cross-section of spinal cord

white matter:
myelinated axons
amyelinated axons
neuroglia

grey matter:
neuron bodies
neuroglia

posterior grey column
(dorsal horn)
grey commissure

lateral grey column
(lateral horn)
(T1-L2 only)

anterior grey column
(ventral horn)
central canal

posterior median sulcus
and septum
posterior funiculus

anterior median fissure
anterior funiculus

lateral funiculus
SPINAL CORD MENINGES
(singular = meninx)

spinal nerve (exits via intervertebral foramen)

spinal cord & meninges in vertebral canal

epidural tissues

-dura mater & subdural space (potential)
-arachnoid mater
-subarachnoid space & CSF (cerebrospinal fluid)
pia mater

strands connecting arachnoid & pia

denticulate ligament

epineurium

dura
One Spinal Cord Segment & Its Pair of Spinal Nerves

Deep back muscles, vertebrae & joints, overlying integument
Monosynaptic Stretch Reflex

N.B.:

1. The single neurons in the diagram represent multiple neurons.

2. No interneurons are involved.
Polysynaptic Reflex: An Example

N.B.: 1. The single neurons in the diagram represent multiple neurons. 2. Interneurons are involved.

Right side  Left side

sensory inflow

motor outflow

flexor muscle contraction

Right side  Left side

excitatory synapse

inhibitory synapse

extensor muscle contraction

no flexor muscle contraction
cerebral cortex (post central gyrus)

Interpretation:
- Modality: pain, temperature, touch, proprioception
- Intensity and frequency
- Localization

thalamus (brainstem)

relay to appropriate areas of cerebral cortex

nucleus cuneatus, nucleus gracilis (cervical spinal cord)

dorsal columns (fasciculi cuneatus & gracilis)

ventral spinothalamic tract

lateral spinothalamic tract

Stimulation of receptors for:
- touch
- pain, temperature
- touch, proprioception
ASCENDING (SENSORY OR AFFERENT) TRACTS
1. Fasciculus gracilis    2. Fasciculus cuneatus
3. Rostral spinocerebellar 4. Posterior spinocerebellar
5. Anterior spinocerebellar 6. Lateral spinothalamic
7. Anterior spinothalamic

DESCENDING (MOTOR OR EFFERENT) TRACTS
A. Lateral corticospinal    B. Rubrospinal
C. Pontine reticulospinal  D. Vestibulospinal
E. Tectospinal             F. Anterior corticospinal
G. Medullary reticulospinal

ASSOCIATION TRACTS
a. Fasciculus proprius  b. Fascicularis interfascicularis
c. Fasciculus septomarginalis

MIXED TRACTS
i. Lissauer's fasciculus   ii. Medial longitudinal fasciculus
REVIEW QUESTIONS

1. Superiorly, the spinal cord is continuous with the ___?___ of the brain; inferiorly, it terminates as the ___?___ at vertebral level ___?___.  (a) pons, filum terminale, L4-L5  (b) medulla, conus medullaris, L1-L2  (c) medulla, cauda equina, S4-S5  (d) pons, cauda equina, L1-L2  (e) medulla, filum terminale, L4-L5

2. The spinal cord is enlarged in two regions: the ___?___ and the ___?___.  (a) cervical, lumbar  (b) cervical, thoracic  (c) cervical, sacral  (d) thoracic, lumbar  (e) lumbar, coccygeal

3. The anterior gray column of the spinal cord contains interneurons and ___?___.  (a) somatic sensory neurons  (b) visceral sensory neurons  (c) somatic motor neurons  (d) visceral motor neurons  (e) all of these.

4. The posterior gray column of the spinal cord contains interneurons involved with the processing of ___?___ information.  (a) somatic and visceral sensory  (b) somatic and visceral motor  (c) both  (d) neither

5. Which of the following structures is found only in spinal cord segments T1-L2(3)?  (a) anterior gray column  (b) lateral gray column  (c) posterior gray column  (d) central canal  (e) gray commissure

6. The lateral gray column of spinal cord segments T1-L2(3) contains ___?___.  (a) somatic sensory neurons  (b) visceral sensory neurons  (c) somatic motor neurons  (d) visceral motor neurons  (e) all of these.

7. The motor neurons in the anterior gray column of the spinal cord control ___?___.  (a) smooth muscle  (b) skeletal muscle  (c) cardiac muscle  (d) glands  (e) all of these

8. The motor neurons in the lateral gray column (T1-L2) of the spinal cord control ___?___.  (a) smooth muscle  (b) cardiac muscle  (c) glands  (d) all of these  (e) none of these

9. The spinal cord is divided into ___?___ spinal cord segments, each bearing a pair of spinal nerves.  (a) 24  (b) 25  (c) 30  (d) 31  (e) 35

10. Which of the following spinal nerve numbers is not correct?  (a) 7 cervical  (b) 12 thoracic  (c) 5 lumbar  (d) 5 sacral  (e) 1 coccygeal

11. The anterior or ventral roots of all spinal nerves carry the axons of ___?___.  (a) anterior horn alpha motor neurons  (b) anterior horn gamma motor neurons  (c) lateral horn visceral motor neurons  (d) all of these  (e) a and b only

12. The anterior or ventral roots of spinal nerves T1-L2 carry the axons of ___?___.  (a) anterior horn alpha motor neurons  (b) anterior horn gamma motor neurons  (c) lateral horn visceral motor neurons  (d) all of these  (e) none of these

13. The dorsal root of a spinal nerve carries the axons of neurons located in the ___?___.  (a) dorsal horn  (b) dorsal root ganglion  (c) lateral horn  (d) anterior horn  (e) none of these.

