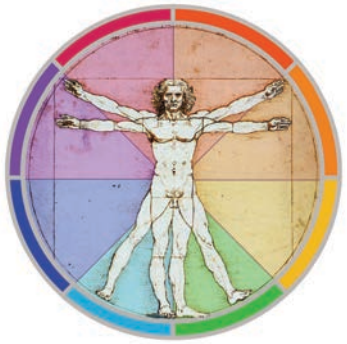
HUBS191 Lecture Material

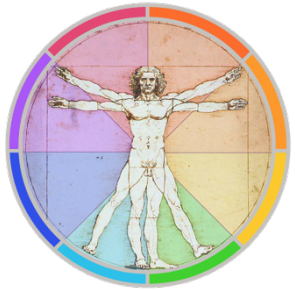
This pre-lecture material is to help you prepare for the lecture and to assist your note-taking within the lecture,

it is NOT a substitute for the lecture !



Please note that although every effort is made to ensure this pre-lecture material corresponds to the live-lecture there may be differences / additions.

Dr Christine Jasoni
Department of Anatomy



HUBS 191

Human Movement and Sensation

Theme 2: Integrating and coordinating roles of the nervous system

Lecture 18: Anatomy and Function of the Spinal Cord and Spinal Nerves

29 March 2017

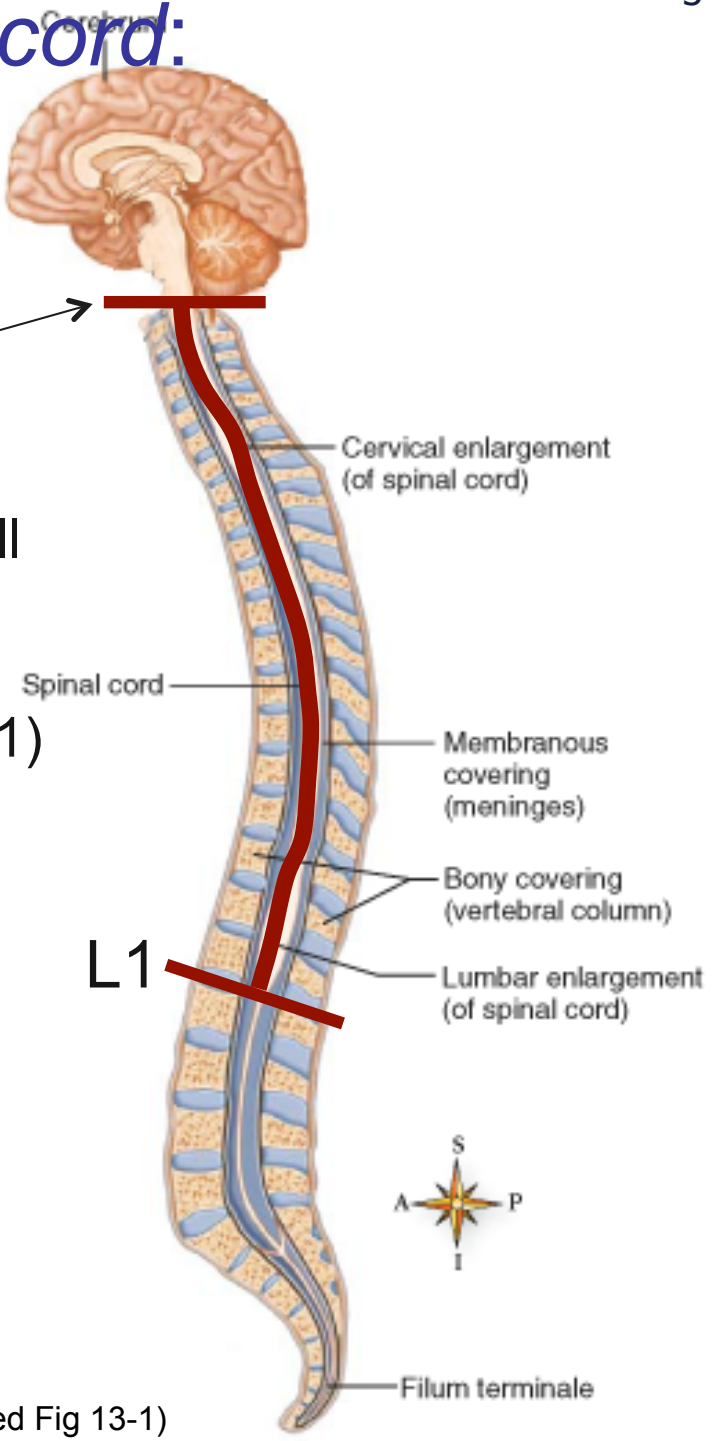
Lecture 18: Learning objectives

After this lecture and associated study you should know and understand:

- The external anatomy of the spinal cord and its associated structures
- The internal anatomy of the spinal cord
- How neural information is organised within the spinal cord and the direction of information flow
- How neural information enters and exits the spinal cord
- The spinal nerves and how neural information travels in them out into the body
- The structure of a peripheral nerve

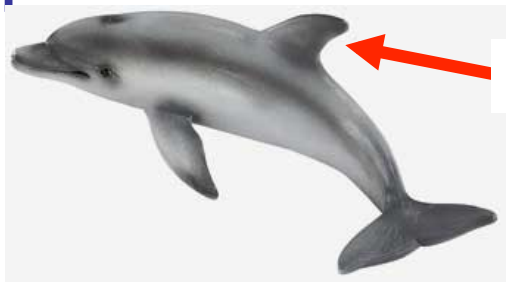
External anatomy of the spinal cord: External features

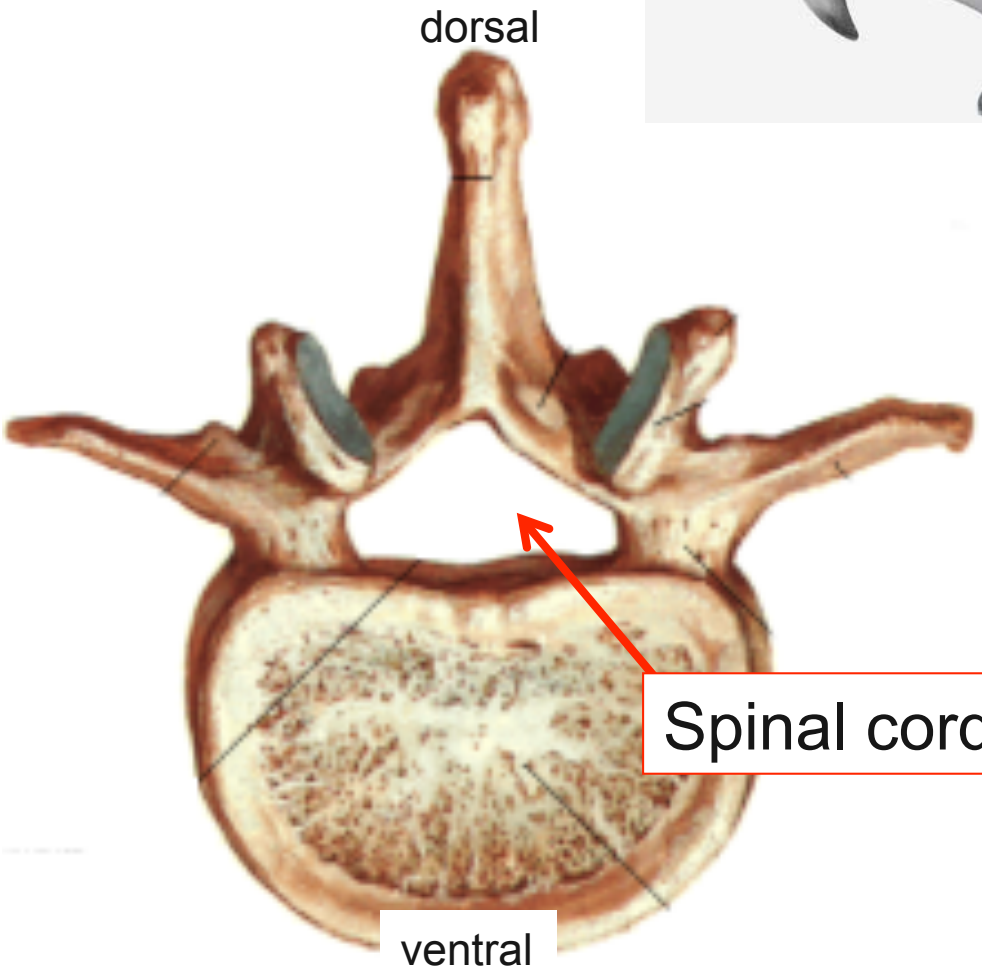
- Starts at: Foramen magnum
  = “big hole”, the opening at the base of the skull
- Ends at: inferior border of 1st lumbar vertebra (L1)
- Within a sack that fits inside the spinal cavity
- Spinal cavity within vertebrae

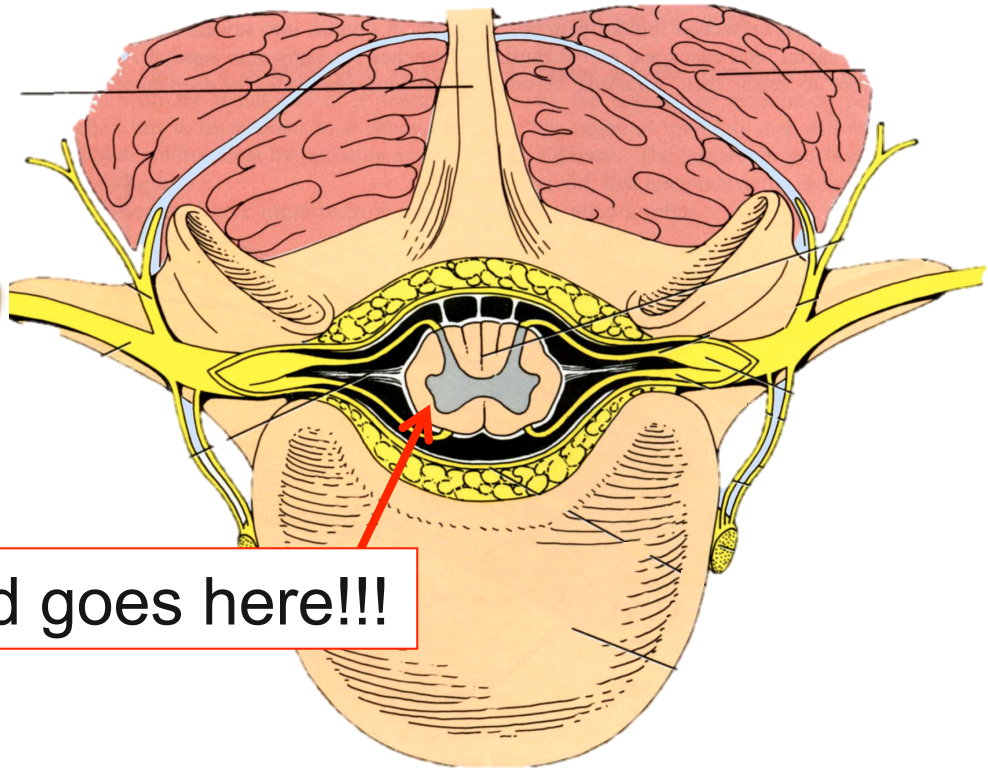


Patton and Thibodeau 8th ed Fig 14-1 (7th ed Fig 13-1)

External anatomy of the spinal cord: Spinal cavity & position in the vertebral column







Spinal cord goes here!!!

Modified from: Tortora, "Principles of human anatomy." ed 5, Fig 17-7.

