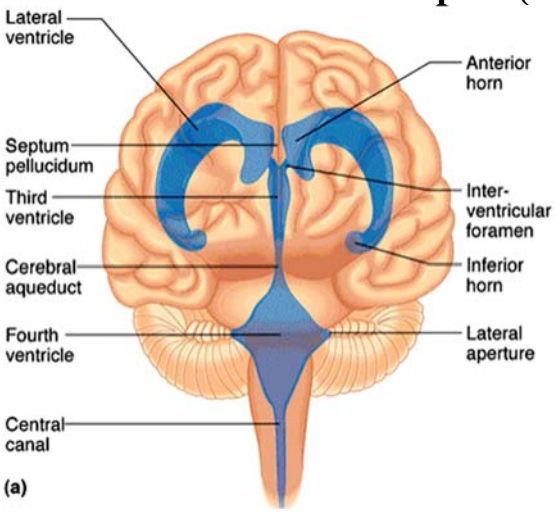
- Spinal cord has central cavity surrounded by gray matter () & white matter ()
- Brain has same design, but with additional regions of gray matter; cerebral hemispheres & cerebellum have outer "bark" of gray matter



Ventricles of the Brain:

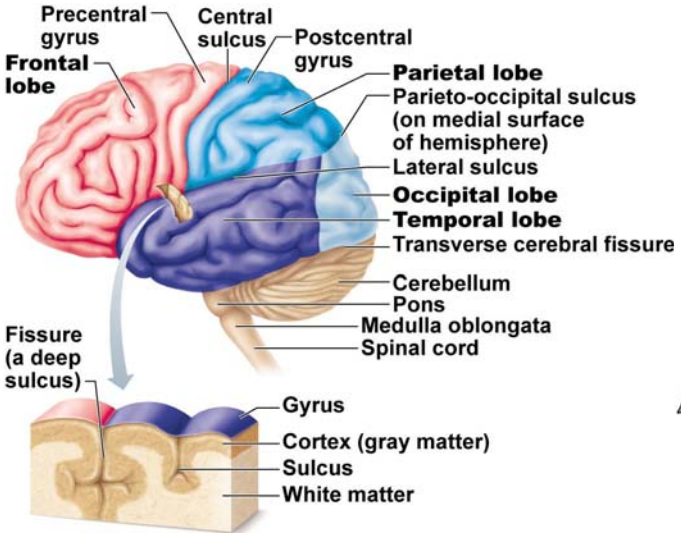
- Continuous with one another and with central cavity of spinal cord; filled with CSF and lined by Ependymal cells

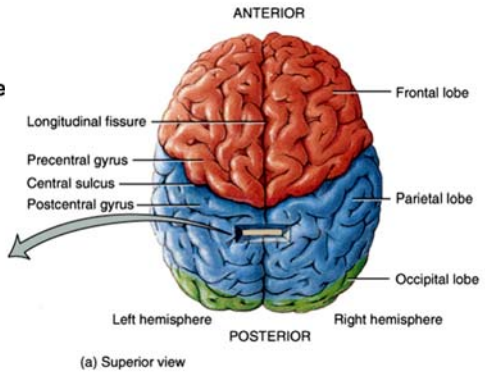
(i) Paired **lateral ventricles** separated by narrow **septum pellucidum**
(ii) Each communicates with narrow **3rd ventricle** in diencephalon via **interventricular foramen**
(iii) 3rd ventricle to **4th ventricle** (dorsal to pons) via **cerebral aqueduct**
(iv) 4th ventricle continuous with central canal
(v) 3 **apertures** (paired **lateral apertures** & **median aperture**) connect ventricles to **subarachnoid space** (surrounds brain)

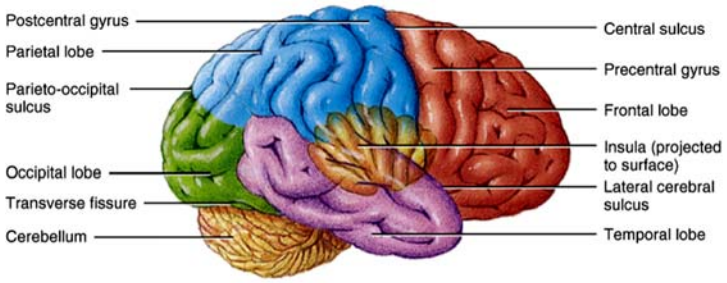


The cerebral hemispheres:

- superior; ~ 83% of brain mass
- **gyri** separated by **sulci**; anatomical landmarks
- **longitudinal fissure; transverse cerebral fissure**
- **Lobes**: frontal, parietal, occipital, temporal, insular
  central sulcus: precentral/postcentral gyrus parieto-occipital sulcus, lateral sulcus







(b) Right lateral view

Cerebral Cortex:

- Allows us to perceive, communicate, remember, understand, appreciate, initiate voluntary movements – **Conscious behaviour**
- Cell bodies, dendrites and unmyelinated axons; only 2-4 mm thick, but many convolutions triple surface area
- **Brodmann** areas: numbered according to subtle differences in thickness, structure of contained neurons; some areas link with particular functions; other functions) memory and language) have overlapping domains; more diffusely organized

(i) 3 functional areas: **motor**, **sensory** & **association**
(ii) each hemisphere handles sensory & motor functions of opposite side of body
(iii) largely symmetrical, but not 100% equal in function (lateralization)
(iv) no functional area of cortex acts alone; all conscious behaviour involves entire cortex in some way

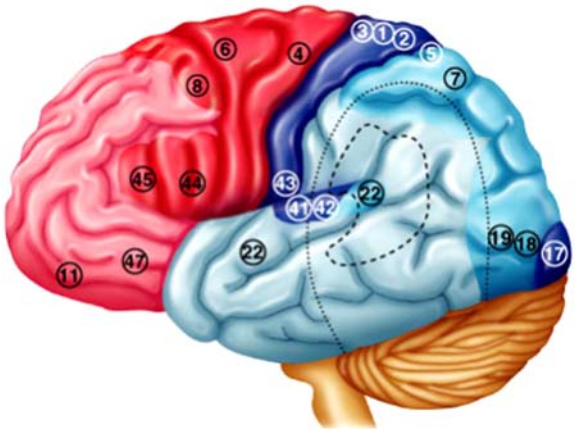
Motor Areas:

- posterior part of frontal lobes: primary motor cortex, premotor cortex, Broca's area and frontal eye field

1) **Primary motor cortex:** - precentral gyrus of frontal lobe of each hemisphere; **pyramidal cells** allow control of skeletal muscles; axons project to spinal cord as pyramidal/corticospinal tracts

- entire body represented spatially in primary motor cortex of each hemisphere – **somatotopy**
- which areas require most precise motor control?
- motor innervation is **contralateral**
- control not as simple as in diagram – some neurons send impulses to more than one muscle – think about coordinated movement of arm
- no overlap between muscles involved in unrelated movements

stroke: damage to area of right hemisphere paralyzes body muscles on left – only voluntary movement lost; reflex contraction still possible



17, 41,42,43

2) **Premotor cortex:**

- anterior to precentral gyrus
- helps plan movements by selecting and sequencing basic motor movements into more complex tasks (e.g. playing musical instrument, keyboarding)
- coordinates movement of several muscle groups simultaneously/sequentially by activating motor cortex
- can control voluntary actions that depend on sensory feedback – e.g. feeling for light switch in a dark room

what if there is damage to the area of premotor cortex regulating keyboarding?