14. Dorsal root or spinal ganglia ___?___.  (a) are located on the dorsal roots of all spinal nerves  (b) contain pseudounipolar neurons  (c) contain both visceral and somatic sensory neurons  (d) all of these  (e) none of these

15. The central processes of the neurons in dorsal root ganglia ___?___.  (a) enter the posterior gray column (dorsal horn) of the spinal cord  (b) may synapse with interneurons  (c) may synapse with motor neurons  (d) may enter tracts in the spinal cord white matter  (e) all of these
16. The peripheral processes of neurons in dorsal root ganglia end in somatic or visceral receptors. (a) true (b) false

17. It is true that the _?_. (a) ventral roots of spinal nerves contain only axons of motor neurons (b) dorsal roots of spinal nerves contain only axons of sensory neurons (c) spinal nerves contain axons of both sensory and motor neurons (d) all of these (e) none of these

18. In general, _?_ spinal cord tracts carry sensory information and _?_ tracts carry motor information. (a) ascending, descending (b) descending, ascending (c) projection, commissural (d) commissural, association (e) none of these

19. Most ascending spinal cord tracts _?_. (a) are crossed (b) involve three sets of synapses (c) have connections with thalamic neurons (d) all of these (e) none of these

20. Which spinal cord tract carries pain and temperature information? (a) anterior spinothalamic (b) posterior cerebellar (c) lateral corticospinal (d) fasciculus gracilis (e) lateral spinothalamic

21. Which tract is involved in voluntary muscular activity and/or maintaining muscle tone? (a) lateral corticospinal (b) anterior corticospinal (c) vestibulospinal (d) rubrospinal (e) all of these

22. The anterior primary rami of nerves C1-C4 form the _?_. (a) cervical plexus (b) brachial plexus (c) lumbar plexus (d) sacral plexus (e) coccygeal plexus.

23. The brachial plexus is formed by the anterior rami of spinal nerves _?_. (a) T1-T12 (b) C5-T1 (c) C8-T5 (d) L1-L4 (e) L5-S2.

24. The lumbar plexus is formed by the _?_. (a) anterior rami of L1-L4 (b) posterior rami of L1-L4 (c) branches of the lumbosacral trunk (d) anterior rami of C5-T1 (e) anterior rami of L1-S2.

25. The sacral plexus is formed by the anterior rami of spinal nerves: (a) L5-S2 (b) L4-S4 (c) L4-L5 (d) S1-S5 (e) none of these.

26. Which nerve is not a branch of the brachial plexus? (a) radial (b) musculocutaneous (c) ulnar (d) median (e) posterior auricular

27. The cords of the brachial plexus _?_. (a) are located in the axilla (b) are formed from the divisions of the trunks (c) are named for their positions around the axillary artery (d) all of these (e) none of these

28. The _?_ nerve supplies the anterior or flexor compartment of the arm? (a) musculocutaneous (b) median (c) ulnar (d) radial (e) axillary

29. The _?_ nerve supplies the posterior compartments of the arm and forearm? (a) musculocutaneous (b) median (c) ulnar (d) radial (e) axillary

30. The _?_ nerve supplies one and a half muscles in the anterior forearm (flexor carpi ulnaris and the parts of flexor digitorum profundus to digits 4 and 5) and all the muscles in the hand except five (the three thenar muscles and the two lateral lumbrical muscles). (a) musculocutaneous (b) median (c) ulnar (d) radial (e) axillary

31. The _?_ nerve supplies all the muscles in the forearm except one and a half (flexor carpi ulnaris and the parts of flexor digitorum profundus to digits 4 and 5) and five muscles in the hand (the three thenar muscles and the two lateral lumbrical muscles). (a) musculocutaneous (b) median (c) ulnar (d) radial (e) axillary
32. The _?_ nerve supplies Deltoid and Teres minor. (a) musculocutaneous (b) median (c) ulnar (d) radial (e) axillary

33. Injury to which nerve could affect supination and extension of the forearm, hand, and digits? (a) musculocutaneous (b) median (c) ulnar (d) radial (e) axillary

34. Injury to which nerve could affect flexion of the forearm? (a) musculocutaneous (b) median (c) ulnar (d) radial (e) axillary

35. Injury to which nerve could result in weakened abduction and lateral rotation of the arm? (a) musculocutaneous (b) median (c) ulnar (d) radial (e) axillary

36. Injury to which nerve could weaken pronation; flexion and abduction of the hand; and flexion of the digits, especially thumb and index and middle fingers? (a) musculocutaneous (b) median (c) ulnar (d) radial (e) axillary

37. Which nerve is not a branch of the lumbar plexus? (a) femoral (b) phrenic (c) obturator (d) iliohypogastric (e) ilioinguinal

38. Which nerve is not a branch of the sacral plexus? (a) sciatic (b) superior gluteal (c) inferior gluteal (d) pudendal (e) axillary

39. Which nerve is motor to the diaphragm? (a) iliohypogastric (b) ilioinguinal (c) phrenic (d) axillary (e) none of these

**Match the muscle group with its nerve supply. An answer may be used more than once or not at all. Remember: The sciatic nerve is really two nerves bundled together: tibial and common fibular ((peroneal).**

40. Anterior thigh  
   a. Obturator nerve

41. Medial thigh  
   b. Sciatic: Tibial nerve

42. Posterior thigh  
   c. Superior and inferior gluteal nerves

43. Gluteal muscles  
   d. Femoral nerve

44. Posterior leg  
   a. Tibial nerve

45. Anterior leg  
   b. Medial and lateral plantar nerves

46. Lateral leg  
   c. Deepfibular (peroneal) nerve

47. Sole of foot  
   d. Superficial fibular (peroneal) nerve