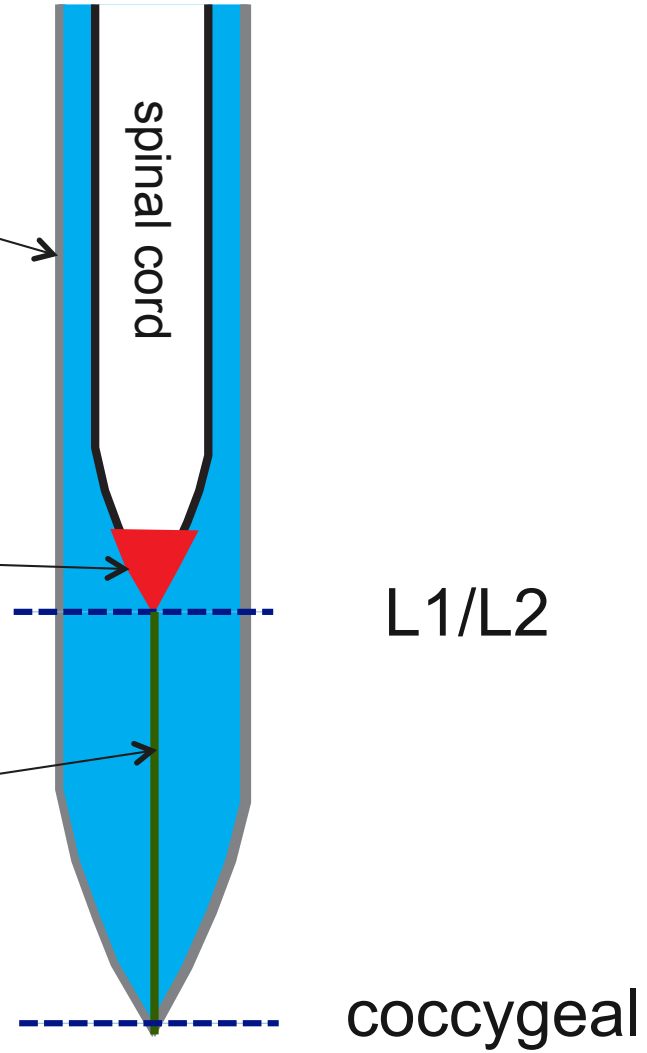
See also: P & T, 8th ed Fig 8-14 (7th ed Fig 8-14)

External anatomical features of the spinal cord: Associated structures

- Extends within a meningeal sack
  - filled with fluid

- End is a tapered cone called the ***conus medularis***

- ***Filum terminale*** extends from conus medularis to end of spinal cavity
  - anchors the spinal cord
  - extension of meninges



See also: Patton and Thibodeau 8th ed Fig 14-7 (7th ed Fig 13-7)

External anatomy of the spinal cord: Spinal nerves

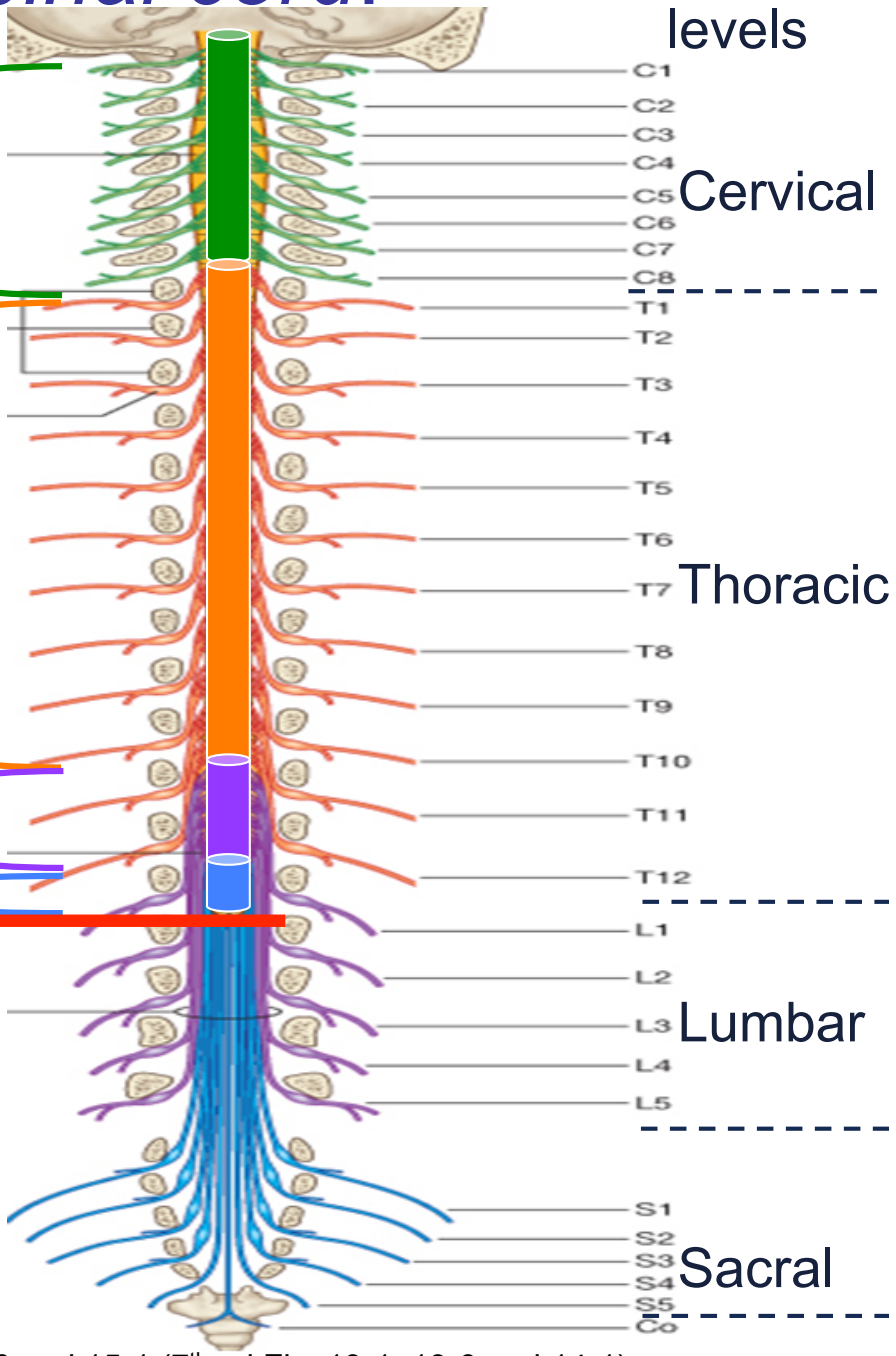
Cervical spinal cord (C1-C7)

Thoracic spinal cord (T1-T12)

Lumbar spinal cord (L-L5)

Sacral spinal cord (S1-S5)

Spinal cord ends!



• Spinal nerves exit the vertebral column at the level appropriate to their origin and destination

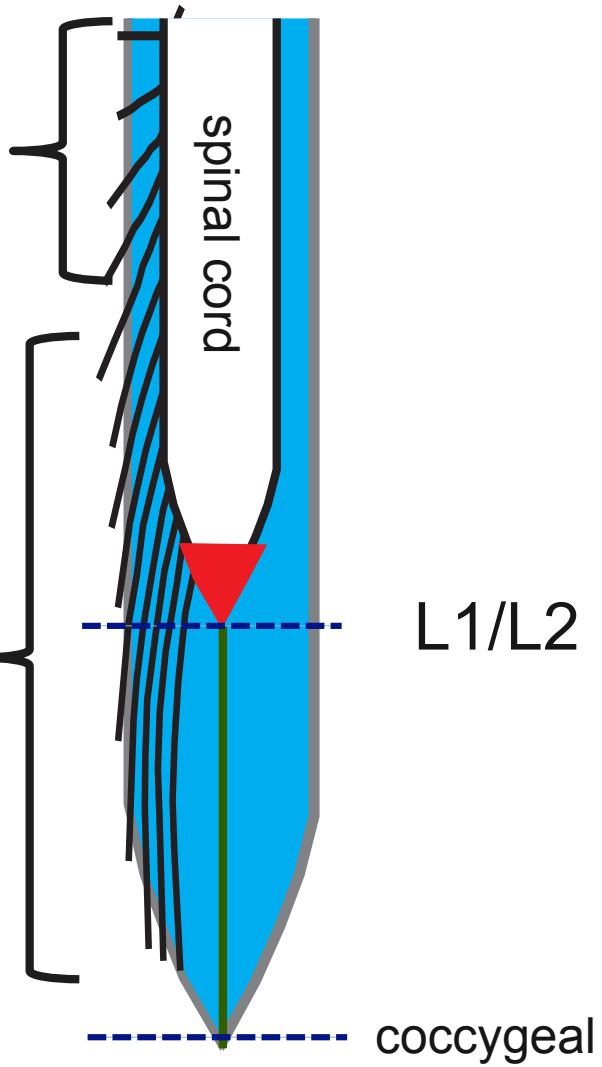
Saladin, 2nd Ed. (See also: Patton and Thibodeau 8th ed Figs 14-1, 14-6 and 15-1 (7th ed Figs13-1, 13-6 and 14-1)

External anatomy of the spinal cord: Spinal nerves, cauda equina

Go to arms & thorax
(Exit vertebral column at cervical and thoracic levels)

- Some spinal nerves exit the spinal cavity and vertebral column *inferior* to end of spinal cord

Go to legs, pelvis, abdomen
(Exit vertebral column at lumbar, sacral, and coccygeal levels)



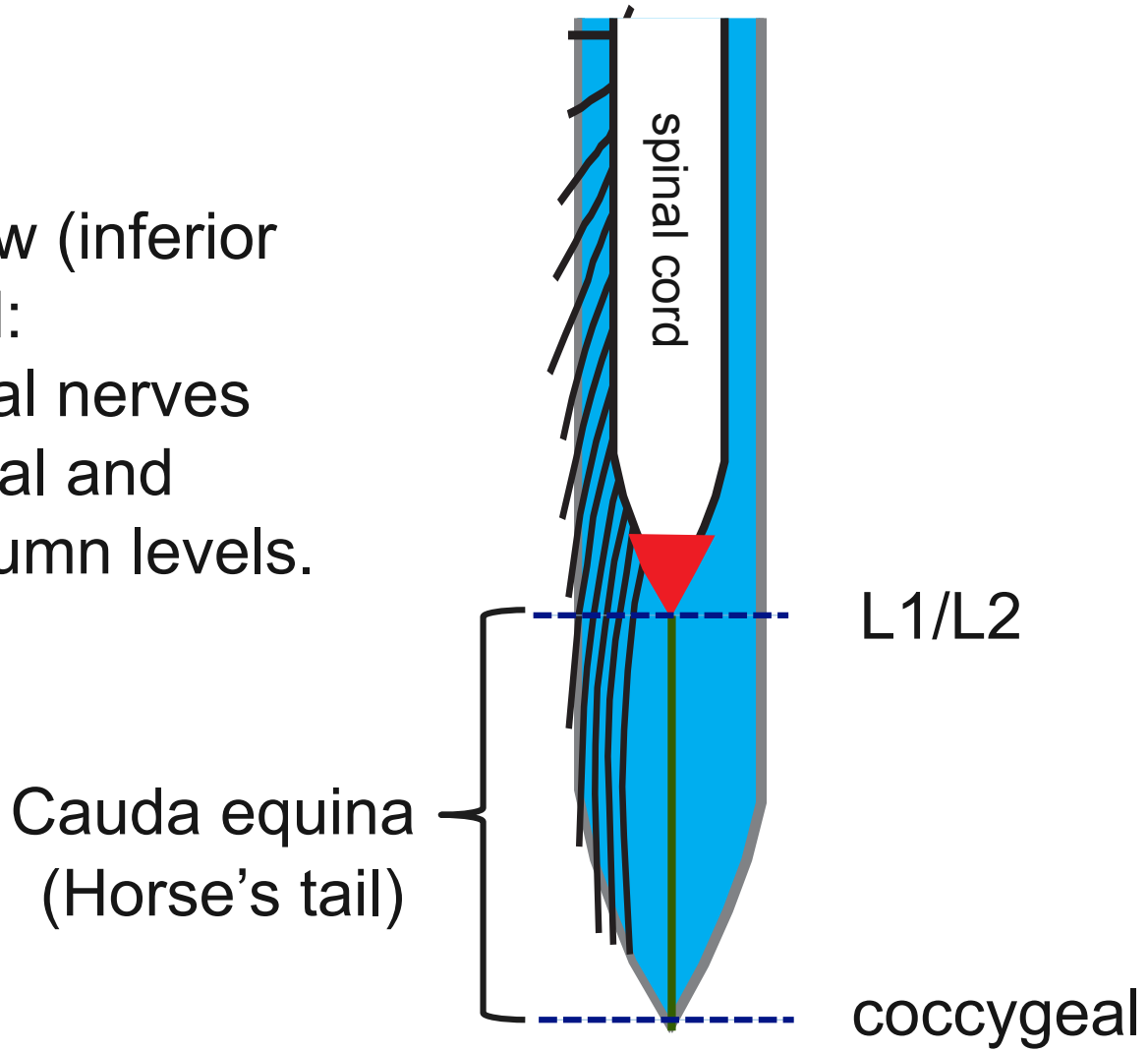
See also: Patton and Thibodeau 8th ed Fig 14-7 (7th ed Fig 13-7)