3) **Broca's area:**

- overlaps Brodmann areas 44 & 45
- present in one hemisphere only – usually the left
- originally thought to be only a motor speech area
- newer studies: Broca's area is active when we prepare to speak and plan voluntary activities other than speech

3)**Frontal eye field:**

- Brodmann area 8; controls voluntary movements of the eyes

Sensory Areas:

1) **Primary somatosensory cortex:**

- in postcentral gyrus of parietal lobe (Brodmann areas (BA) 1-3)
- receives info from somatic sensory receptors (skin) & proprioreceptors (skeletal muscle)
- **spatial discrimination**

2) **Somatosensory association cortex:**
   - posterior to PSC (BA 5-7) - many connections with it
   - integrate/analyze somatic inputs (temp, pressure, ..) – interpret wrt size, texture, relationship of parts based on prior experience

3) **Visual areas:**
   - **primary visual cortex** Ø posterior tip occipital lobe
     - largest cortical area; contains map of visual space on retina (opposite sides)
   - **visual association area** Ø surrounds PVC
     - interprets visual image based on prior experience – eg: recognition of a face, letter (also movement!)

What is the result of damage to the primary visual cortex? To the visual association area?

4) **Auditory areas:**

- **primary auditory cortex** (~ BA 42**)** sound evaluated wrt pitch, rhythm, loudness
- **auditory association area** (~ BA 22) interpretation based on memory – speech, words, music, thunder, etc.

5) **Vestibular (equilibrium) cortex:**

- awareness of balance – posterior part of insula & adjacent parietal cortex

6) Olfactory cortex:

- medial aspects of temporal lobes = **uncus**
- small in humans; most of surrounding tissue now forms limbic system (emotions, memory)
- conscious awareness of different odors

7) **Gustatory cortex:**
- insula; ~ BA 43 and a bit anterior

8) Visceral sensory area:

- posterior to gustatory cortex
- *what sort of information?*

Visual Agnosia: the inability to recognize/understand things that you see

Multimodal Association Areas:

1) **Anterior Association Area (Prefrontal Cortex):**

- intellect, complex learning (cognition) & personality (working memory is here)
- abstract ideas, judgment, reasoning, persistence, planning, concern, conscience

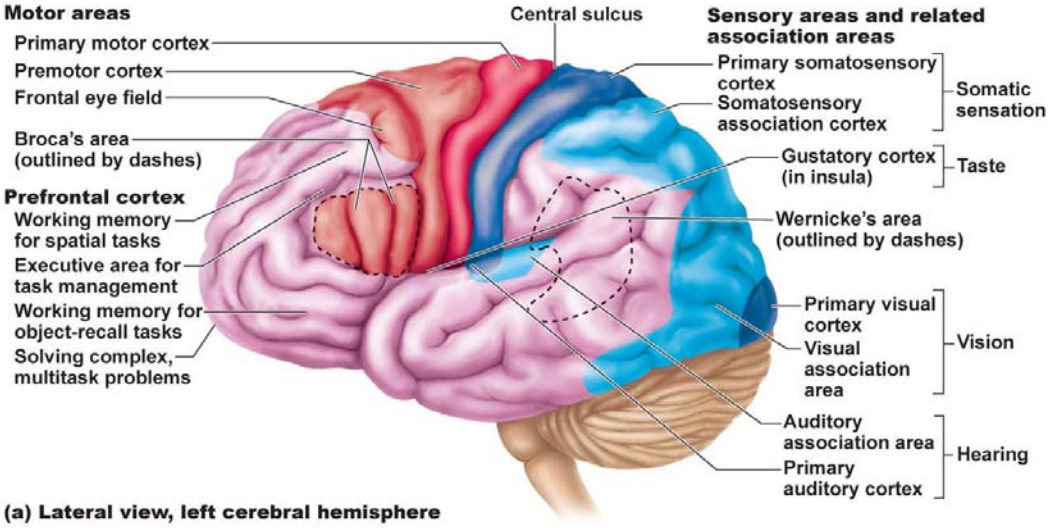
- matures slowly; dependent on feedback from social environment
- losely linked to limbic system; involved in mood

2) **Posterior Association area:** parts of temporal, parietal & occipital lobes

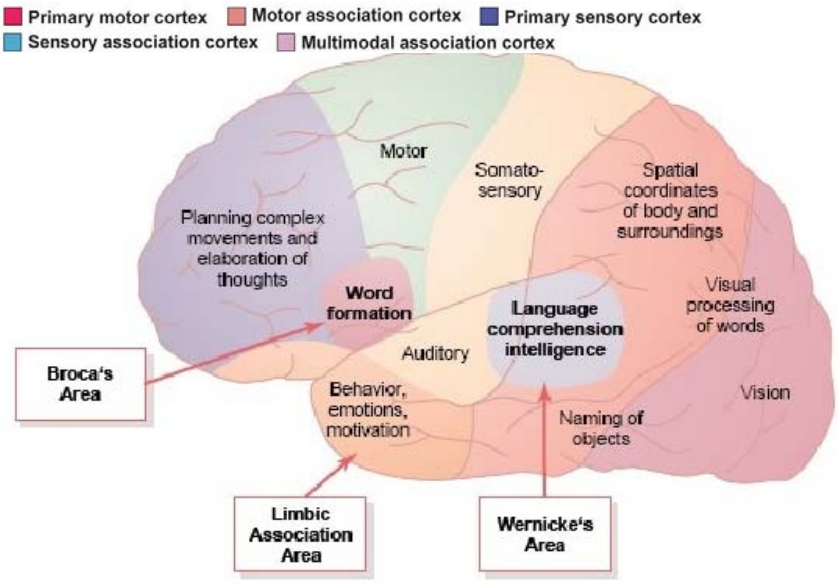
- input from all sensory association areas – storage of complex memories linked to sensation – put info together to understand what see, feel etc
- localization of self and surroundings in space
- recognition of patterns, faces
- some parts for understanding written & spoken language (Wernicke's area)

3) **Limbic Association area:**

- provides emotional impact – e.g. be aware of the danger associated with a particular situation and to remember it, etc.



(a) Lateral view, left cerebral hemisphere

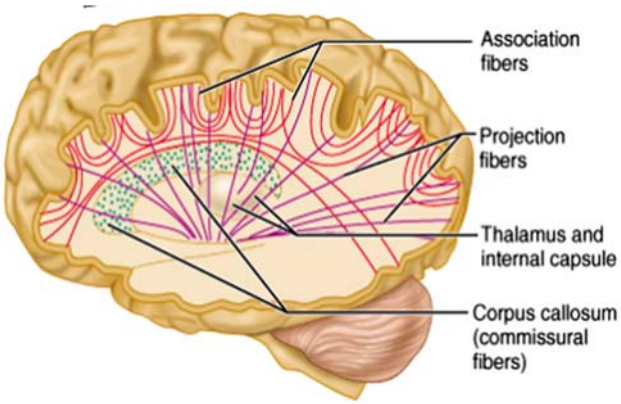


Lateralization of Cortical Functioning

- each cerebral hemisphere has some abilities not completely shared by other hemisphere
- cerebral dominance = hemisphere that is dominant for **language**
- 90% of people: **left** hemisphere dominant for language, math, logic
- other hemisphere dominates for visual-spatial skills, intuition, emotion, appreciation of art & music – creative side, better at recognizing faces
- most individuals with **left** cerebral dominance are **right-handed**
- in remaining 10%, roles reversed or shared equally