External anatomy of the spinal cord: Spinal nerves, cauda equina

→ Meningeal sack below (inferior to) end of spinal cord:

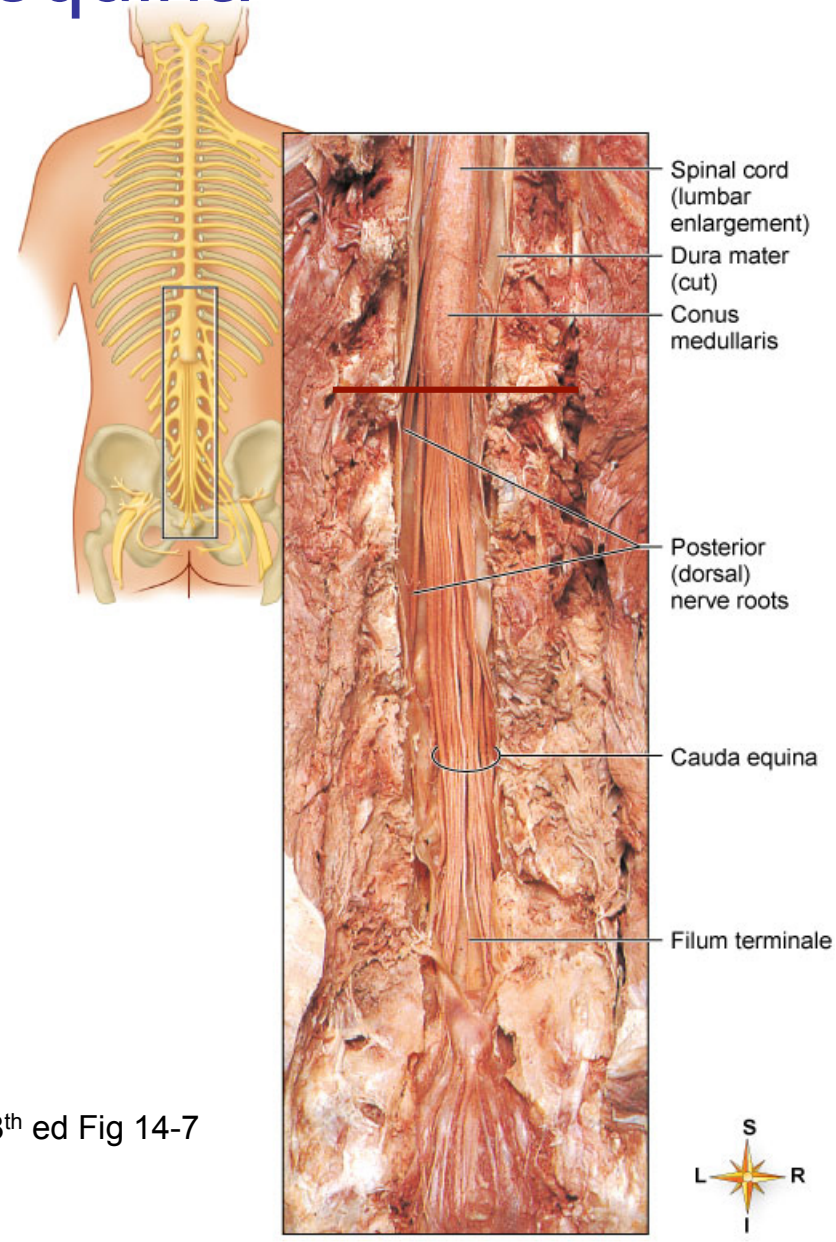
- Filled with spinal nerves

that exit at lumbar, sacral and coccygeal vertebral column levels.



See also: Patton and Thibodeau 8th ed Fig 14-7 (7th ed Fig 13-7)

External anatomy of the spinal cord: Cauda equina

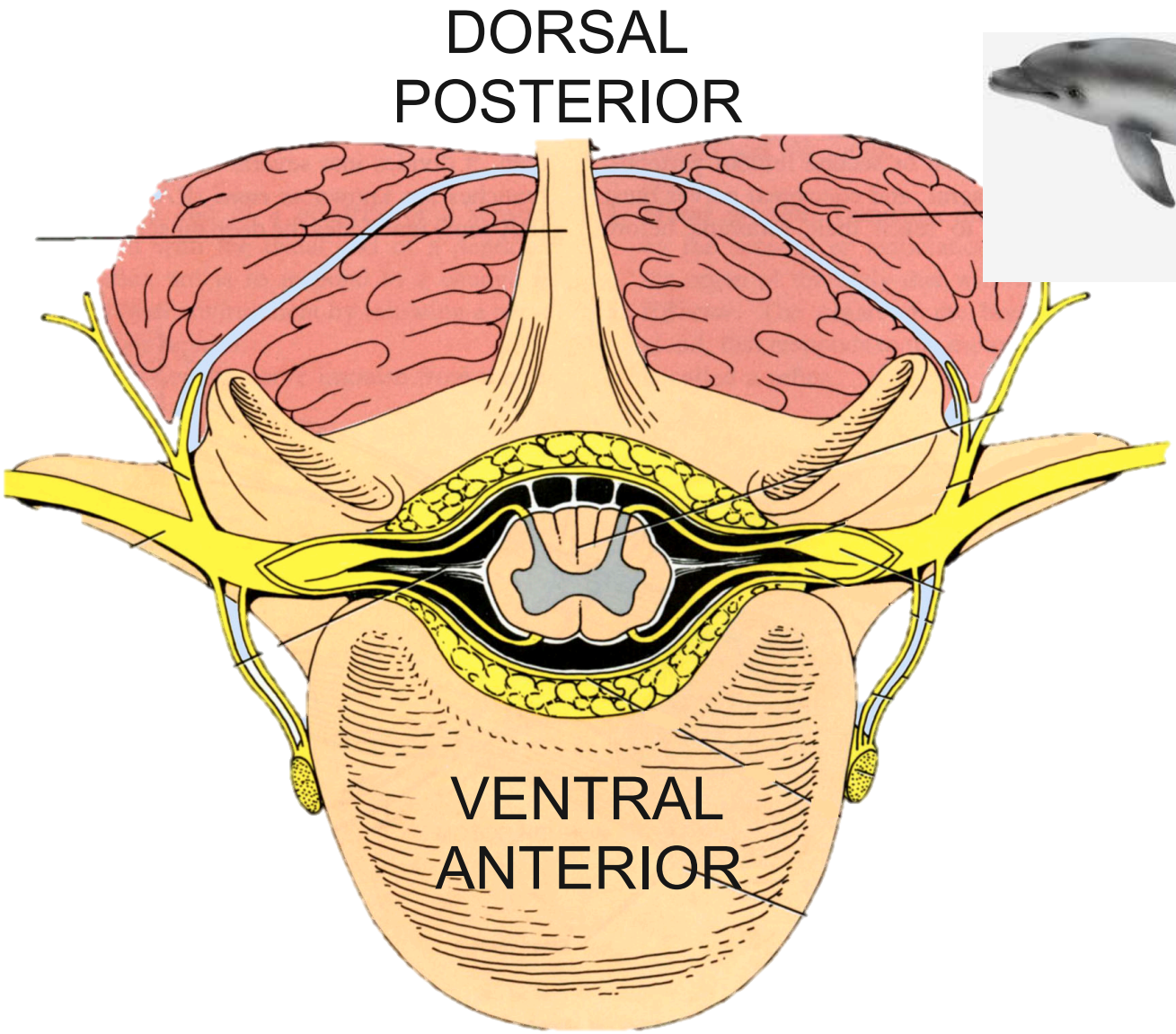


From Gosling J, Harris P, Whitmore I, Willan P: *Human anatomy*, ed 4, Philadelphia, 2002.

Patton and Thibodeau 8th ed Fig 14-7
(7th ed Fig 13-7)

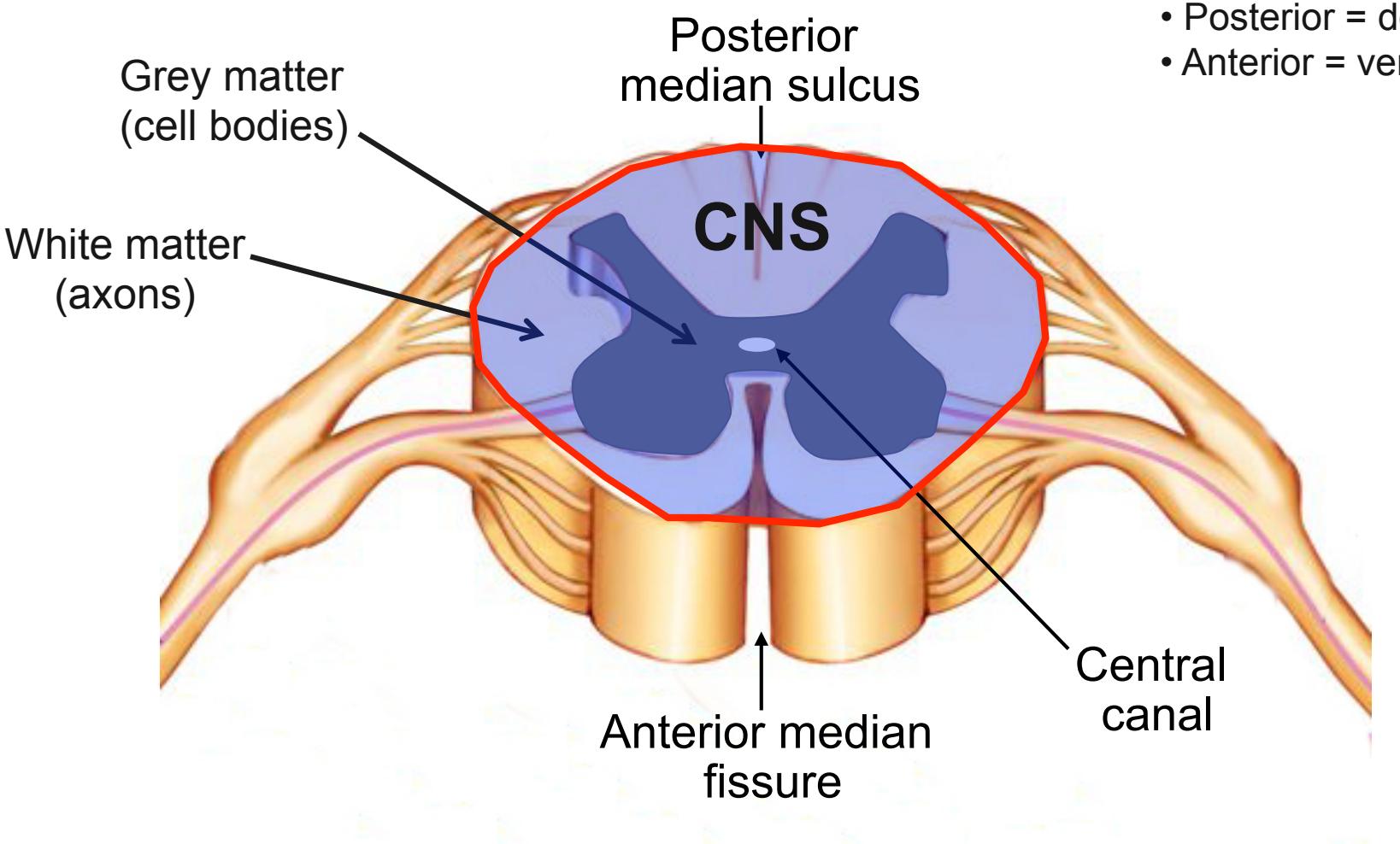
http://vaquerofeed.com/?p=290

Reminder...



Anatomy of the spinal cord: Internal features

- Sulcus = Latin, furrow
- Fissure = a deep sulcus
- Posterior = dorsal
- Anterior = ventral



Equivalent to Patton and Thibodeau 8th ed Fig 14-6 (7th ed Fig 13-6)

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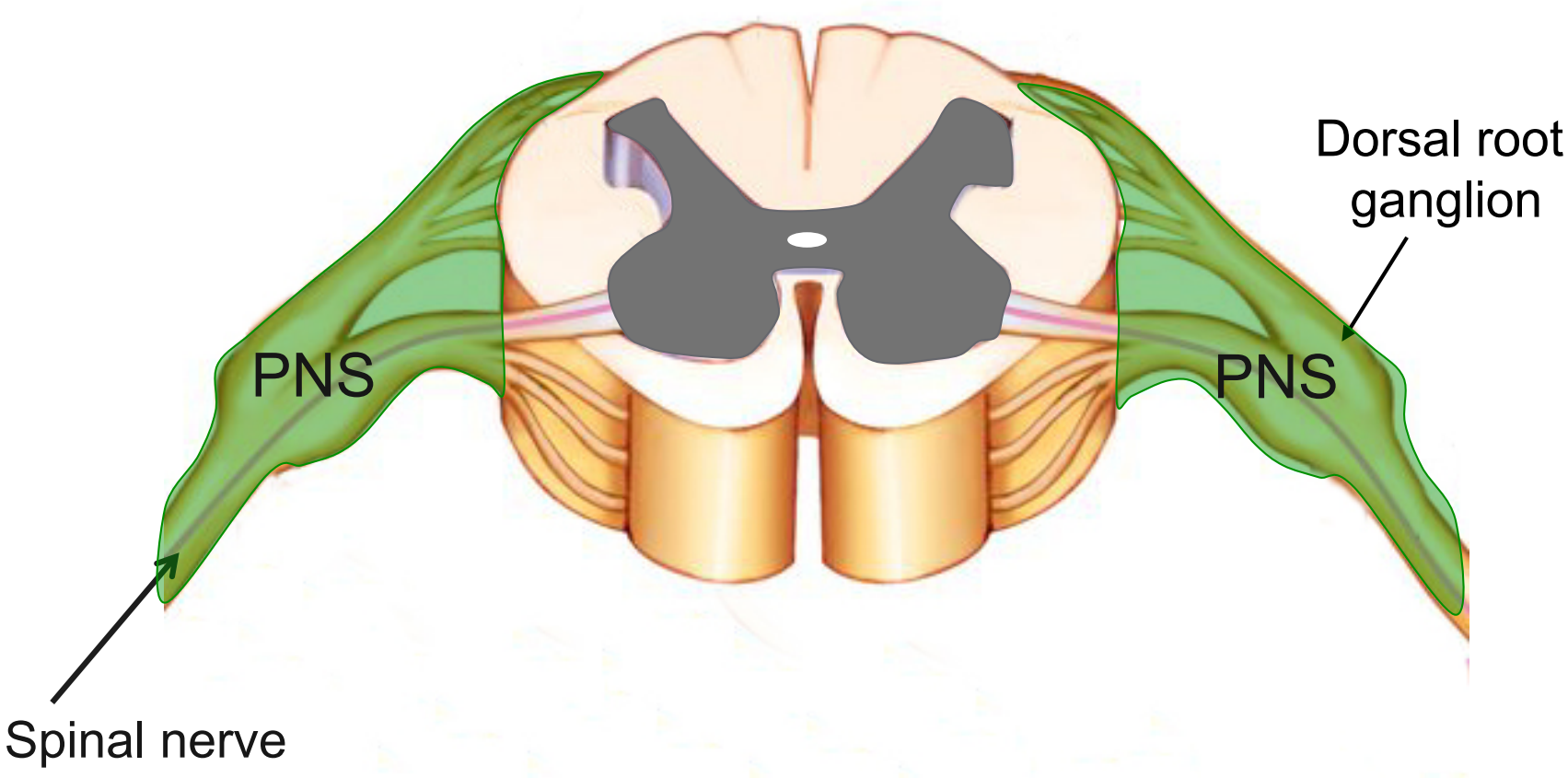
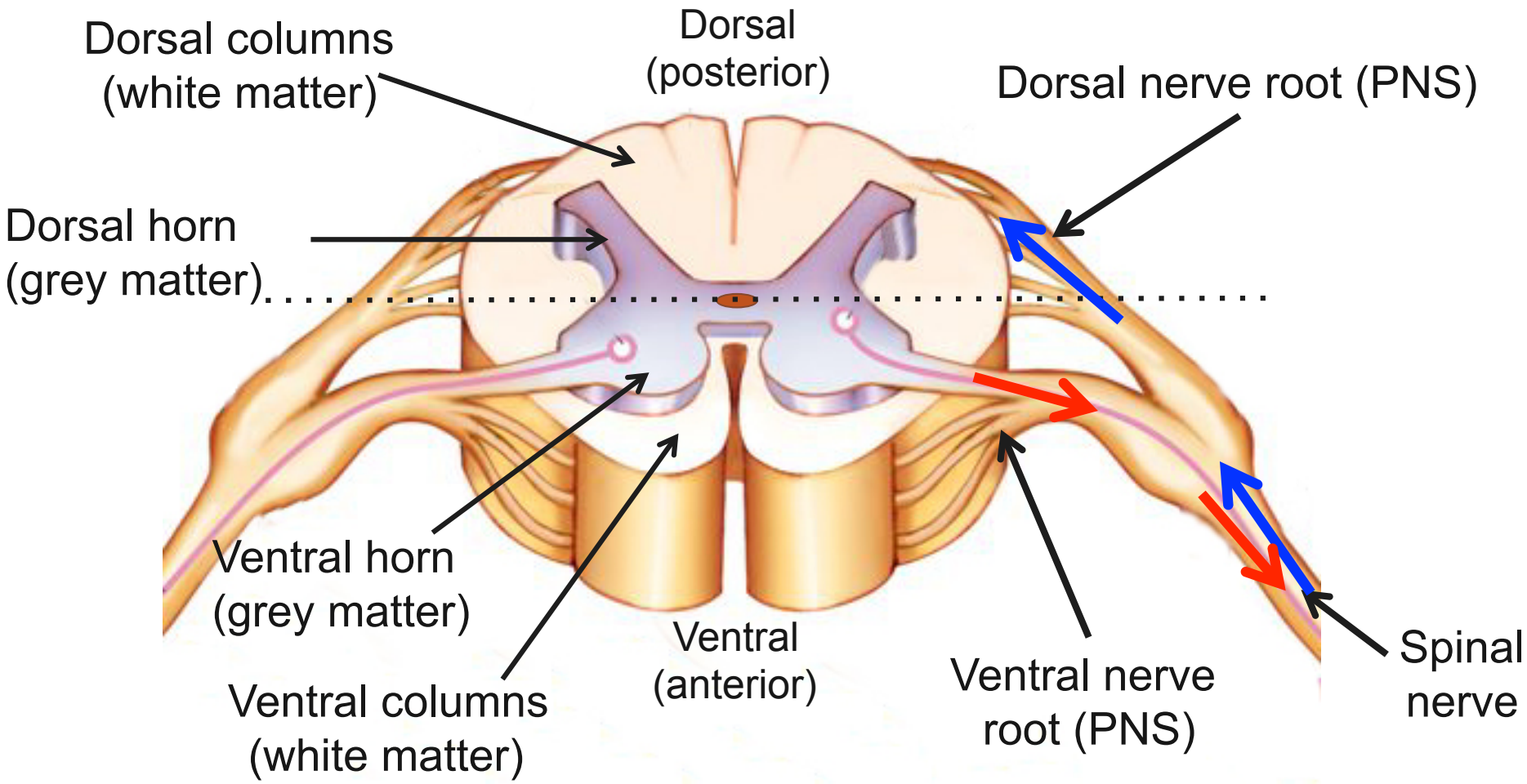


Equivalent to Patton and Thibodeau 8th ed Fig 14-6 (7th ed Fig 13-6)

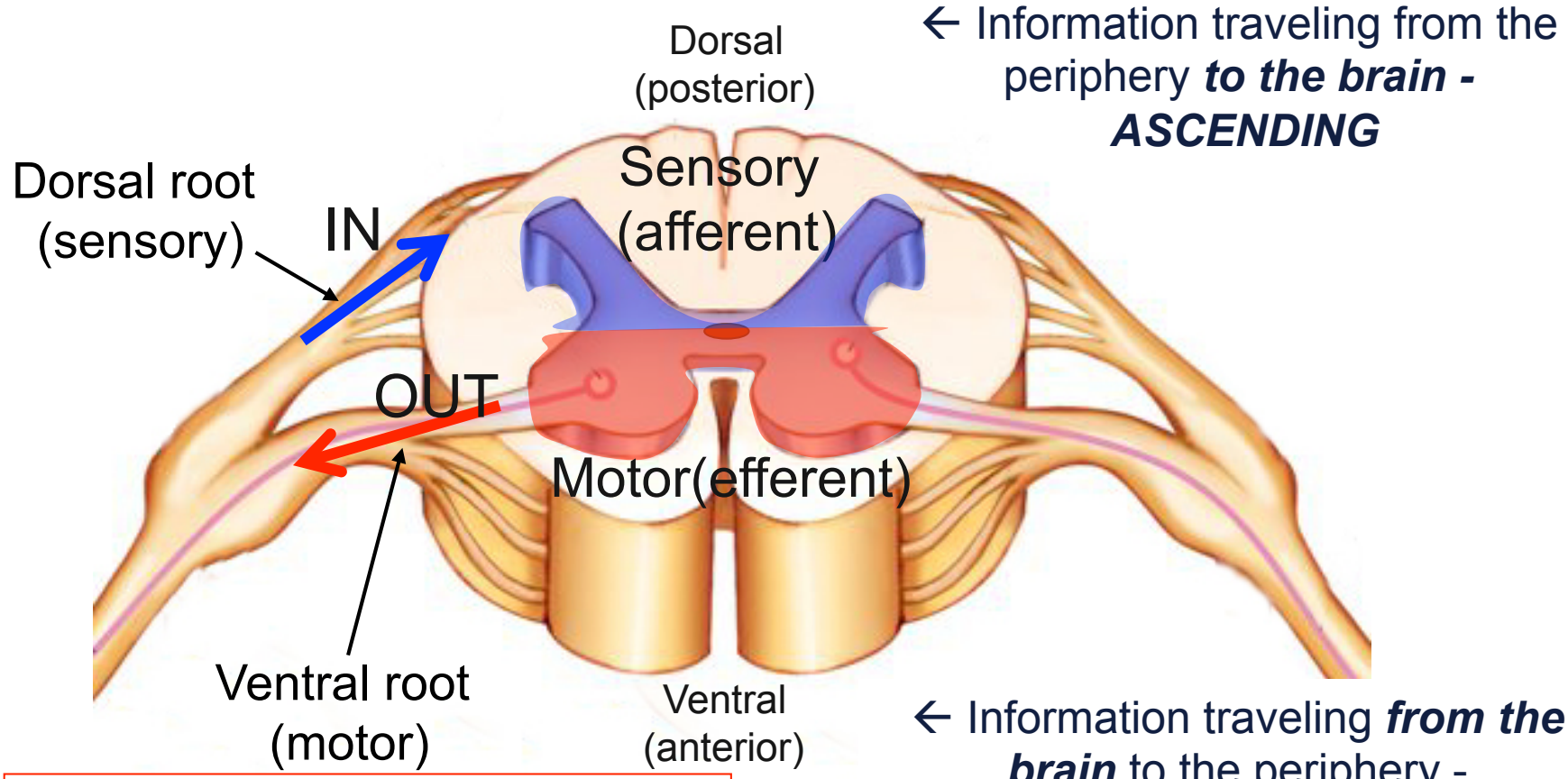
Anatomy of the spinal cord: Internal features

- White matter (axons)
- Grey matter (cell bodies)



Equivalent to Patton and Thibodeau 8th ed Fig 14-6 (7th ed Fig 13-6)