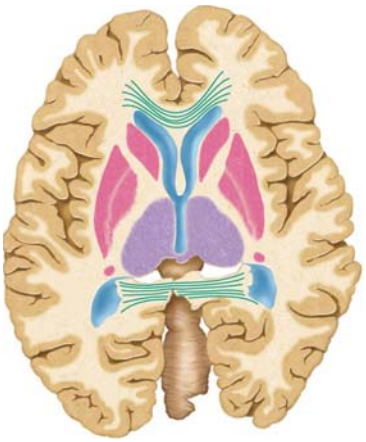
Cerebral white matter:

- communication between cerebral areas, between cortex & lower CNS centres
- **commissural fibers:** connect corresponding areas **between** the 2 hemispheres – largest is **corpus callosum**
- **association fibers:** connections **within** a hemisphere (connect gyri, lobes)
- **projection fibers:** to or from cortex and **rest** of nervous system; these ones run vertically



Basal Nuclei:

- **caudate nucleus +[putamen & globus pallidus = lentiform nucleus]**
- inputs from entire cerebral cortex, other subcortical nuclei & each other
- project to premotor & prefrontal cortices to influence muscle movements directed by primary motor cortex – have no direct access to motor pathways
- precise roles elusive (difficult to access; some roles overlap with cerebellum) – roles in starting, stopping, monitoring intensity of movements executed by cortex, especially if slow, sustained, stereotyped; also inhibit antagonistic and/or unnecessary actions
- disorders can result in too much movement (e.g. Huntington's disease) or too little movement (Parkinson's disease)



Huntington's Disease:

- hereditary disorder in which mutant *huntingtin* protein accumulates in brain cells → degeneration of the basal nuclei and eventually of the cortex
- as caudate deteriorates, connections to frontal lobe become lost so that the affected individual in unable to control feelings, thoughts or movements

Parkinson's disease:

- degeneration of dopamine-releasing neurons of **substantia nigra** (midbrain)
- causes basal nuclei usually targeted by substantia nigra to become overactive → persistent tremor at rest; muscles become rigid leading to difficulty walking, loss of facial expression, difficulty writing, etc.

The Diencephalon:

- **thalamus, hypothalamus, epithalamus –** enclose the **3rd ventricle**

Thalamus: 80%; bilateral masses of gray matter held together by midline commissure called the **intermediate mass**

- consists of many different nuclei, named for their position in thalamus – afferent impulses from all senses & all parts of body converge on thalamus
- sorting & editing of information; group like impulses to send to appropriate region of cortex – crude awareness of sensation at level of thalamus
- also input pertaining to emotions & viscera from hypothalamus
- key roles in mediating sensation, motor activities, cortical arousal, learning, memory = **"gateway to cerebral cortex"**

Hypothalamus: "below" thalamus

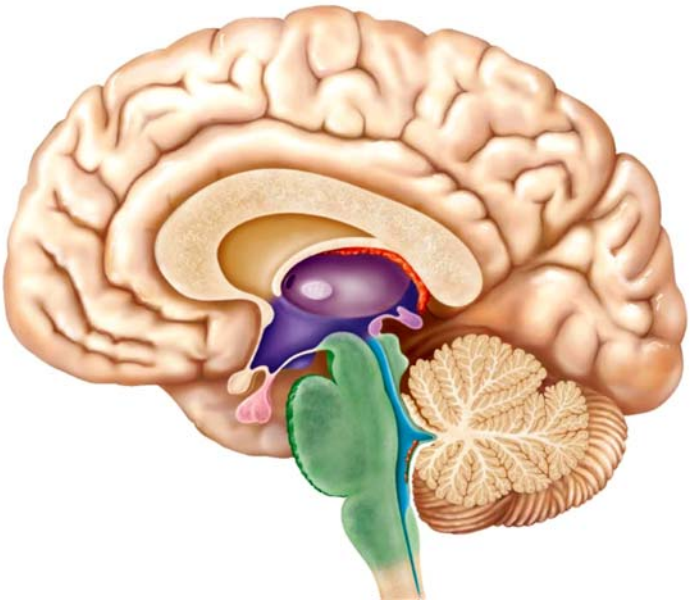
(i) **Autonomic control centre:** centres for bp, heart, GI, respiration, etc
(ii) **Centre for emotional response & behaviour:** heart of limbic system
(iii) **Body temperature regulation:**
(iv) **Regulation of food intake:** hunger, satiety

(v) **Regulation of water balance & thirst:** release of ADH; thirst centre
(vi) **Regulation of sleep-awake cycles:** suprachiasmatic nucleus
(vii) **Control of endocrine system:** releasing factors plus 2 nuclei (supraoptic & paraventricular) produce ADH & oxytocin

Hypothalamic disturbances: cause disorders in body homeostasis such as body wasting, obesity, sleep disturbances, dehydration, emotional imbalances

Epithalamus: most dorsal part of diencephalon & forms roof of 3rd ventricle; **pineal gland** (melatonin) extends from its dorsal border

- **choroid plexus** (CSF-forming structure) also part of epithalamus



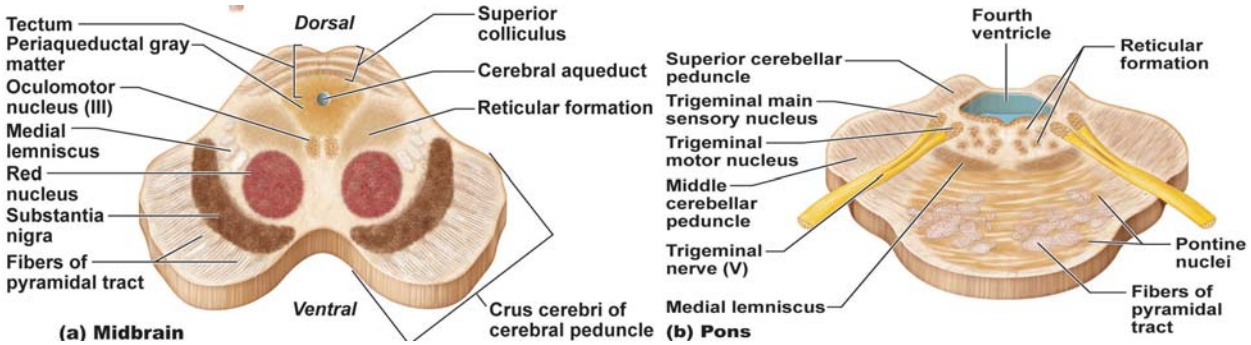
The brain Stem:

- consists of midbrain, pons, medulla oblongata

(i) rigidly programmed, automatic behaviours necessary to survival
(ii) pathway between higher & lower neural centres
(iii) associated with 10 pairs of cranial nerves

Midbrain:

- 2 cerebral peduncles that contain large pyramidal (corticospinal) motor tracts
- hollow cerebral aqueduct runs through midbrain
- periaqueductal gray matter involved in pain suppression
- ***Corpora quadrigemina:*** superior colliculi are visual reflex centres; inferior colliculi are part of auditory relay (*also startle reflex*)
- **substantia nigra**: band-like nucleus; high melanin content (precursor Ø dopamine); linked to basal nuclei of cerebral hemispheres (Parkinson's disease)
- **red nucleus**: rich vascular supply, iron pigment in neuron cell bodies; relay nuclei for descending pathways influencing limb flexion
- also some nuclei associated with reticular formation



Pons: dorsally, forms part of anterior wall of 4th ventricle

- primarily conduction tracts ("bridge"); some run longitudinally; others oriented transversely to communicate with cerebellum
- **cranial nerves V** (trigeminal), **VI** (abducens) & **VII** facial; other pons nuclei are part of reticular formation and others are involved in respiration)
- Medulla oblongata: from pons to spinal cord

pyramids, decussation (*significance of this?)*

- inferior **olivary nuclei**: relay sensory info re muscles & joints to cerebellum
- **cranial nerves XII** (hypoglossal), **IX** (glossopharyngeal), **X** (vagus), **XI** (accessory)
- vestibulocochlear nerve fibers (**VIII**) synapse with cochlear nuclei (***functions?***)

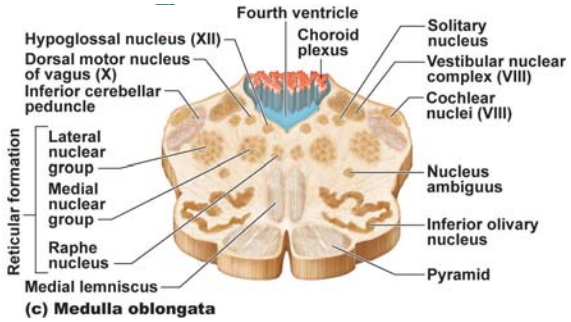
Medulla oblongata: crucial role as autonomic reflex centre for homeostasis

(i) **Cardiovascular centre:** cardiac & vasomotor centres

(ii) **Respiratory centres:** rate & depth of breathing

(iii) **Other centres:** eg: vomiting, hiccupping, swallowing coughing, sneezing

- overlap with hypothalamus: hypothalamus controls most visceral functions by relaying instructions through medullary centres which carry them out



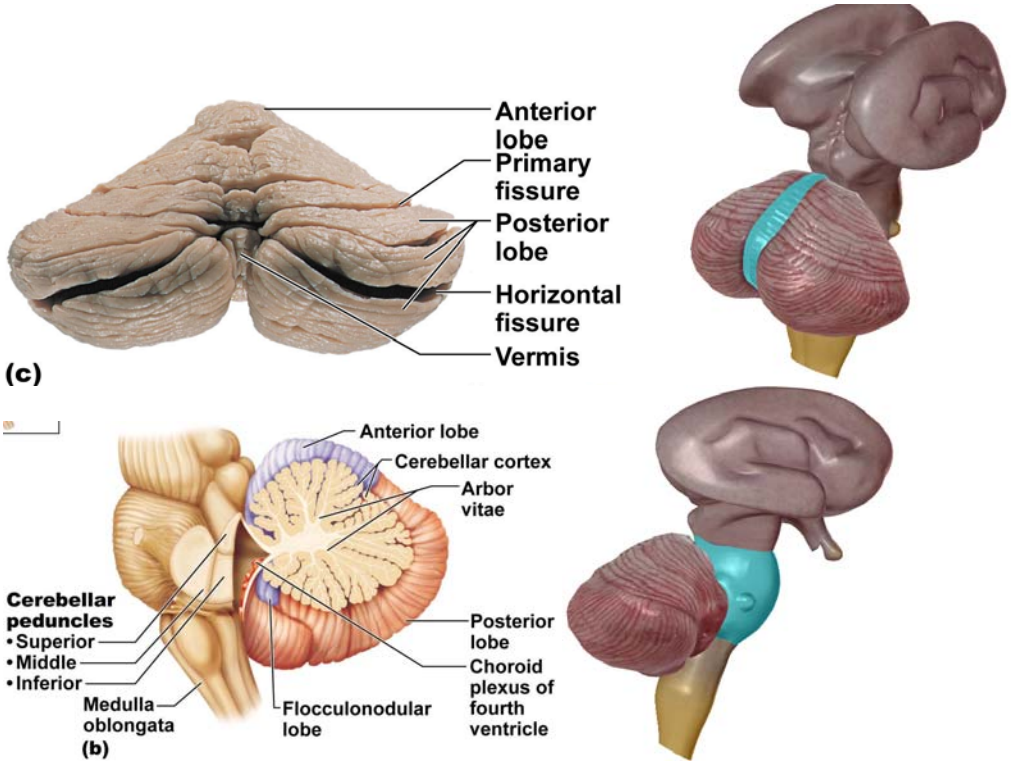
The cerebellum:

- processes inputs from cerebral motor cortex, brainstem nuclei & sensory receptors Ø timing & patterns of skeletal muscle contraction for smooth, daily movements – eg: driving, typing, playing a musical instrument, etc (not under conscious control)
- bilaterally symmetrical; connected by **vermis**; fine transverse fissures called **folia**; each hemisphere divided into 3 lobes: anterior, posterior, flocculonodular
- anterior & posterior lobes have overlapping sensory & motor maps of body

(medial: trunk & girdle

intermediate: distal limbs, skilled movements
lateral: input from association areas of cortex (esp. planning movements))

- flocculonodular lobes – input from equilibrium sensors: balance, some eye movements



<u>*Cerebellar Peduncles*</u>

- connect cerebellum to brain stem
- virtually all fibers entering & leaving cerebellum are **ipsilateral** (unlike cerebral cortex)

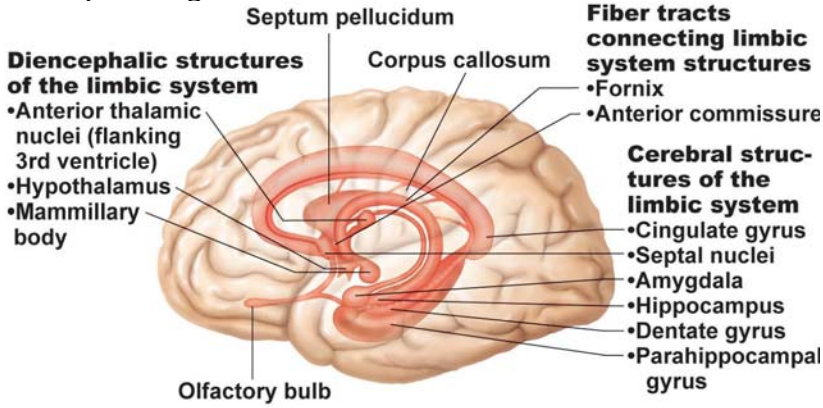
Superior: connect cerebellum & midbrain; fibers originate from neurons in deep cerebellar nuclei & project to cerebral motor cortex via thalamus
Middle: connect pons & cerebellum; one-way communication from pons to cerebellar neurons (informs cerebellum of voluntary motor activities initiated by motor cortex)
Inferior: connect cerebellum & medulla; afferent tracts - sensory info to cerebellum from muscle proprioceptors & vestibular nuclei of brain stem (equilibrium & balance

Functional Brain Systems:

- networks of neurons that work together but span large distances within brain

Limbic system: (limbus = ring)

- • medial aspect of each cerebral hemisphere & diencephalon
- • emotional-visceral brain – esp: **amygdala** (anger, fear, assess danger), **hippocampus** (emotions & memory), **anterior cingulate gyrus** (gestures, resolve conflicts when frustrated)
- • link between odours, memories & emotions
- • link for psychosomatic illnesses: stress & effects on bp, GI tract, heart
- • links with cortex:(i) aware of emotions, (ii) react emotionally if consciously understand; also: emotions can override logic; reason can stop us from expressing emotions