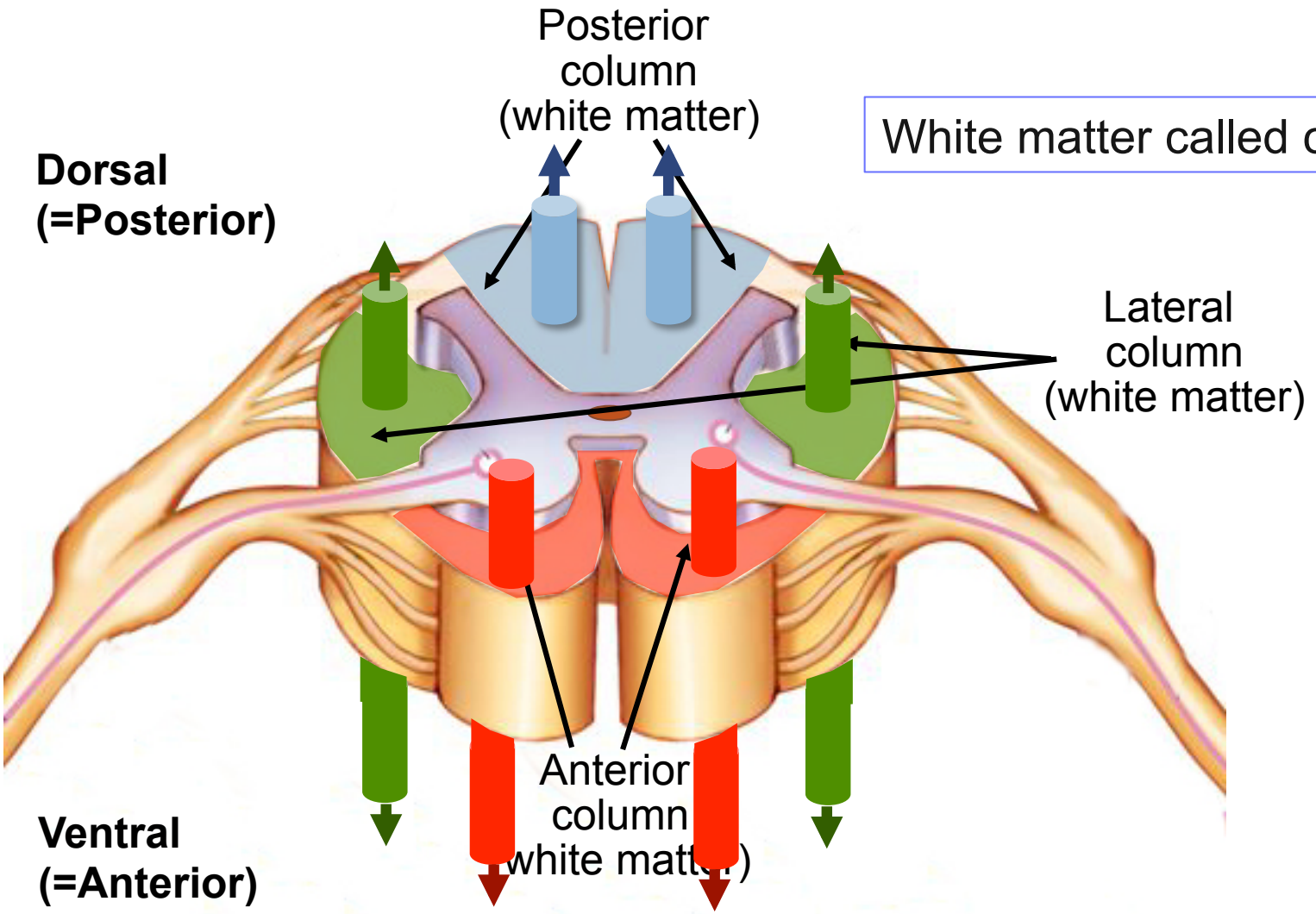
Anatomy of the spinal cord: Internal organisation of neural information



*Q: Are these ventral root axons myelinated or unmyelinated?

Equivalent to Patton and Thibodeau 8th ed Fig 14-6 (7th ed Fig 13-6)

Anatomy of the spinal cord: Directions of information flow & divisions of white matter

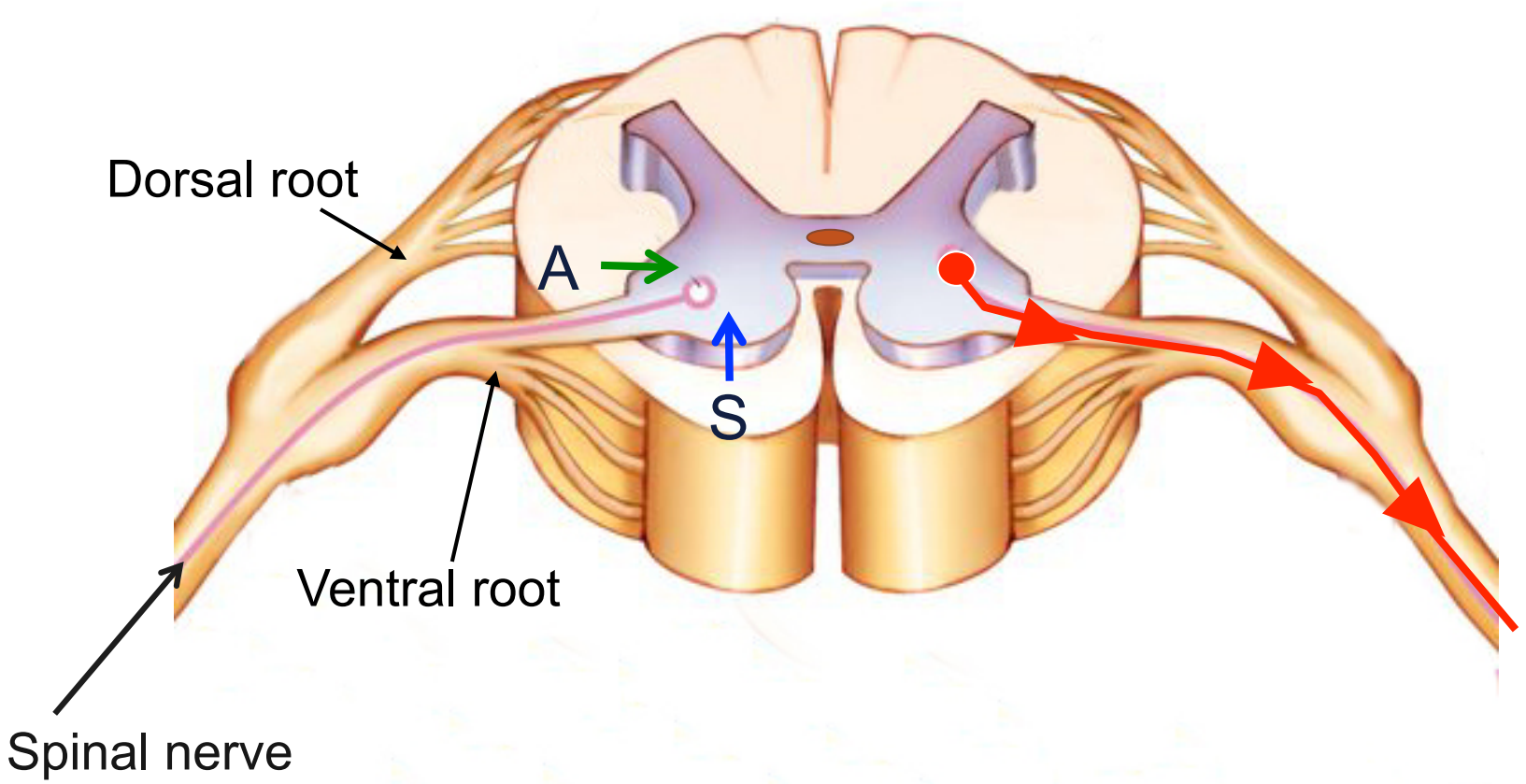


Equivalent to Patton and Thibodeau 8th ed Fig 14-6 (7th ed Fig 13-6)

Flow of information ***out of*** the spinal cord

Efferent (motor) information leaves through ventral roots

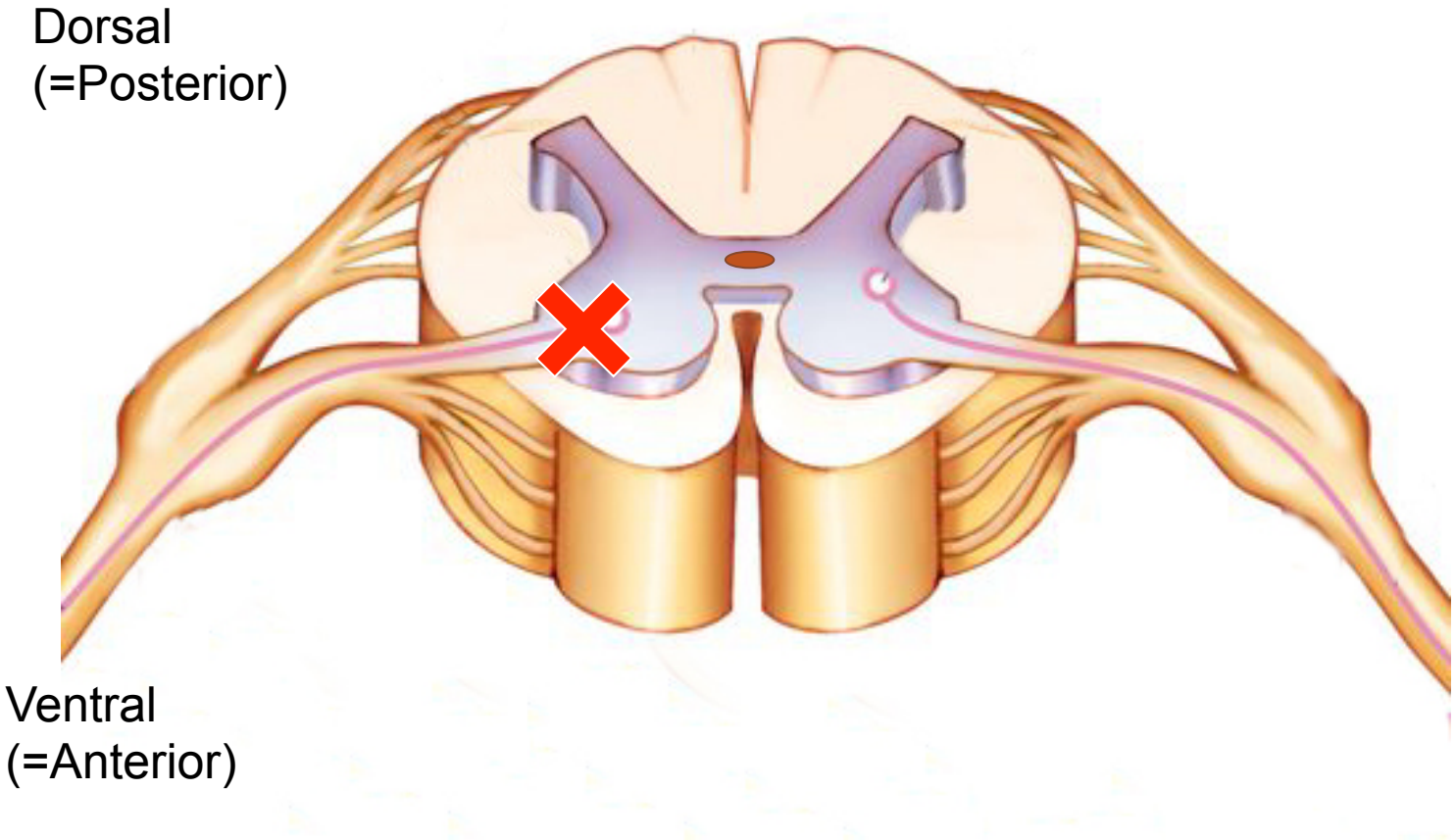
- **Somatic** motor neurons in ventral horns of spinal cord
- **Autonomic** in lateral/ventrolateral horns of spinal cord



See also Patton and Thibodeau 8th ed Fig 14-6 (7th ed Fig 13-6)

Functional anatomy of the spinal cord

What would happen if there was a lesion here?