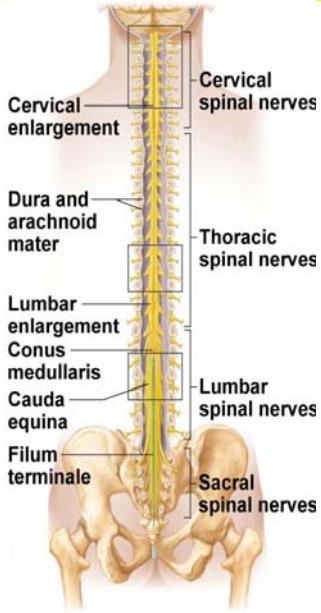
- ***Reticular formation:***
- • central core of medulla oblongata, pons, midbrain; neurons project to hypothalamus, thalamus, cortex, cerebellum, spinal cord
- • reticular activating system (RAS):
- (i) maintains arousal of brain;
- (ii) filter for incoming signals (RAS & cerebral cortex disregard ~99% of all sensory stimuli)

Part B:

The Spinal Cord:

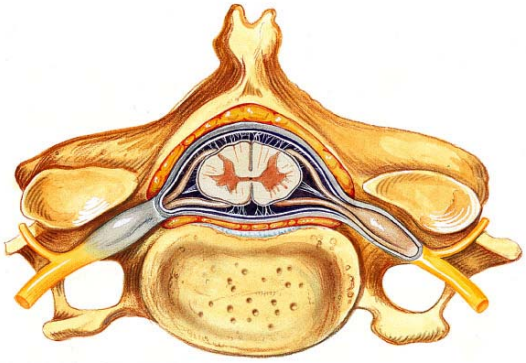
- from foramen magnum to 1st/2nd lumbar vertebra; below this is ideal spot for lumbar puncture
  (i) 2-way conduction system
  (ii) major reflex centre
  (iii) initiates complex patterns of motor activity
- 31 pairs of spinal nerves exit via???
- cervical & lumbar enlargements for ???
- spinal cord held in place by:
  (i) denticulate ligaments: pia mater shelving
  (ii) filium terminale: pia mater-covered conus extension

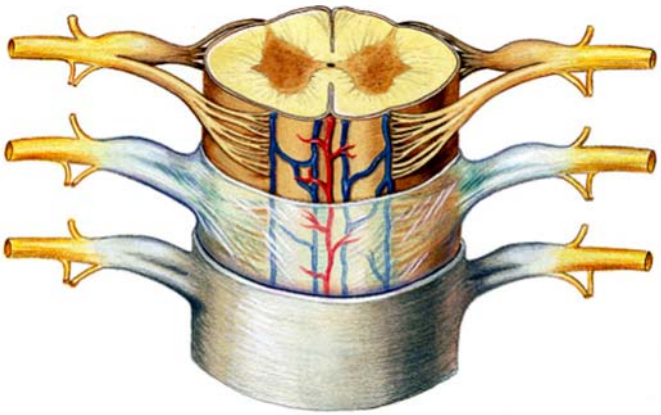
What is the cauda equina?



Gray Matter & Spinal Roots:

- gray matter as for other regions of CNS – but all neurons multipolar
- organized like butterfly wings: paired anterior (ventral) & posterior (dorsal) horns connected by gray commissure *(where is the central canal?)*
- small lateral horns associated with thoracic & superior lumbar regions of cord(lacks myelin)





Anterior horns:

- nerve cell bodies of **somatic motor neurons** – axons ***exit*** via ventral roots
- largest at levels of cervical & lumbar enlargements – *why??*

Lateral horns:

- para**sympathetic motor neurons** to visceral organs; also ***exit*** via ventral roots

Dorsal root ganglion:

- afferent fibers from peripheral **sensory** receptors form dorsal roots; dorsal root ganglia house cell bodies of associated sensory neurons – their axons ***enter*** cord to:
  (i) travel to higher cord/brain centres
  (ii) synapse with interneurons in posterior horns at level they enter
- spinal nerve = fused dorsal & ventral roots

What is poliomyelitis??

White Matter:

- myelinated & unmyelinated fibers – communication between different parts of cord & between cord & brain
- scending, descending & transverse (commissural) tracts – direction of fibers

Some general properties of spinal tracts:

(i) Most pathways cross over from one side of CNS to other (decussate)
(ii) Most consist of a chain of 2 or 3 neurons
(iii) Most exhibit **somatotopy**:
(iv) All pathways & tracts are paired

Protection of the CNS

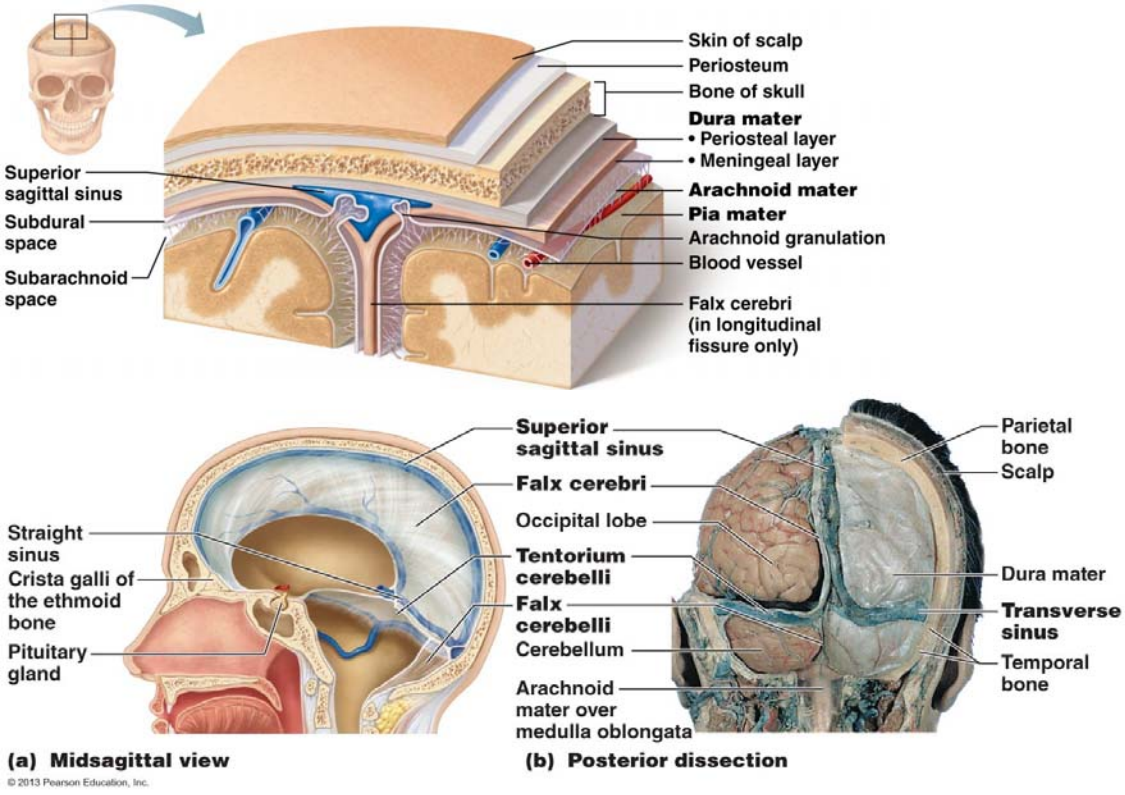
(i) Bones
(ii) Meninges
(iii) Cerebrospinal fluid
(iv) Blood-brain barrier

Meninges (meninx)

• 3 CT membranes that: (a) cover & protect CNS
(b) protect blood vessels & enclose venous sinuses
(c) contain cerebrospinal fluid
(d) form partitions within skull

Dura mater:

- tough; 2 layers around **brain**: outer **periosteal** layer & inner **meningeal** layer
- spinal cord has **only** meningeal layer
- around brain, 2 layers fused except where enclose **dural sinuses**
- **dural septa** to partition and anchor: falx cerebri, falx cerebelli, tentorium cerebelli



Arachnoid mater:

- loose covering separated from dura mater by **subdural space**
- **subarachnoid space** between arachnoid mater & pia mater – filled with CSF & contains largest blood vessels serving brain
- *role of arachnoid villi (granulations) in accumulation of CSF*

Pia mater:

• delicate CT + tiny blood vessels – clings tightly to brain, follows convolutions

What is meningitis? What is encephalitis?