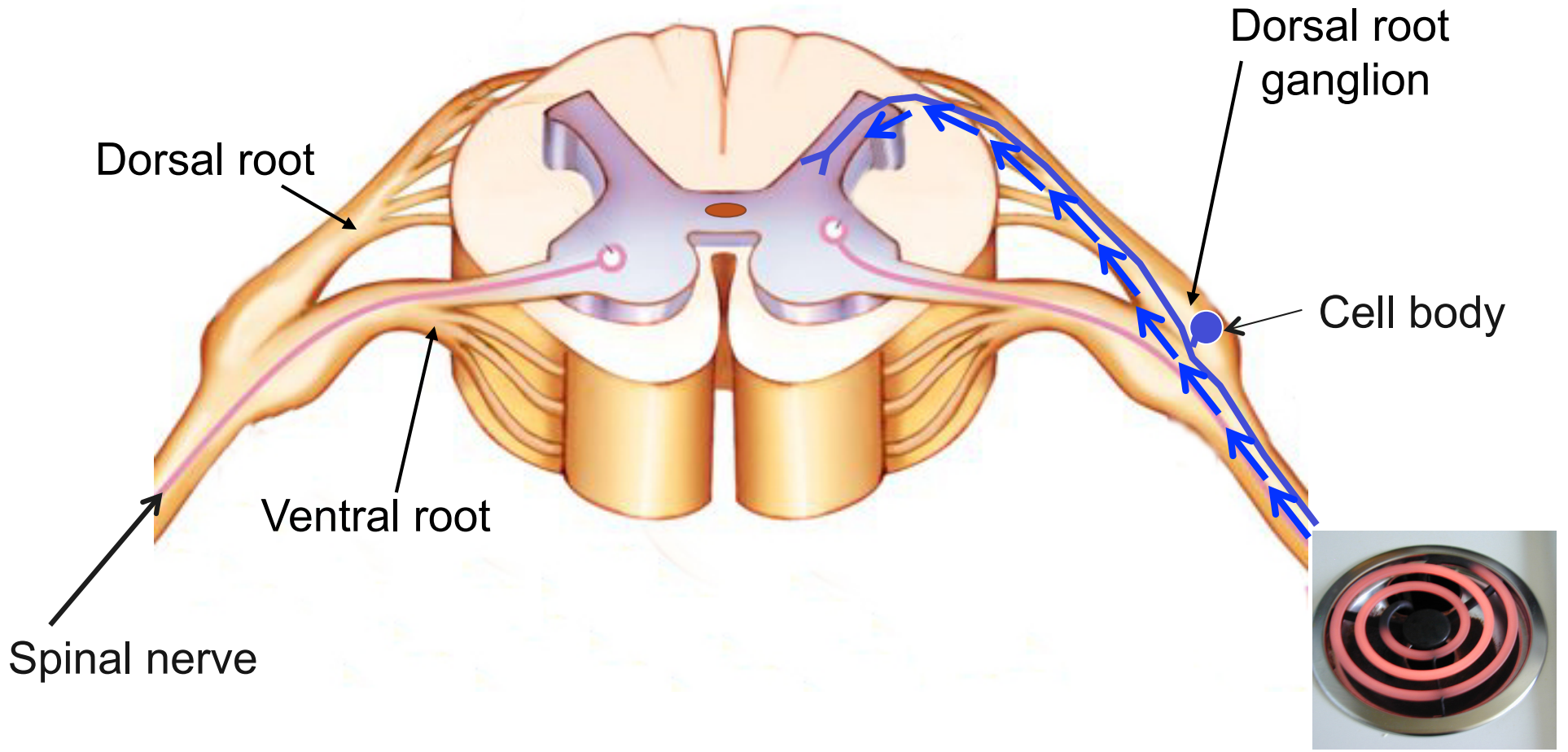


See also Patton and Thibodeau 8th ed Fig 14-6 (7th ed Fig 13-6)

Flow of information *into* the spinal cord

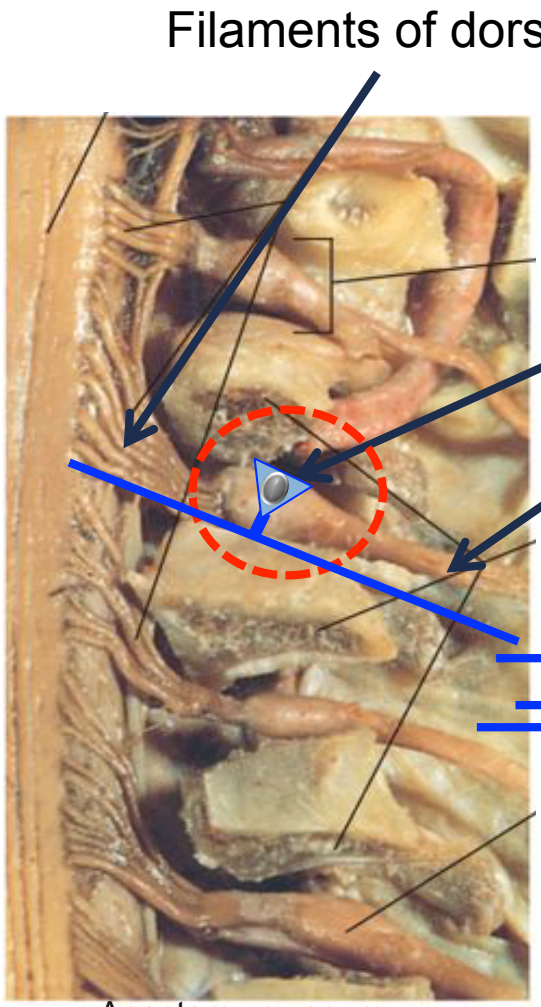
Afferent (sensory) information enters the spinal cord in dorsal roots

- Cell bodies of sensory neurons are in the ***dorsal root ganglion***

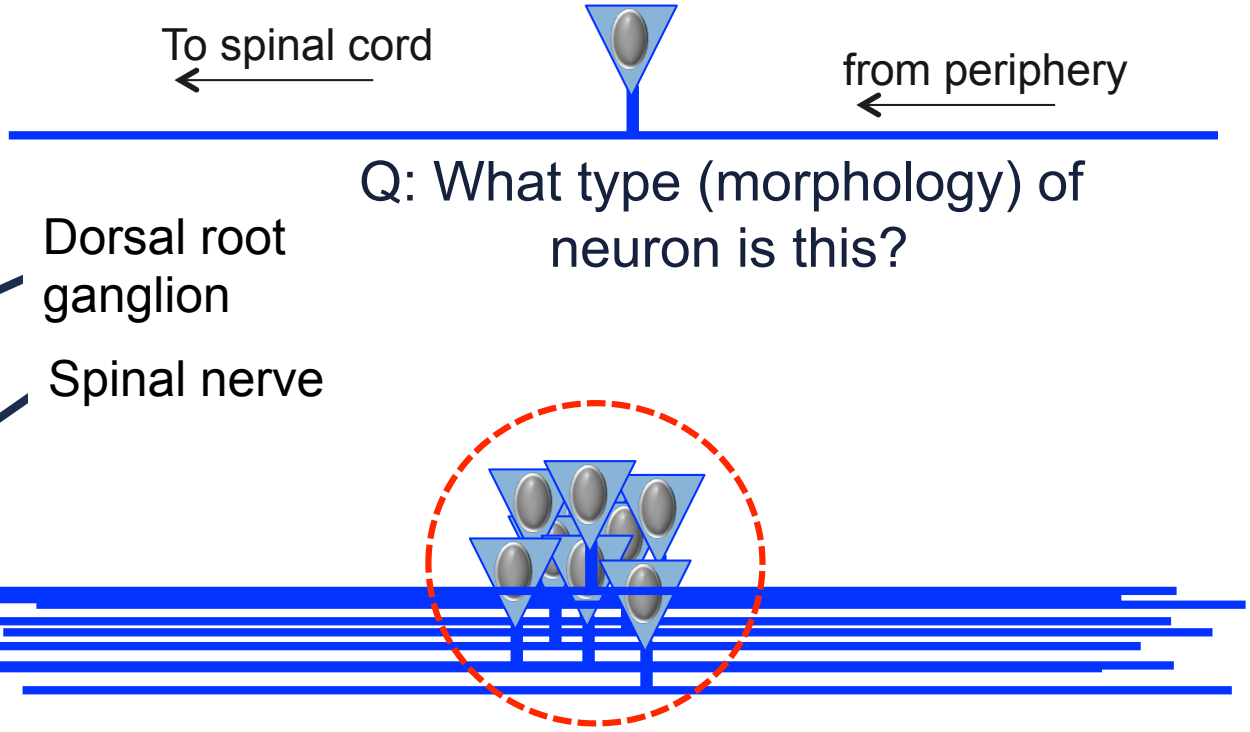


See also Patton and Thibodeau 8th ed Fig 14-6 (7th ed Fig 13-6)

Dissection: Dorsal view of the spinal cord and dorsal nerve root



Anantomy museum

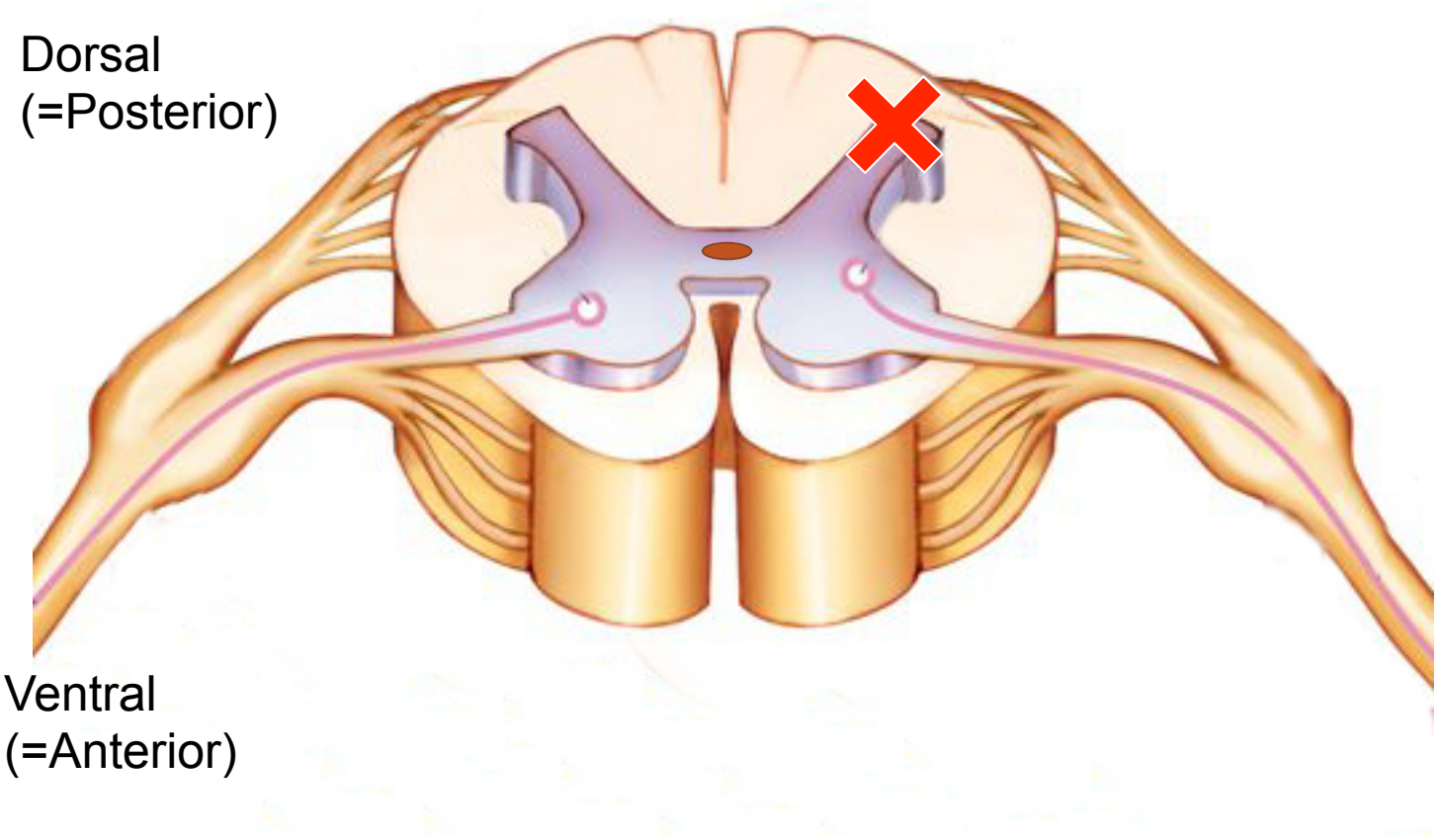


Q: What type (morphology) of neuron is this?

Q: What is this structure called?

Functional anatomy of the spinal cord

What would happen if there was a lesion here?

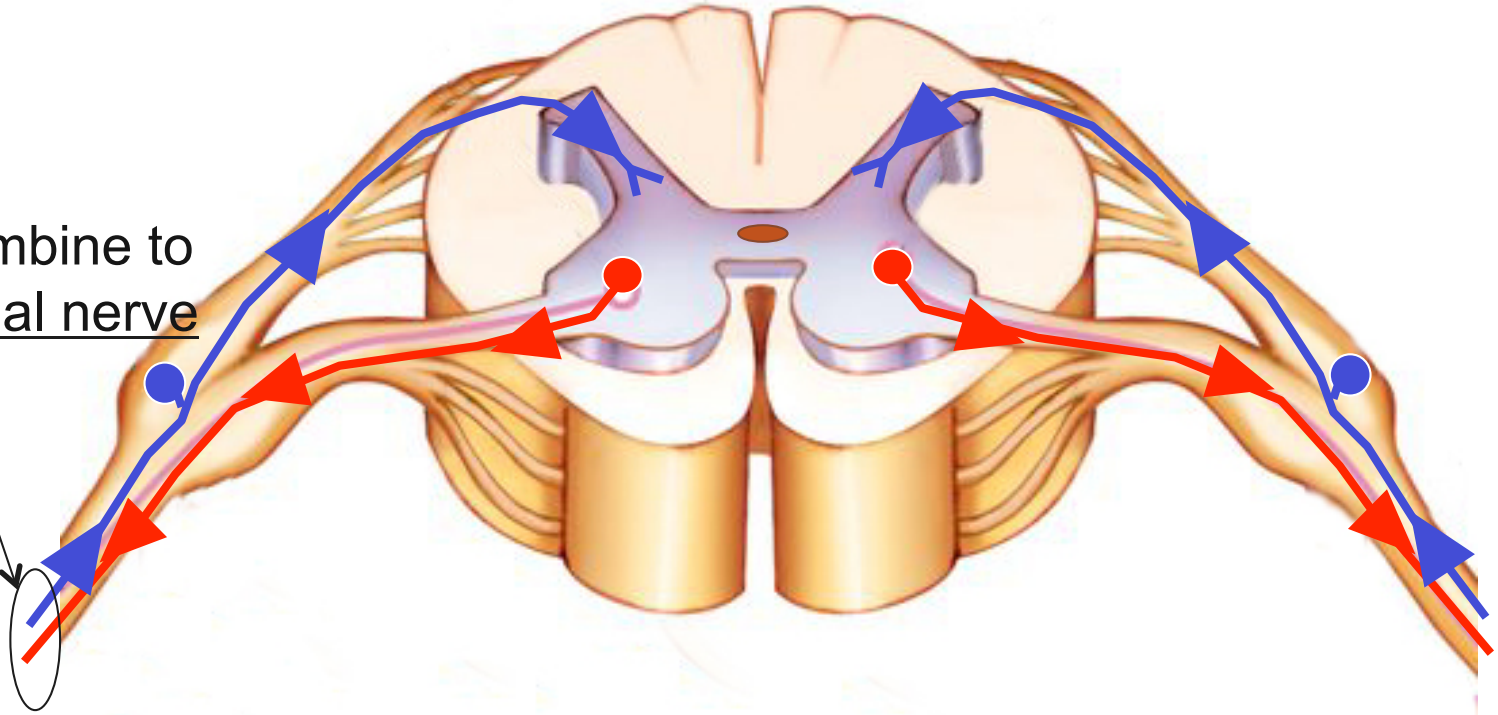


See also Patton and Thibodeau 8th ed Fig 14-6 (7th ed Fig 13-6)

Summary: Flow of information into and out of the spinal cord

- Dorsal nerve roots – flow of information 1-way = IN
- Ventral nerve roots – flow of information 1-way = OUT

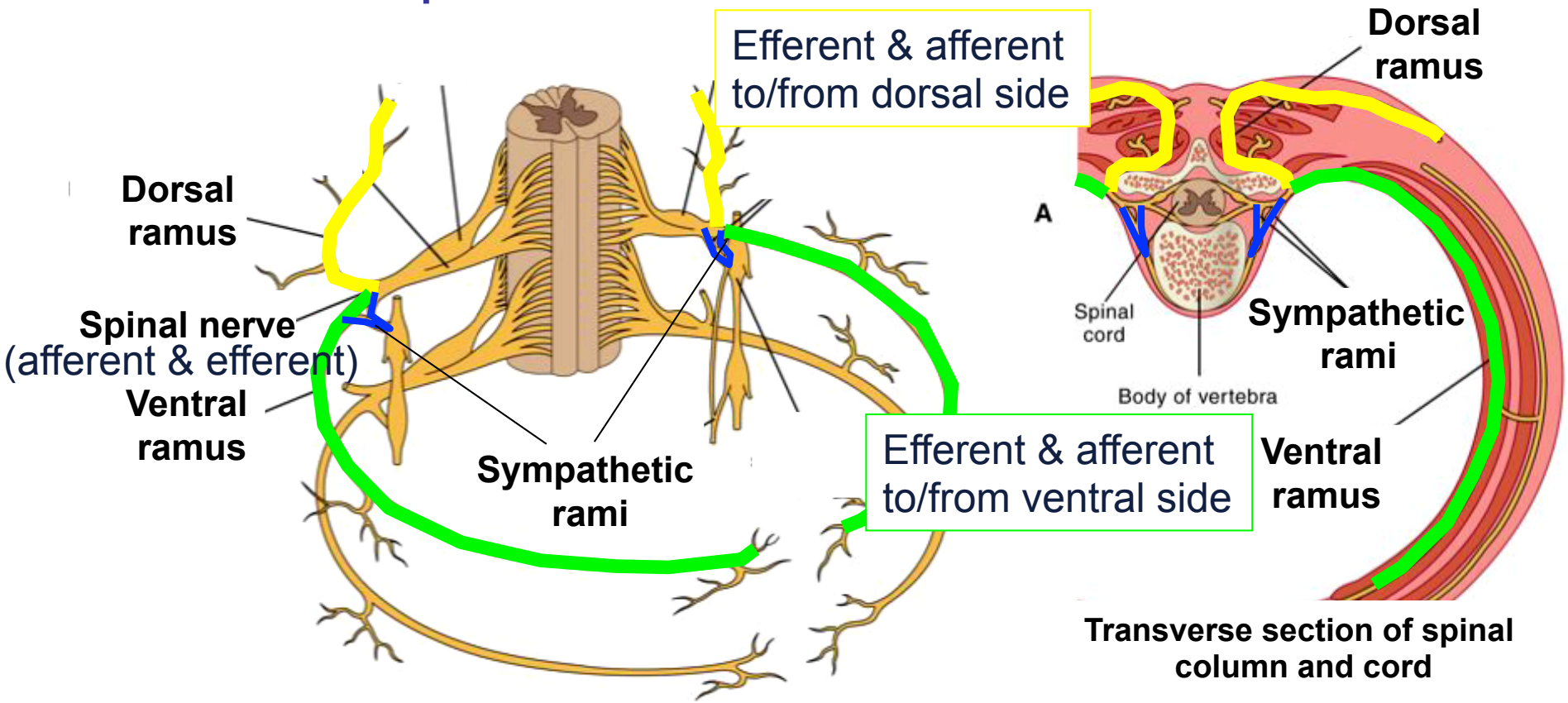
- Roots combine to form a spinal nerve



- Spinal nerves – flow of information 2-way = IN and OUT
  - Spinal nerves are called MIXED nerves

See also Patton and Thibodeau 8th ed Fig 14-6 (7th ed Fig 13-6)

What happens to the spinal nerves once they leave the spinal column?

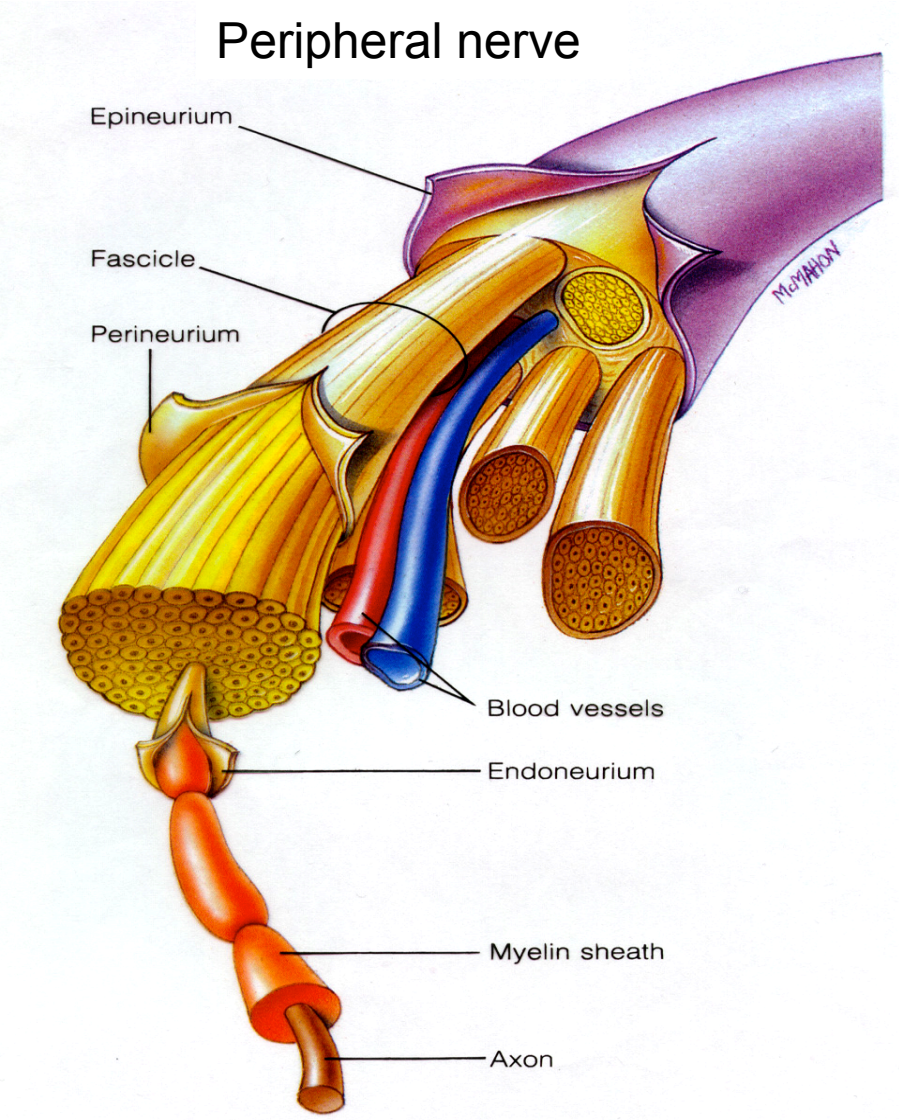


- They break into two branches - ventral and dorsal ramus (ramus = branch; plural 'rami' = branches)
- The ventral ramus communicates with the sympathetic chain via two sympathetic rami

Patton and Thibodeau 8th ed Fig 15-2 (7th ed Fig 14-2)

Structure of a peripheral nerve

- Individual axons may be myelinated or unmyelinated
- Axons are covered with **endoneurium**
- Endoneurium-covered axons (nerve fibers) are bundled together to form a **fascicle**
- Fascicles are covered with **perineurium**
- Fascicles bundle with each other and with blood vessels to form a **nerve**
- Nerves are covered by **epineurium**