Cerebrospinal Fluid

- liquid cushion to give buoyancy to CNS tissue; also protective, nutritive roles
- similar to plasma but less ptn, more vit C, Na^+, Cl^-, Mg^{++} & H^+, less Ca^{++}, K^+
- **choroid plexuses** in roof of ventricles form CSF: clusters of permeable capillaries enclosed by layer of ependymal cells (role of these cells?)
- total CSF = 150 ml; replaced ~ every 8 hours; choroid plexuses also clean CSF

What is hydrocephalus?

Blood-Brain Barrier

- why?? some hormones also act at NTs; ions can increase rate of neuronal firing
- composed of 3 layers:

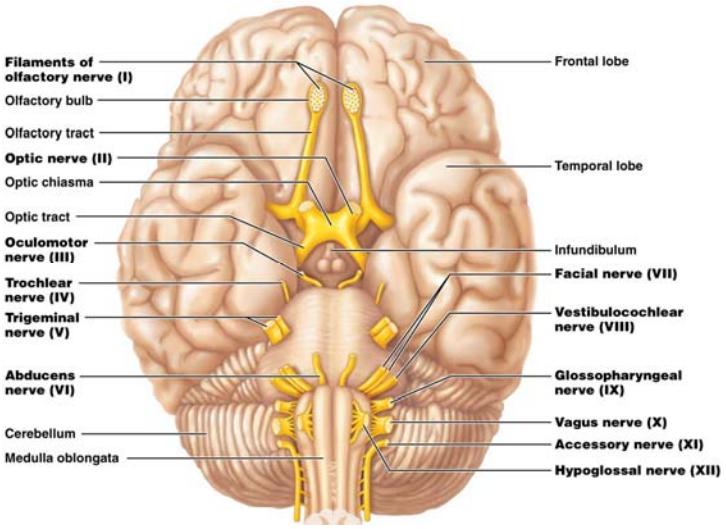
(i) continuous epithelium of capillary wall (sealed by tight junctions)
(ii) thick basal lamina surrounding external face of capillary
(iii) bulbous feet of astrocytes

- *what gets in?* glucose, essential amino acids, some electrolytes; also fats, fatty acids, oxygen, carbon dioxide, any other fat-soluble molecules
- not completely uniform:

(i) capillaries of choroid plexuses porous but ependymal cells linked by tight junctions
(ii) very permeable near vomiting centre, hypothalamus; incomplete in newborns

Macroscopic Anatomy of the PNS

- 12 pairs of **cranial nerves** pass through various foramina of the skull
- first two pairs attach to forebrain; rest originate from brain stem
- all except vagus nerve serve only head & neck structures
- except those for special sense organs, most cranial nerves are mixed nerves
- "**O**n **o**ccasion, **o**ur **t**rusty **t**ruck **a**cts **f**unny – **v**ery **g**ood **v**ehicle **a**ny**h**ow"



Olfactory Nerves:

- from nasal mucosa to olfactory bulbs
- fibers of olfactory bulb neurons extend as olfactory tract to primary olfactory cortex
- afferent sensory fibers for smell

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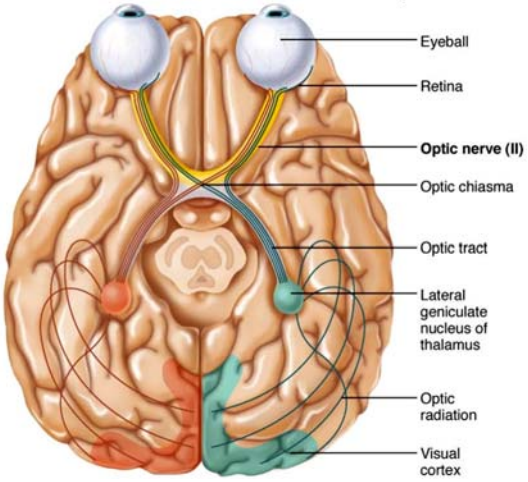
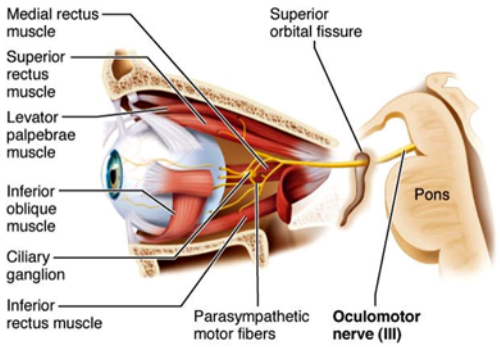


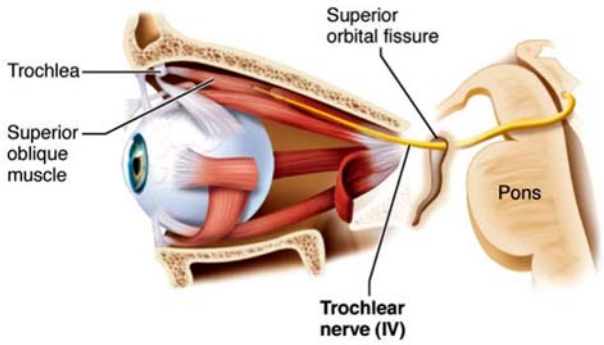
III. Oculomotor Nerves:

- "eye mover"; supplies 4/6 extrinsic muscles of eyeball
- fibers from ventral midbrain (near pons) through bony orbit to eye
- mixed motor nerves to extrinsic eye muscles, but also paraymp fibers to iris, lens & (sensory afferents from extrinsic eye muscles to midbrain)



IV. Trochlear Nerves (pulley):

- innervates ext eye muscle that loops through pulley-shaped ligament in orbit
- motor fibers from dorsal midbrain to superior oblique eye muscle

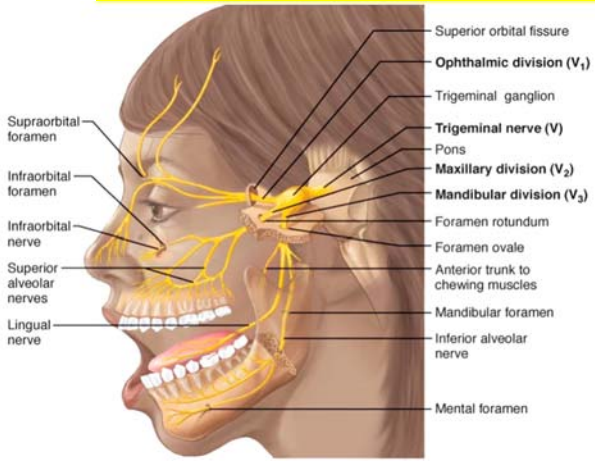


V. Trigeminal Nerves:

- largest of cranial nerves; 3 branches: sensory fibers to face & motor fibers for chewing (mandibular division)

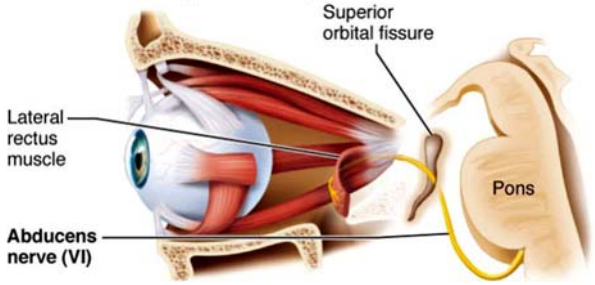
Opthalmic division
Maxillary division
Mandibular division

- what nerves are useful to the dentist??



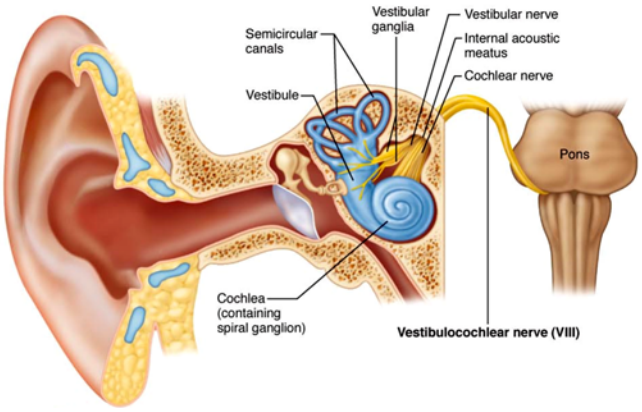
VI. Abducens Nerves:

- controls extrinsic eye muscle that **abducts** eyeball
- mixed nerve; primarily motor to lateral rectus muscle



Vestibulocochlear Nerves:

- sensory nerve for hearing & balance
- cochlear (hearing) & vestibular (balance) branches that fuse

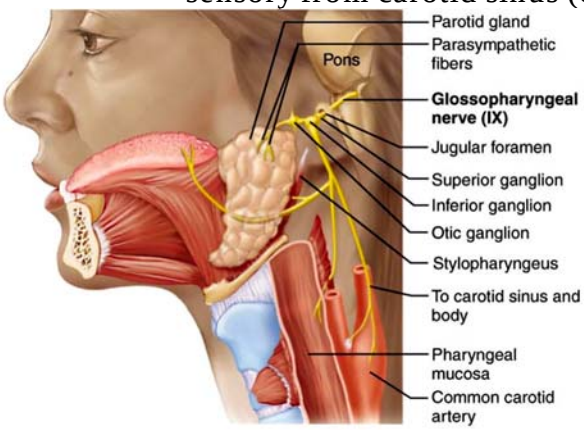


VII. Facial Nerves:

- large nerve; facial expression
- from pons to lateral face
- mixed nerve (primarily **motor**):
- also parasympathetic to lacrimal glands & sensory from anterior 2/3 of tongue

IX. Glossopharyngeal Nerves

- "tongue & pharynx"; mixed nerves to & from medulla
  - swallowing & gag reflex; also parasympathetic fibers to parotid glands
  - sensory (taste, touch, pressure, pain) from pharynx, posterior tongue
  - sensory from carotid sinus (chemo, bp)

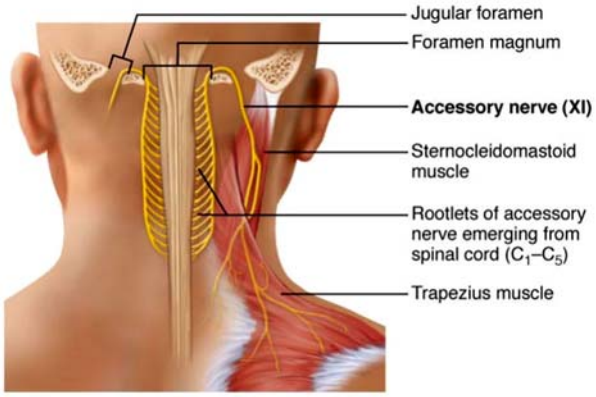


X. Vagus Nerve

- "wanderer"; only cranial nerve to extend beyond head-neck region
- mixed nerves; to & from medulla
- parasympathetic motor to heart, lungs, abdominal viscera; also somatic to pharynx & larynx
- sensory from carotid sinus; also for taste, from proprioceptors in muscles of pharynx, larynx

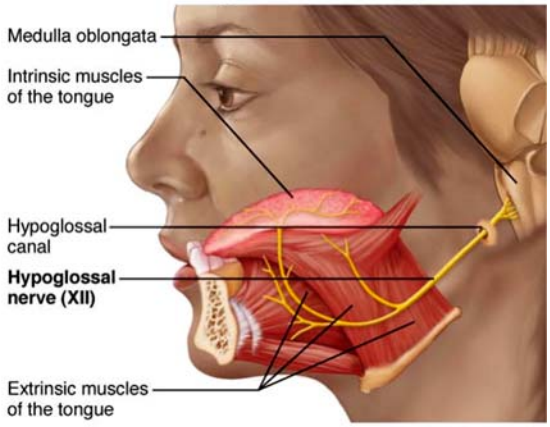
XI. Accessory Nerves:

- accessory part of vagus nerve; formed by junction of a cranial root with a spinal root
- mixed nerves, but **mostly motor** to pharynx, larynx, soft palate; spinal root supplies motor fibers to trapezium & sternocleidomastoid muscles (head & neck movement)



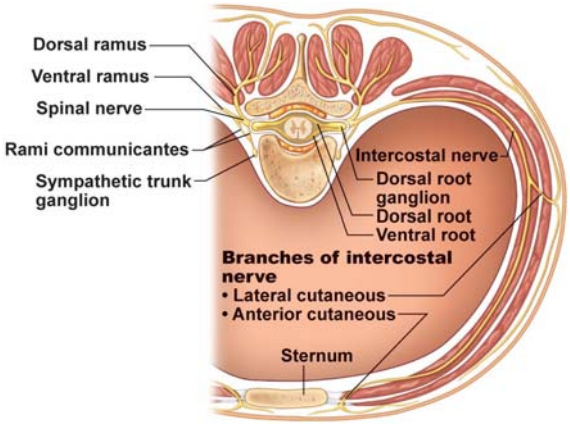
XII. Hypoglossal Nerves:

"beneath tongue"; mixed, **primarily motor** to tongue for mixing, swallowing and speech



Spinal Nerves:

- 31 pairs, all are mixed nerves; named according to point of issue
- **C_1-C_8; T_1-T_{12}; L_1-L_5; S_1-S_5; C_0**
- almost immediately after exit from foramen, each spinal nerve branches into a **dorsal ramus** & a **ventral ramus**
- rami carry both **sensory** & **motor** fibers



- except for T_2-T_{12}, all **ventral rami** branch & make lateral connections just outside spinal cord Ø **nerve plexuses**
- fibers from different rami criss-cross in plexuses:

(i) Each branch of a plexus contains fibers from several different spinal nerves
(ii) Fibers from each ventral ramus travel to body periphery via several different routes

Result: each muscle in a limb receives nerve supply from more than one spinal nerve Ø *damage to one spinal segment or root cannot completely paralyze any limb muscle*