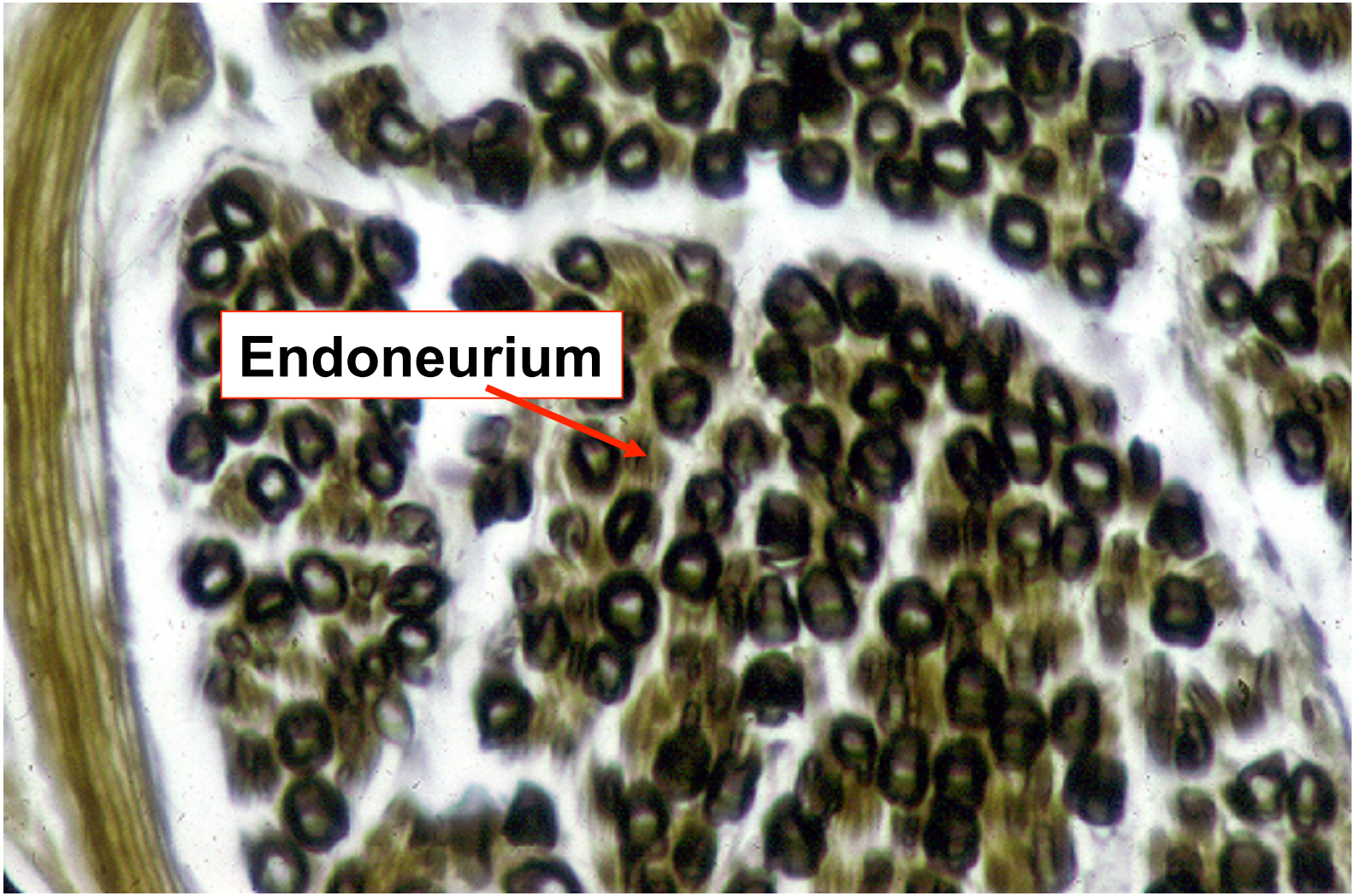


Bundles of axons in the CNS are called a tract

See also: Patton & Thibodeau 8th ed Fig 13-2 (7th ed Fig 12-12)

ENDONEURIUM

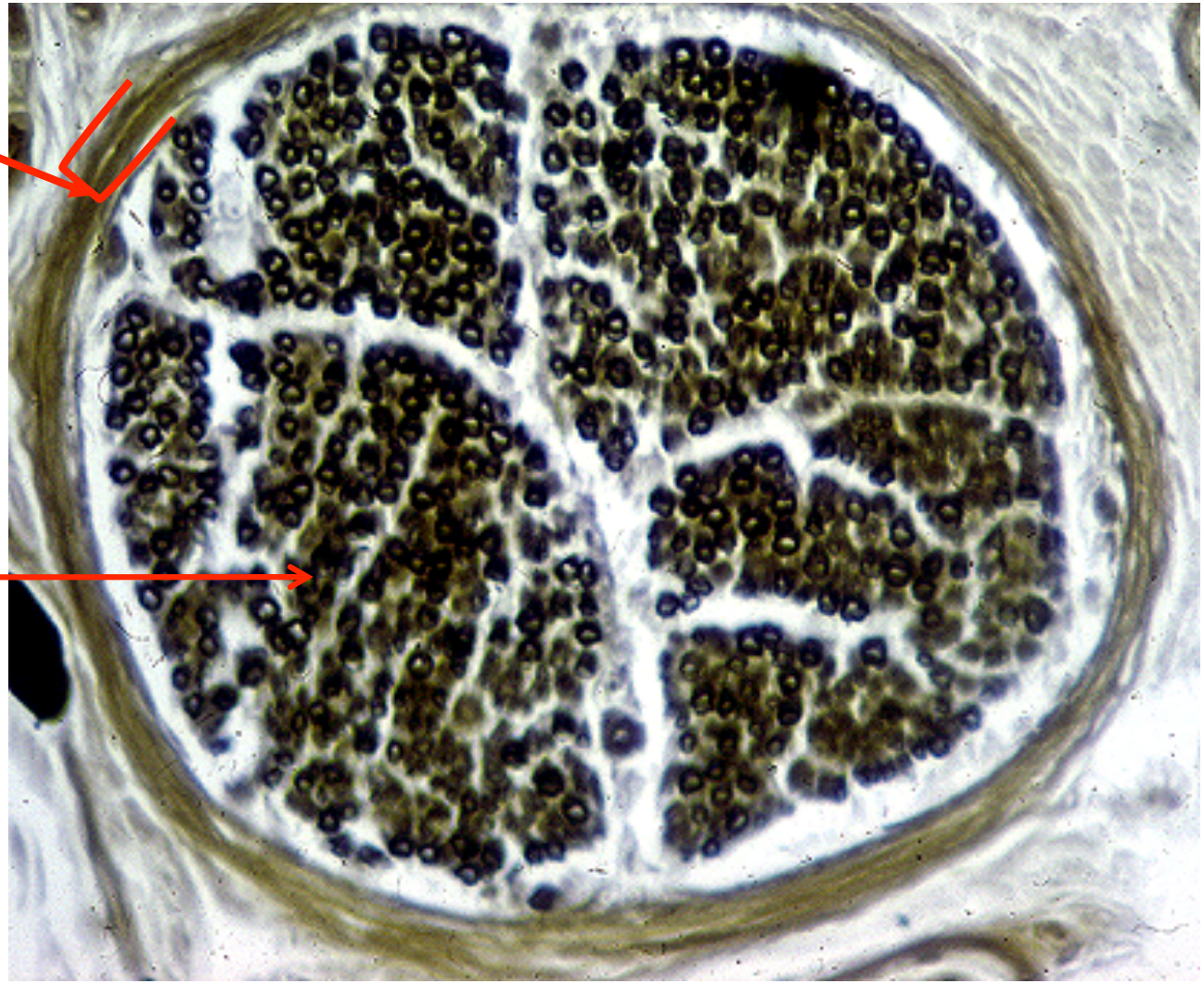
- Surrounds individual axons (myelinated OR unmyelinated)



See also: Patton and Thibodeau 8th ed Fig 13-12B (7th ed Fig. 12-12 B)

PERINEURIUM

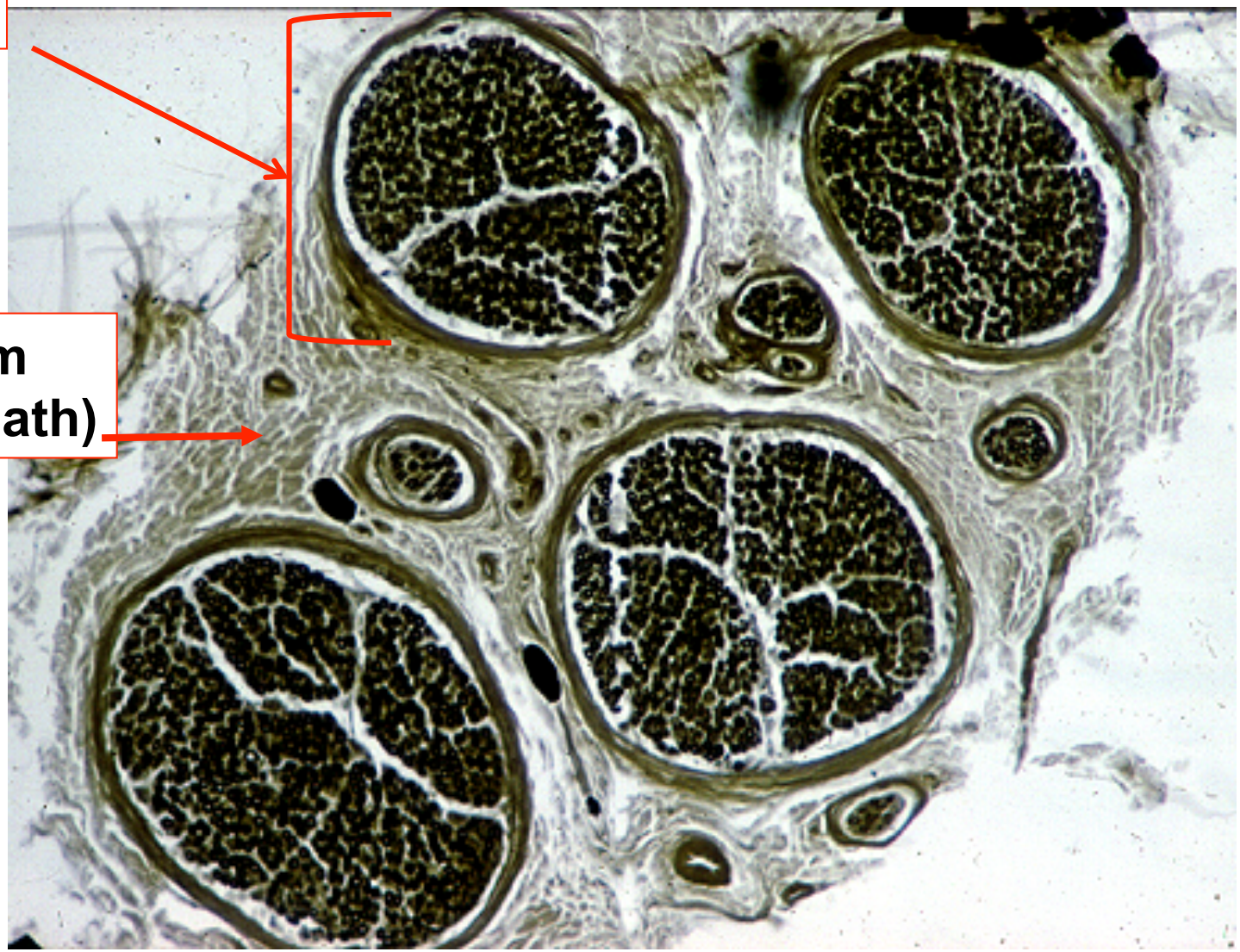
- Surrounds FASCICLES (= bundles of nerve fibers)



See also: Patton and Thibodeau 8th ed Fig 13-12B (7th ed Fig. 12-12 B)

EPINEURIUM

- Surrounds groups of fascicles, plus blood vessels



Equivalent to Patton and Thibodeau 8th ed Fig 13-12B (7th ed Fig. 12-12 B)

Lecture 18: Post-lecture Quiz

• The dorsal white columns are part of:
(a) PNS; (b) spinal nerves; (c) sensory system; (d) efferent system.

• Spinal nerves contain:
(a) Only myelinated axons; (b) only unmyelinated axons; (c) both a & b; (d) filum terminale

• Which of the following is true of the spinal cord
(a) it is part of the PNS; (b) contains spinal nerves; (c) it contains sympathetic nerve fibers; (d) it contains perineurium.

• Which of the following is true of the ventral ramus
(a) it contains only motor information; (b) it contains only sensory information; (c) it is part of the CNS; (d) it contains both efferent and afferent information

HUBS191