A. Cervical Plexus & the Neck:

- **C_1-C_4**; deep in neck under sternocleidomastoid muscle
- most branches are **cutaneous nerves**
- single most important nerve is **phrenic nerve**: both motor & sensory fibers to diaphragm

B. Brachial Plexus & Upper Limb:

- C_5-C_8 & most of T_1; partly neck, partly axilla – nerves supplying upper limbs

(i) **Axillary nerve** to shoulder (esp. deltoid muscle)
(ii) **Musculocutaneous nerve** – to biceps brachii & brachialis to flex arm
(ii) **Median nerve** – flexor muscles in anterior forearm & into palm Ø pronate forearm, flex wrist/fingers, oppose thumb
iv) **Ulnar nerve** – medial to elbow ("funny bone") & follows ulna along medial forearm Ø wrist & finger flexion and adduction & abduction of medial fingers
(v) **Radial nerve** – largest – to humerus & dorsal part of hand Ø elbow extension, supination of forearm, extension of wrist & fingers, abduction of thumb

C. The Back:

- **dorsal rami;** follows segmented plan

D. Anterolateral Thorax:

- T_1-T_{12}; simple & segmented as for innervation of back
- **intercostal nerves**: to intercostal muscles; anterolateral thorax

E Lumbar Plexus:

- L_1-L_4; branches to abdominal wall muscles, also anterior & medial thigh

(i) **Femoral nerve**: anterior thigh muscles Ø thigh flexors & knee extensors
(ii) **Obturator nerve**: medial thigh Ø adductor muscles

F. Sacral Plexus:

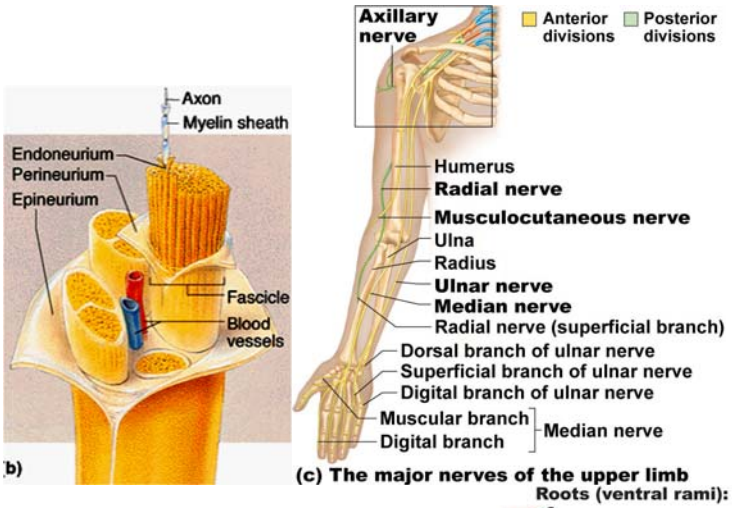
- L_4-S_4; immediately caudal to lumbar plexus – branches to buttocks, lower limbs, pelvis

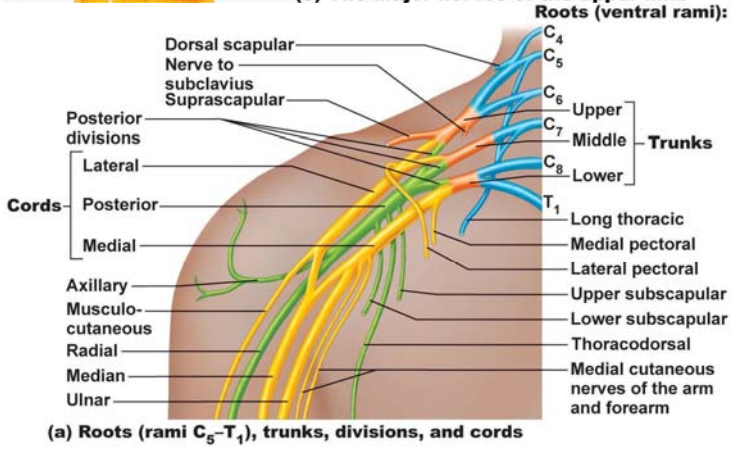
(i) **Sciatic nerve:** posterior thigh – then diverges into (ii) & (iii):
(ii) **Tibial nerve:** behind knee joint to posterior calf & sole of foot
(iii) **Common fibular nerve:** to knee joint, calf (anterolateral) & dorsum of foot
(iv) **Superior & inferior gluteal nerves:** to buttocks
(v) **Pudendal nerve:** muscles & skin of perineum (e.g. erection, voluntary urination)

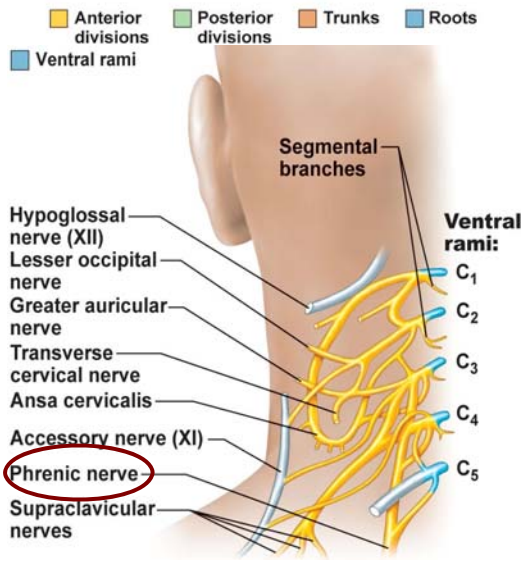
Dermatome: area of skin innervated by cutaneous branches of a single spinal nerve

Endoneurium: loose CT that encloses nerve fiber + associated myelin or neurilemma sheath
Perineurium: coarser CT wrapping around a group of fibers (fascicle)
Epineurium: tough fibrous sheath around all the fascicles to make a nerve

What do I mean when I say that most nerves are mixed nerves?


Axillary nerve
Anterior divisions
Posterior divisions
Axon
Myelin sheath
Endoneurium
Perineurium
Epineurium
Fascicle
Blood vessels
b)
Humerus
Radial nerve
Musculocutaneous nerve
Ulna
Radius
Ulnar nerve
Median nerve
Radial nerve (superficial branch)
Dorsal branch of ulnar nerve
Superficial branch of ulnar nerve
Digital branch of ulnar nerve
Muscular branch
Digital branch
Median nerve
(c) The major nerves of the upper limb


Roots (ventral rami):
Dorsal scapular
Nerve to subclavius
Suprascapular
Posterior divisions
Cords
Lateral
Posterior
Medial
Axillary
Musculo-cutaneous
Radial
Median
Ulnar
C_4
C_5
C_6
C_7
C_8
T_1
Upper
Middle
Lower
Trunks
Long thoracic
Medial pectoral
Lateral pectoral
Upper subscapular
Lower subscapular
Thoracodorsal
Medial cutaneous nerves of the arm and forearm
(a) Roots (rami C_5–T_1), trunks, divisions, and cords


Anterior divisions
Posterior divisions
Trunks
Roots
Ventral rami
Segmental branches
Ventral rami:
Hypoglossal nerve (XII)
Lesser occipital nerve
Greater auricular nerve
Transverse cervical nerve
Ansa cervicalis
Accessory nerve (XI)
Phrenic nerve
Supraclavicular nerves
C_1
C_2
C_3
C_4
C_5

Anatomy of the Muscle System

Part A: