

Central Nervous System: Part 2

1. Meninges
2. CSF
3. Spinal Cord and Spinal Nerves

Explain spinal cord anatomy, including gray and white matter and meninges (give the general functions of this organ).

Discuss the structure and functions of the spinal nerves and plexuses.

Describe the structural components of reflexes.

1. Cranial Meninges

Three layers:

1. **Dura mater** - strong, "tough mother"

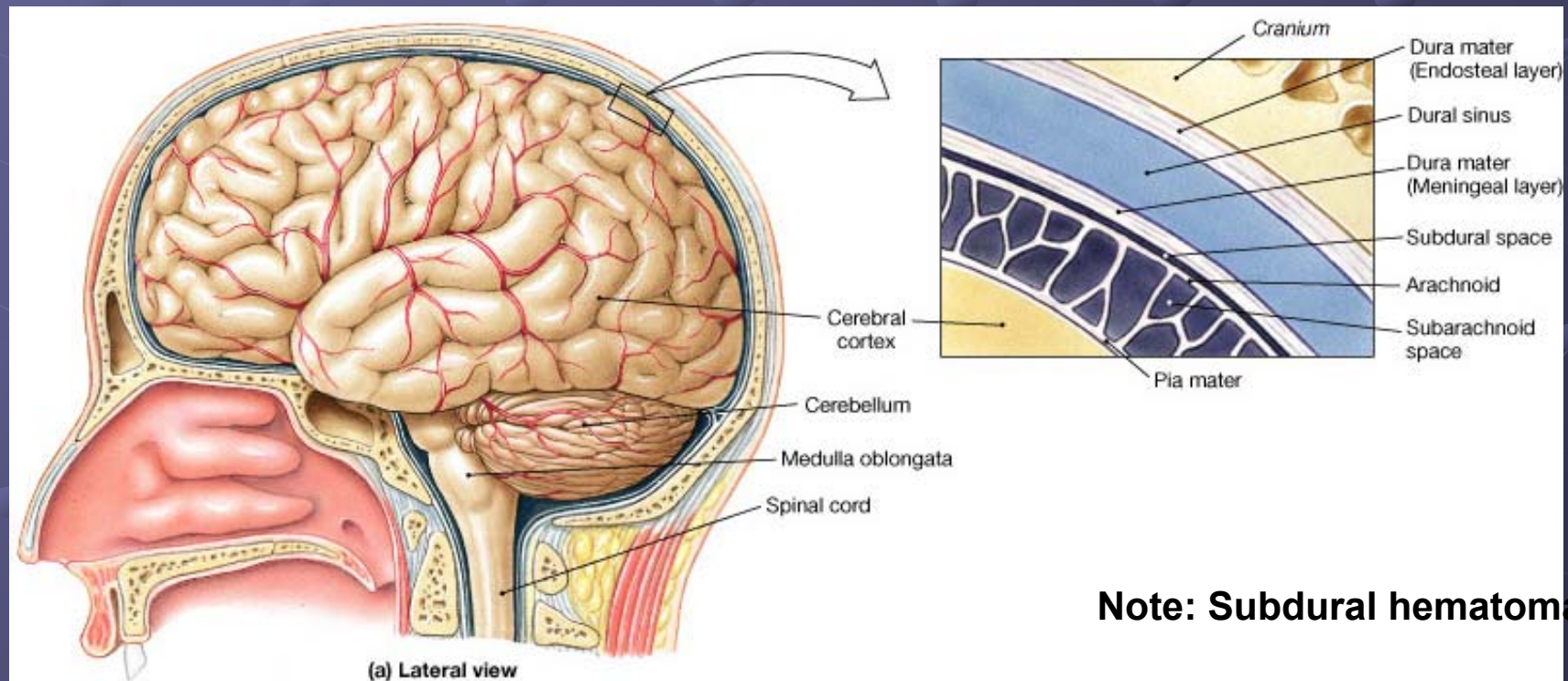
a. falx cerebri

b. falx cerebelli

c. tentorium cerebelli

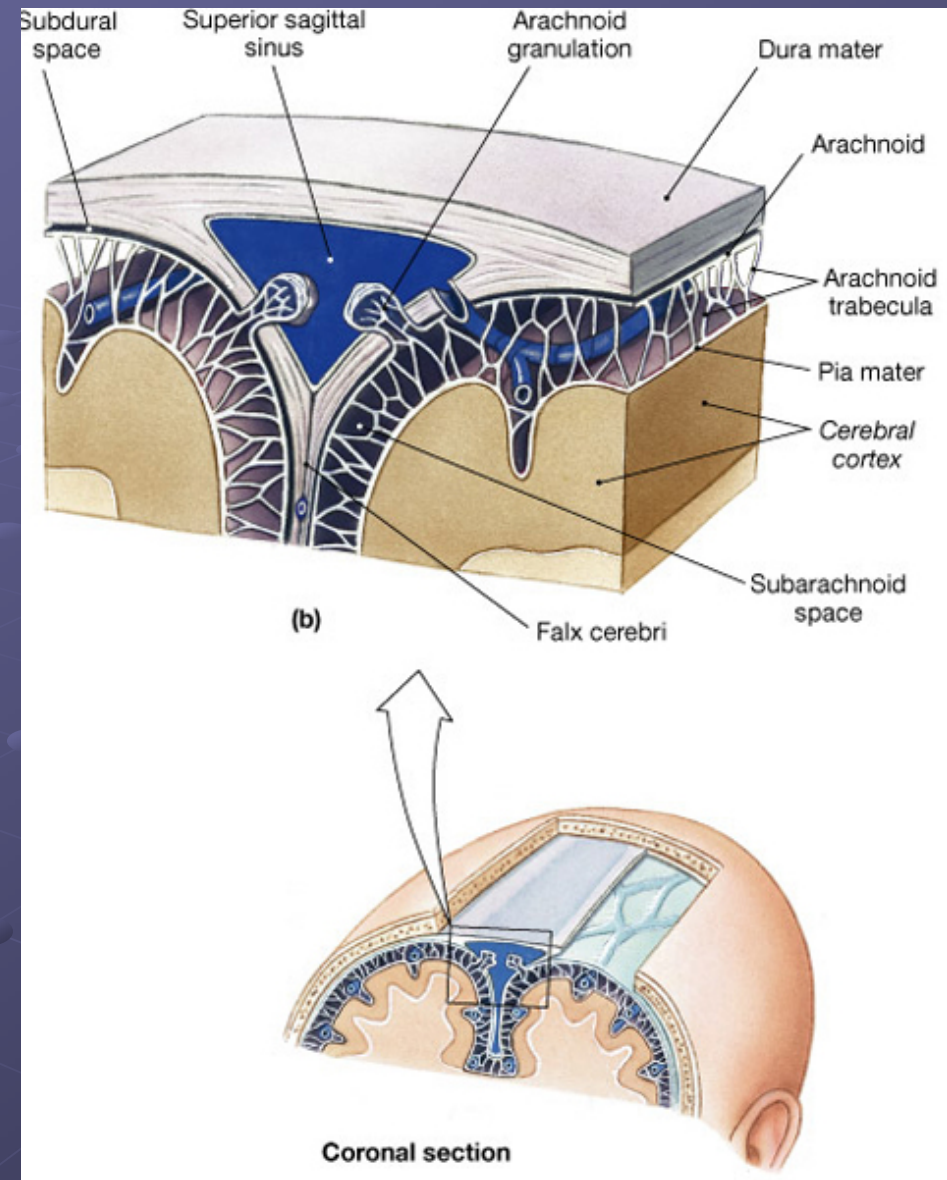
2. **Arachnoid** - spidery, holds blood vessels

3. **Pia mater** - "delicate mother"



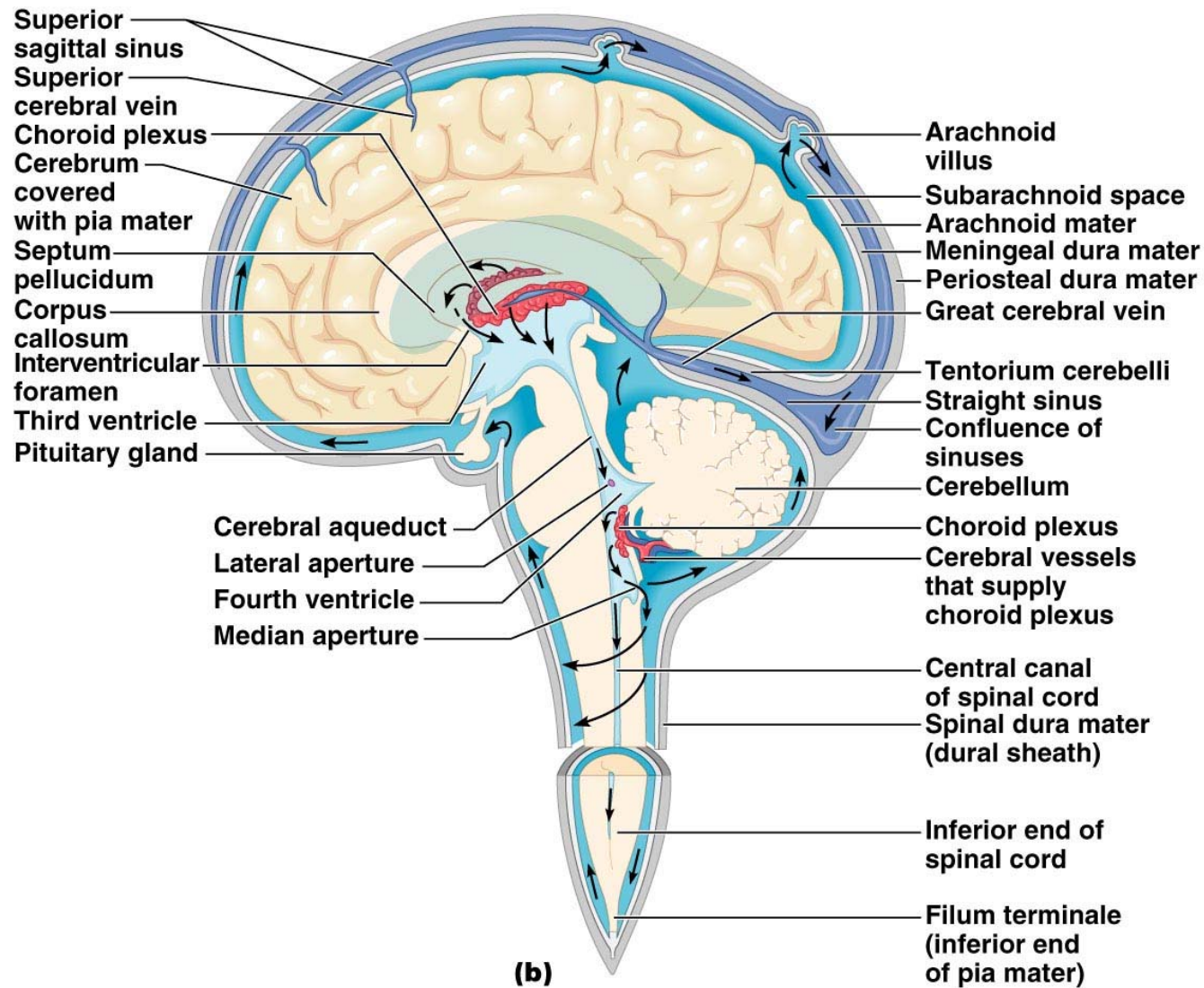
Note: Subdural hematoma

The meninges



2. CSF: Cerebrospinal Fluid

- Formation in ventricles by specialized ependymal cells of **choroid plexus** (~500 mL/day; total volume ~ 150 mL)
- *Functions*
 - transport medium (nutrients, waste)
 - shock absorption
 - buoyancy (floats the brain)
- CSF circulation: Ventricles → central canal → subarachnoid space
- An important diagnostic tool.



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Hydrocephalus?



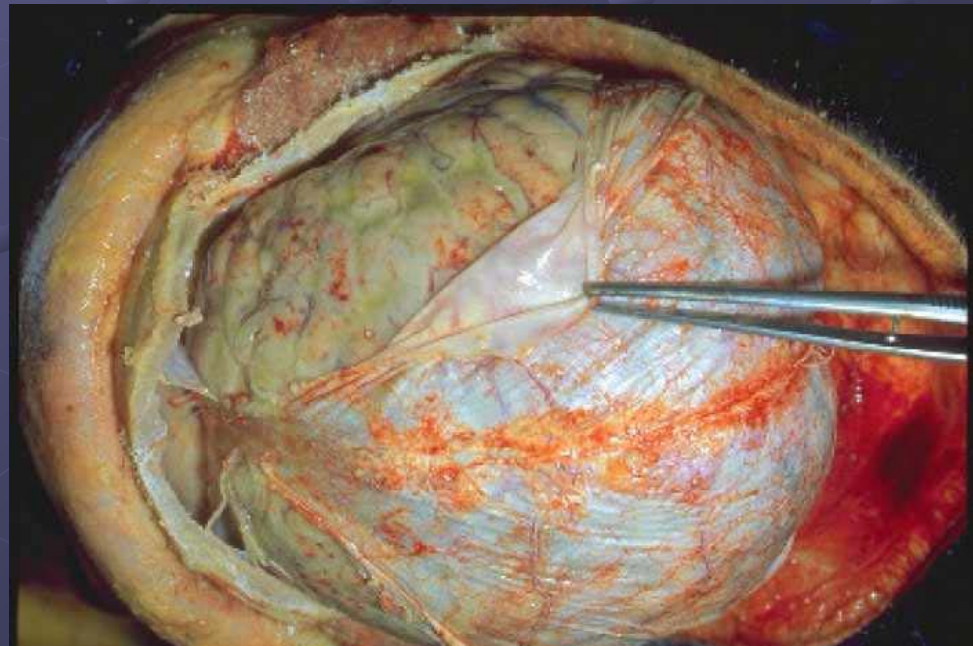
Longitudinal
fissure

The image shows a deep anatomical dissection of the brain, specifically the longitudinal fissure. The upper part of the image shows the surface of the cerebral hemisphere, while the lower part shows the internal structures, including the arachnoid granulations. A white arrow points from the text 'Longitudinal fissure' to the deep groove between the two cerebral hemispheres. The arachnoid granulations are visible as small, white, nodular structures protruding from the arachnoid membrane into the subarachnoid space.

Arachnoid granulations: This is where the CSF produced in the choroid plexuses of the ventricles and which has circulated into the subarachnoid space is reabsorbed.

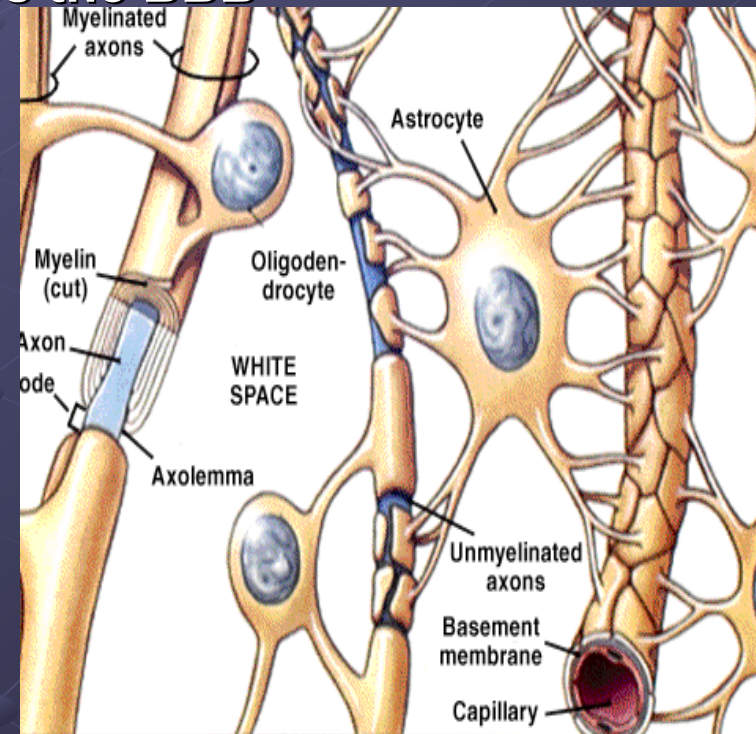
Meningitis: inflammation of meninges/CSF

- Bacterial
 - Relatively rare
 - Life threatening
 - Antibiotics
- Fungal
- Viral—most common
 - Younger
 - Self-resolving



Blood Brain Barrier (BBB)

- Tight Junctions in capillary endothelium prevent passive diffusion into the brain. Lots of Active Transport, especially of H_2O soluble compounds (think glucose).
- Fat soluble compounds readily pass the BBB
 - E.g. steroid hormones, ADEK
- Major role of astrocytes
- *3 areas in brain don't have BBB*
 - portion of hypothalamus
 - pineal gland (in diencephalon)
 - choroid plexus



3. Spinal cord:

- Resides inside vertebral canal
 - **Extends to L1/ L2**
- 31 segments, each associated with a pair of dorsal root ganglia
- Two enlargements
 - **Cervical and Lumbar**
- **Conus medullaris**
- **Cauda Equina**
- **Filum Terminale**

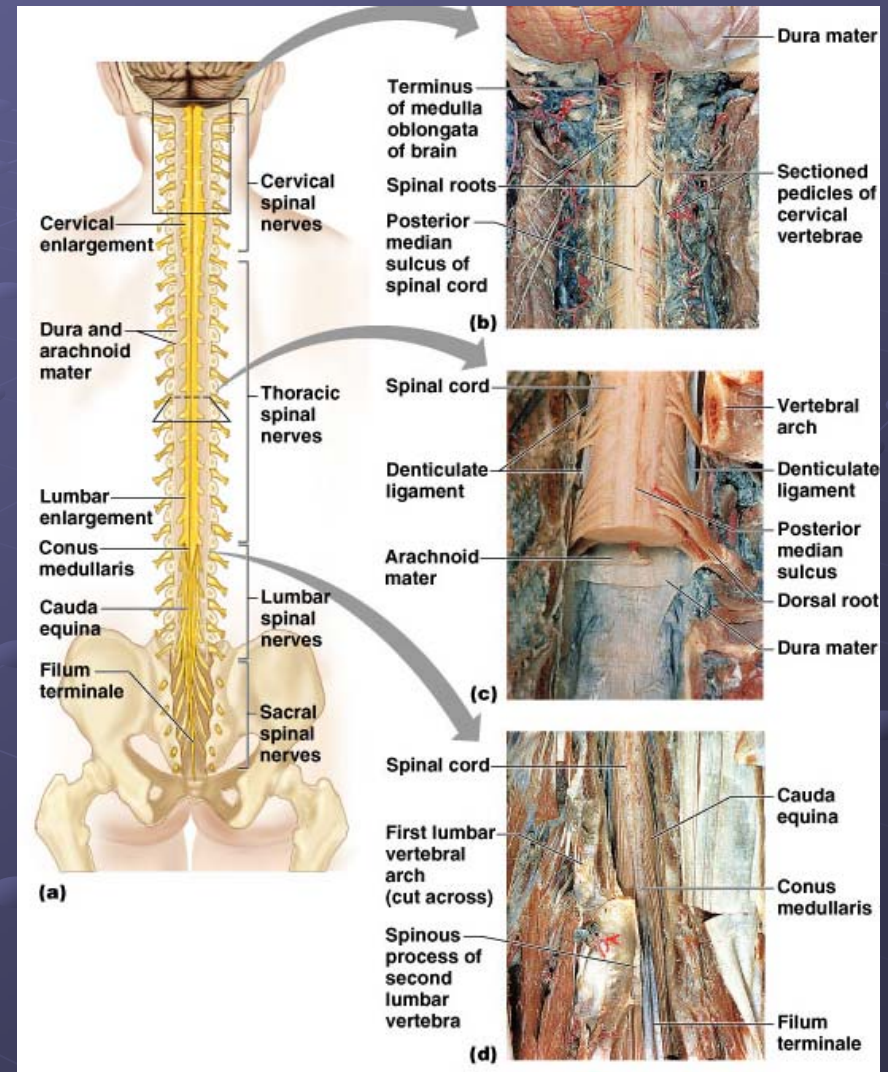
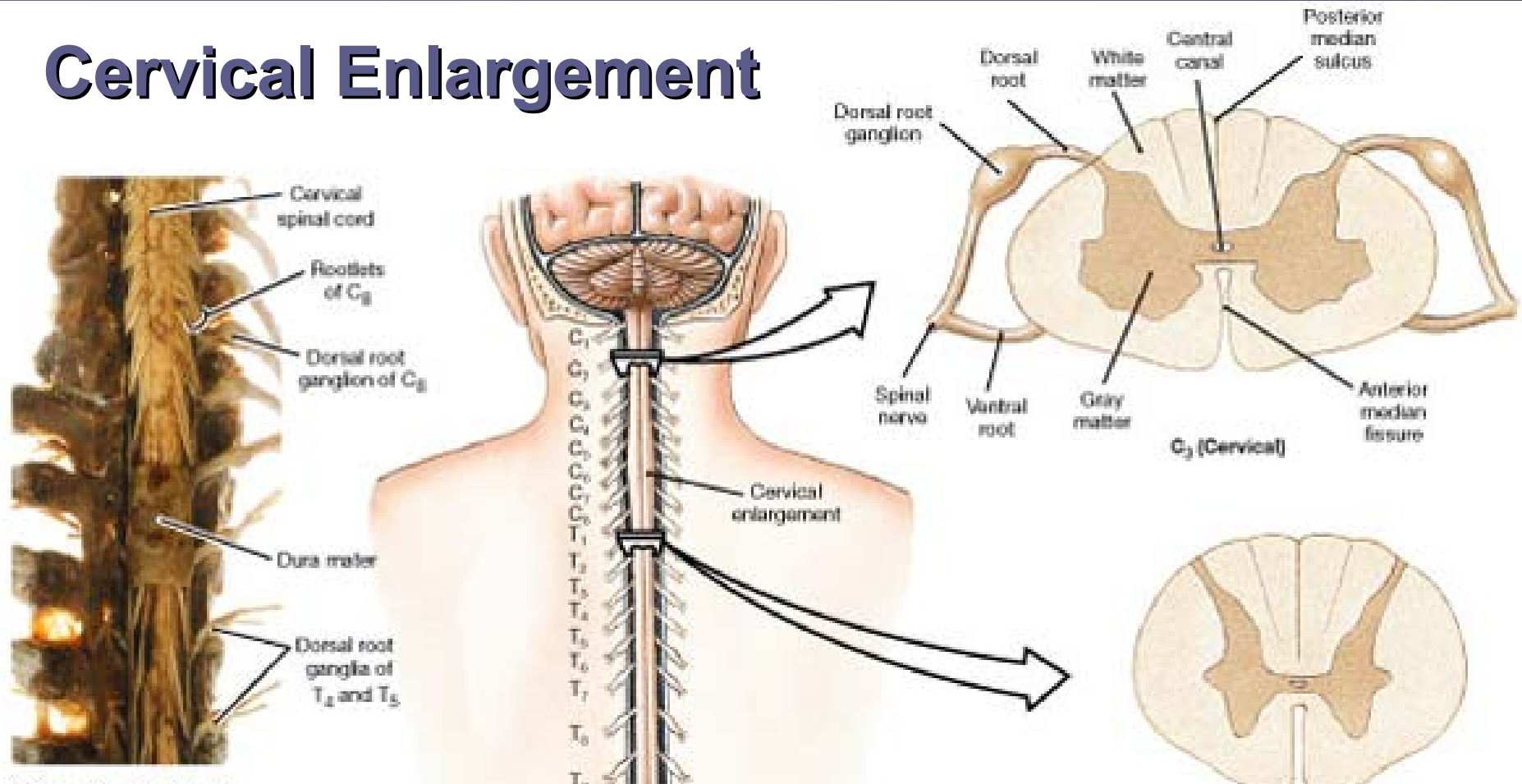


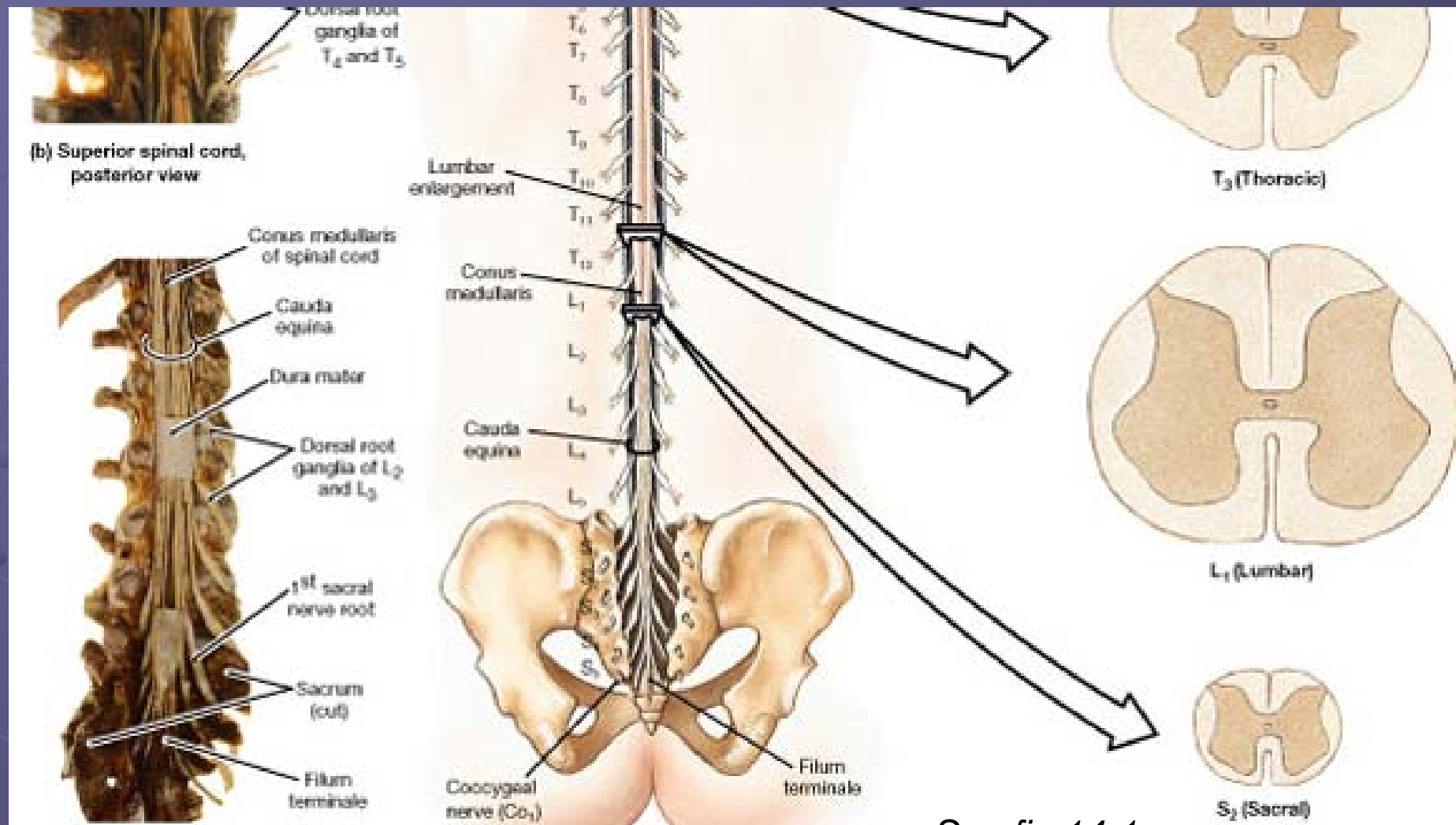
Fig. 13-29

Cervical Enlargement



Gray matter expanded to incorporate more sensory input from limbs and more cell bodies for motor control of limbs

Lumbar Enlargement



See fig 14-1

Spinal Meninges

Three membranes surround all of CNS

1) **Dura mater** - "tough mother", strong. Note the Epidural Space.

2) **Arachnoid** - spidery looking, carries blood vessels, etc. Note the Subarachnoid space which contains CSF

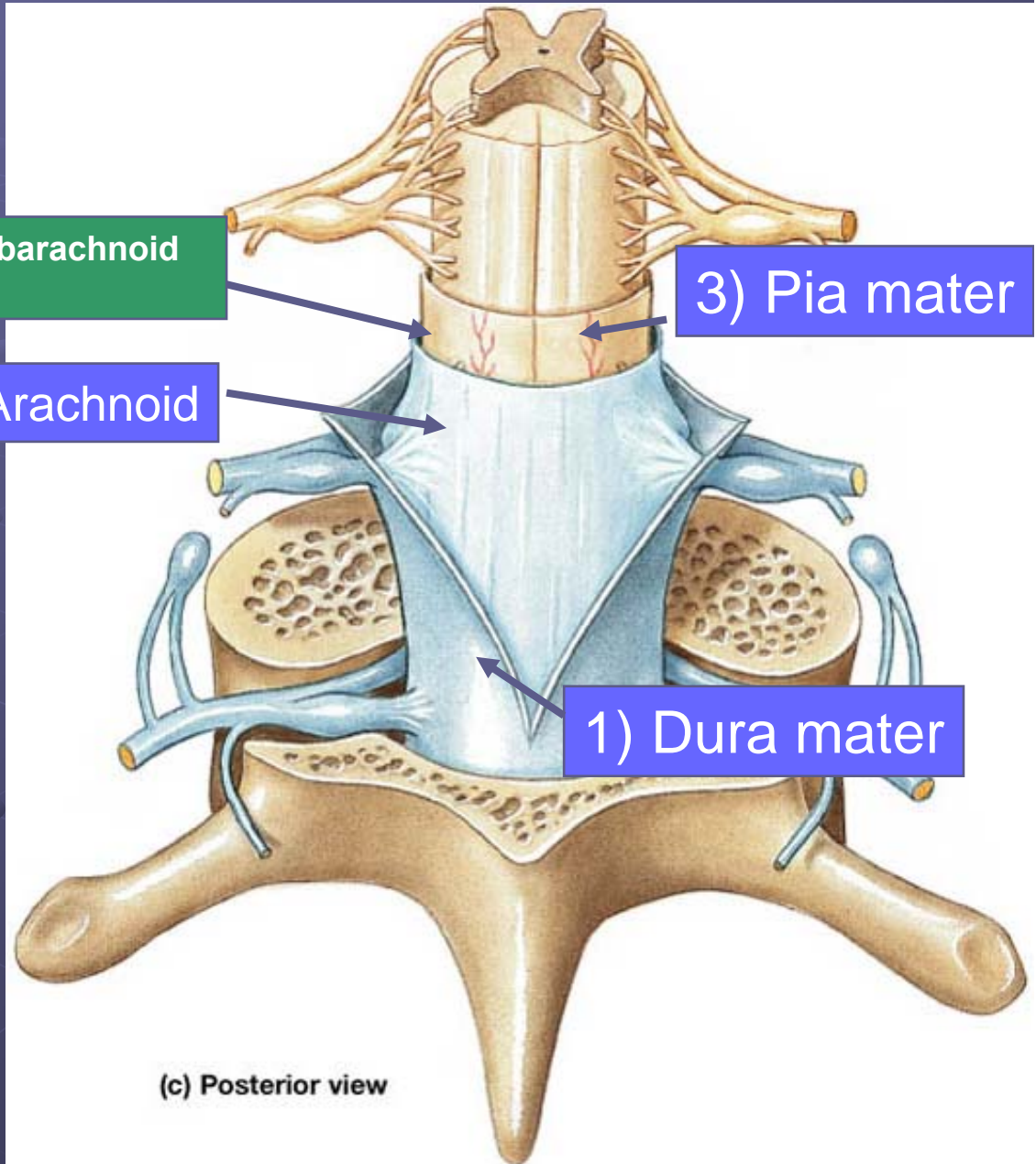
3) **Pia mater** - "delicate mother", adheres tightly to surface of spinal cord

2a) Subarachnoid Space

2) Arachnoid

3) Pia mater

1) Dura mater



(c) Posterior view

Transverse Section

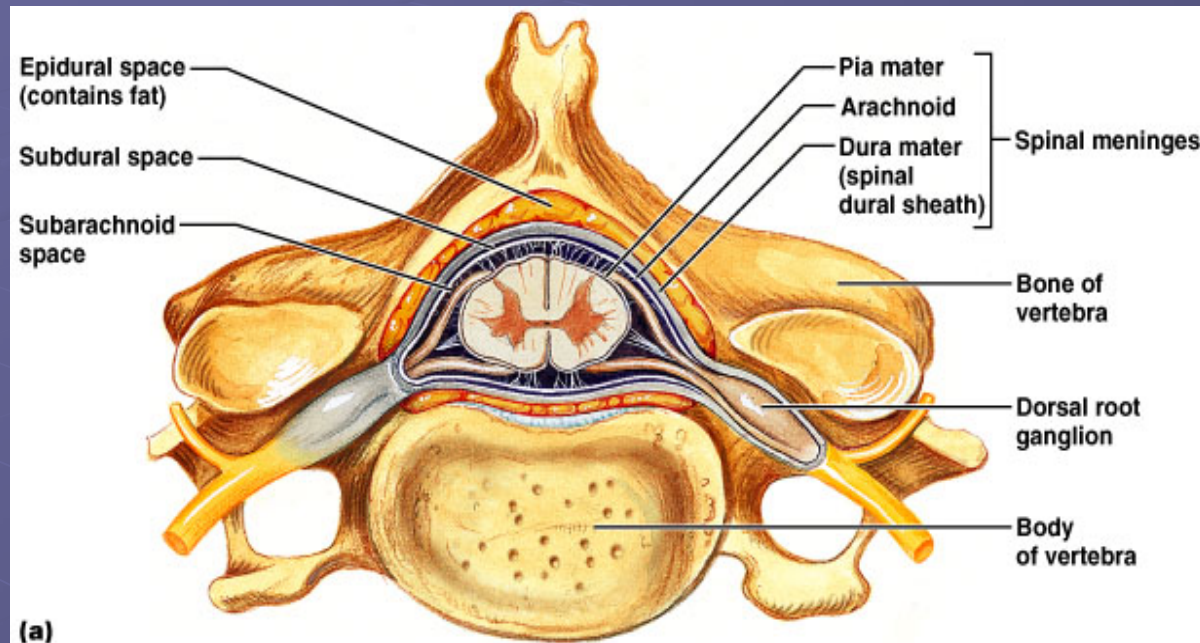


Fig 13.30

Compare the spinal roots with the model of the vertebral column in the lab. Note that the dura covers both the dorsal and ventral roots.

Organization of Spinal Cord

Gray matter - interior horns

posterior - somatic and visceral sensory nuclei

anterior (and lateral) gray horns – somatic and visceral motor control

gray commissures - axons carrying information from side to side

White matter - tracts or columns

posterior white column -

anterior white column

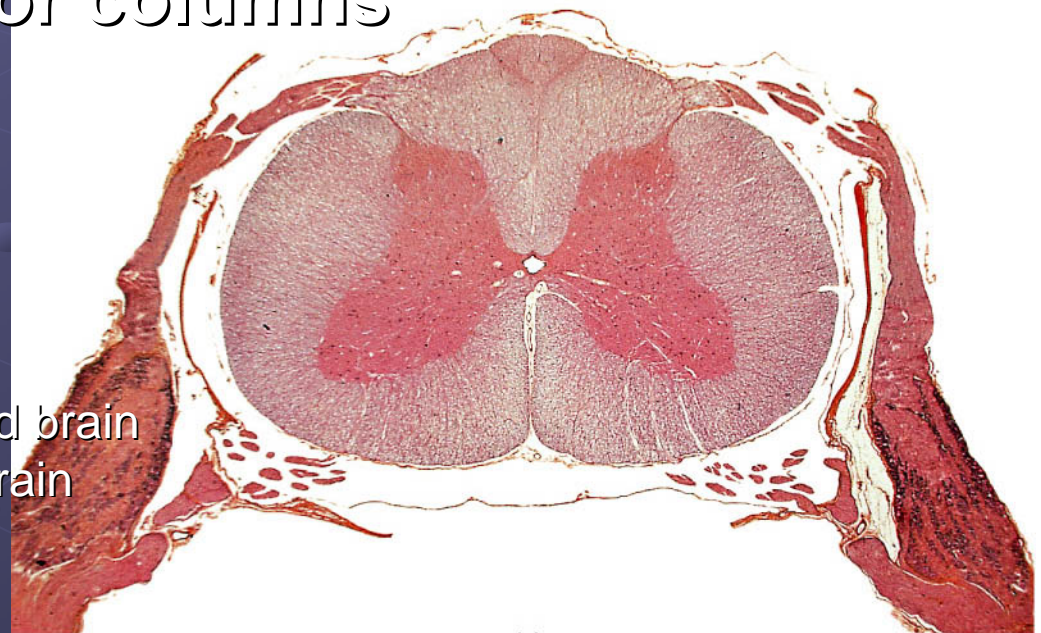
lateral white column

anterior white commissure

functions

ascending tracts - sensory toward brain

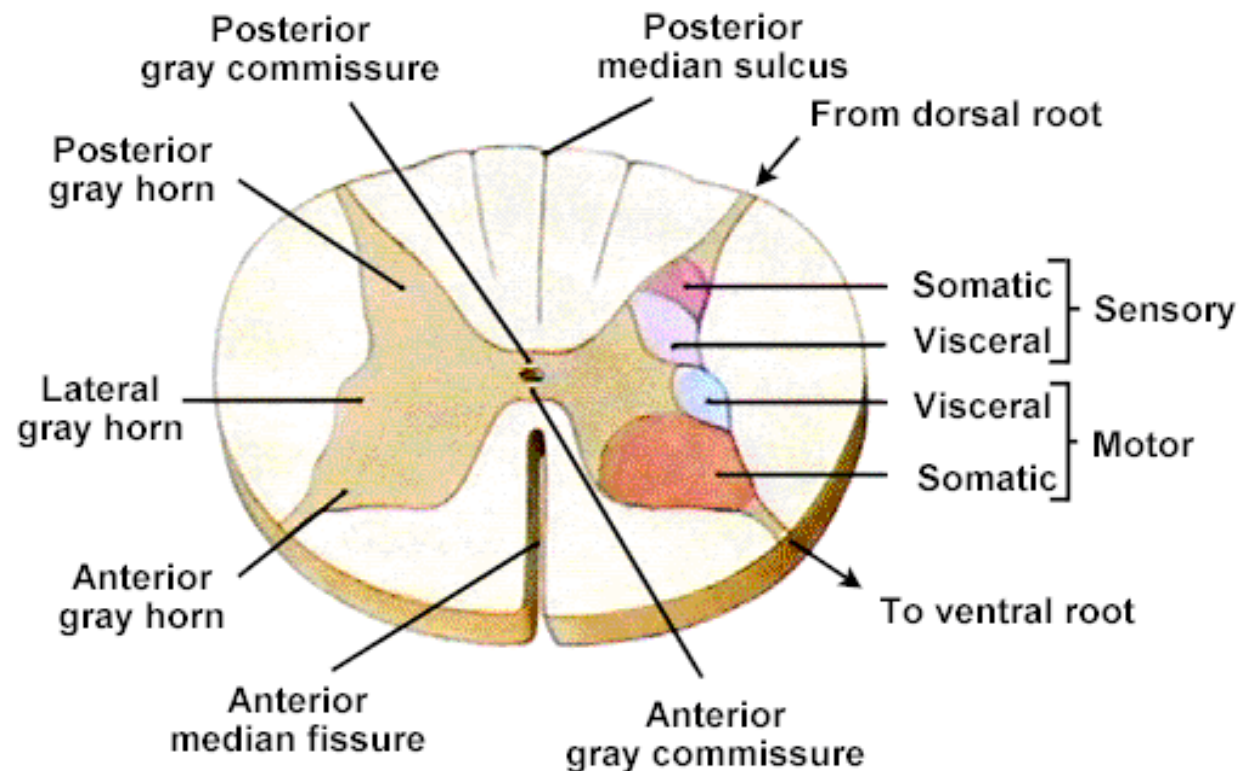
descending tracts - motor from brain



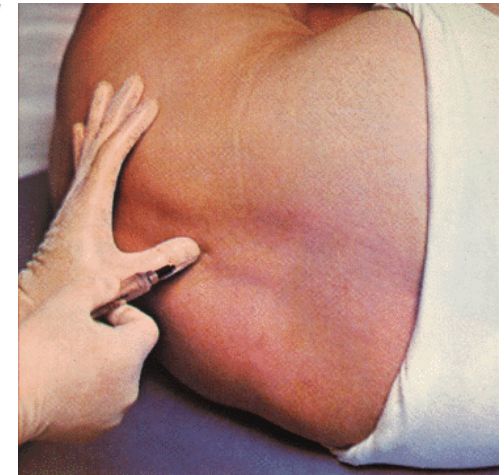
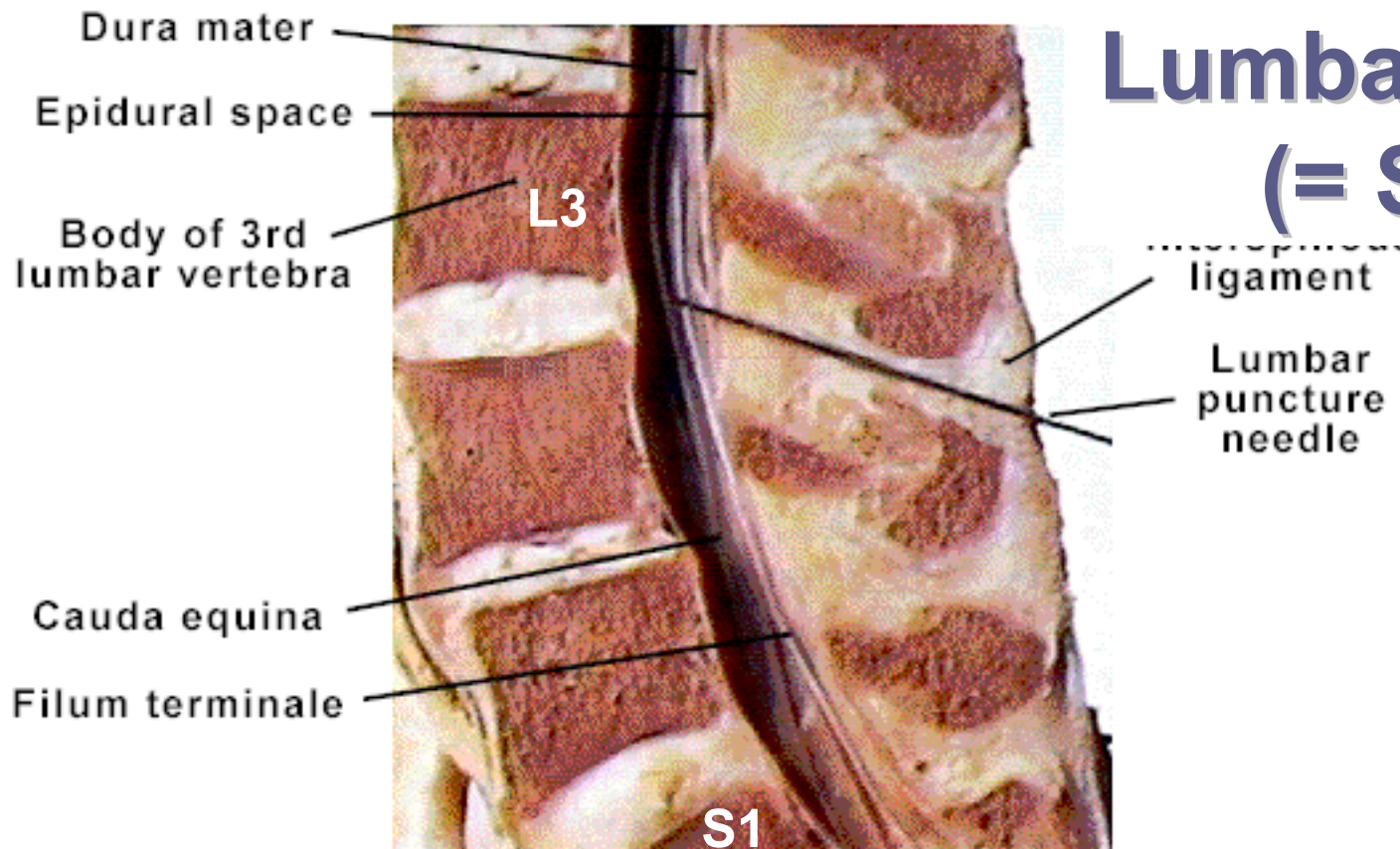
(a)

Sectional anatomy of spinal cord

Outer white part; inner gray butterfly



Lumbar Puncture (= Spinal Tap)



For clinical examination of CSF or administration of radiopaque dyes, drugs and anesthetics

However: mostly “epidurals” for anesthetics



Organization of Spinal Nerves:

1. **Root** – inside vertebral canal
 - a. dorsal sensory root with a ganglion
 - b. ventral motor root
2. **Mixed spinal nerve**
3. **Rami**
 - a. dorsal - mixed to skin and muscles of back
 - b. ventral - mixed “spinal nerve” to ventrolateral body surfaces and limbs
 - c. *white ramus communicans* motor ANS
 - d. *gray ramus communicans* motor ANS

Reflexes

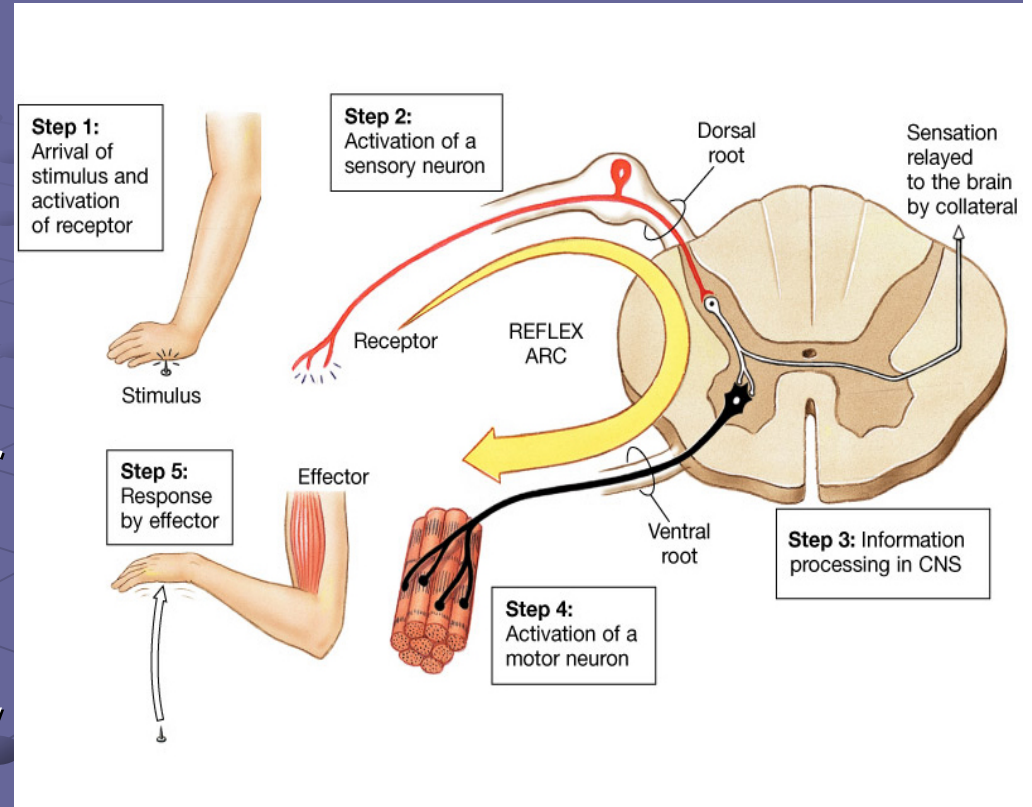
Fast, preprogrammed, inborn, automatic responses

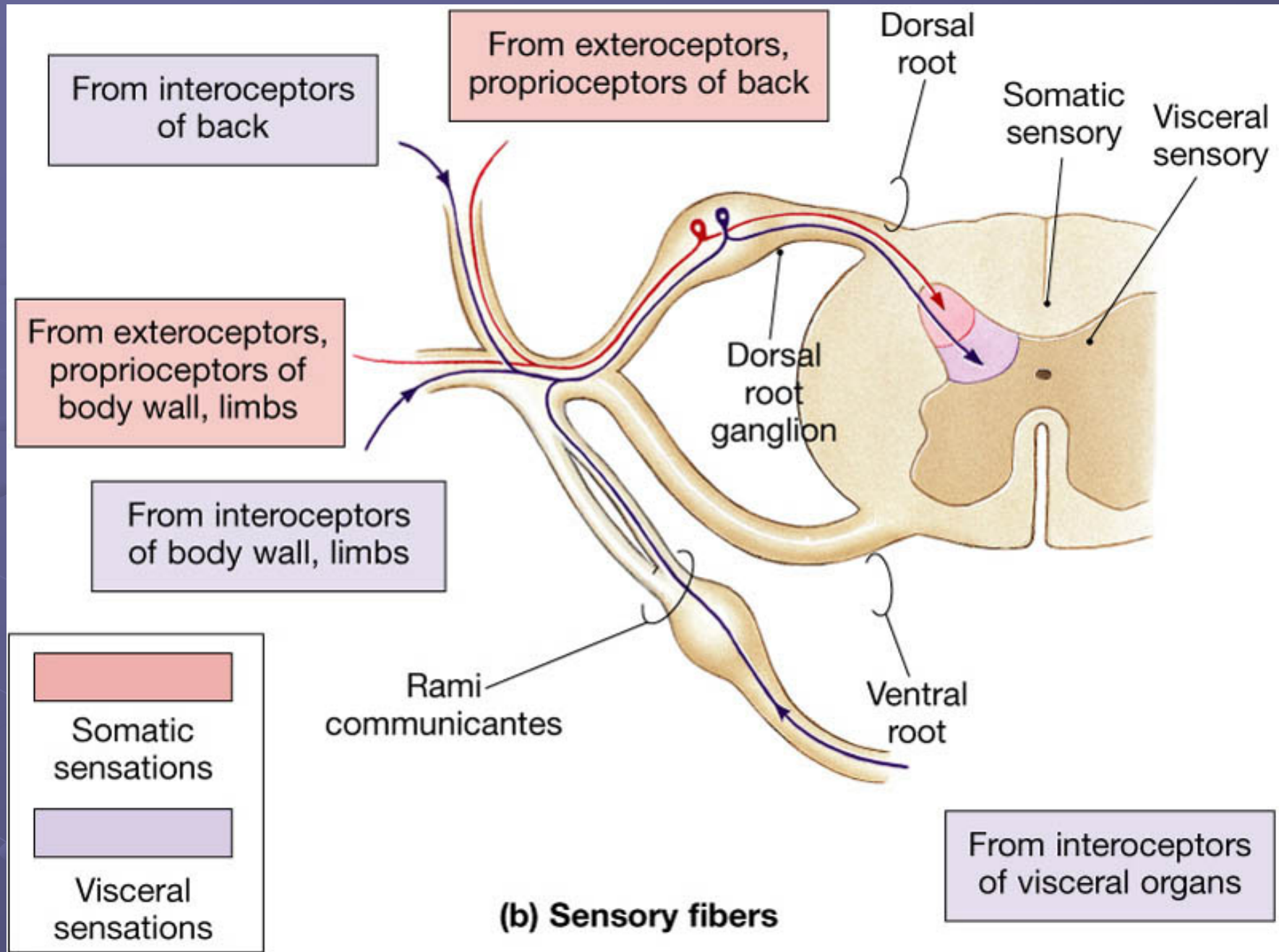
Occur in the CNS at the spinal cord or brainstem levels (cranial nerves)

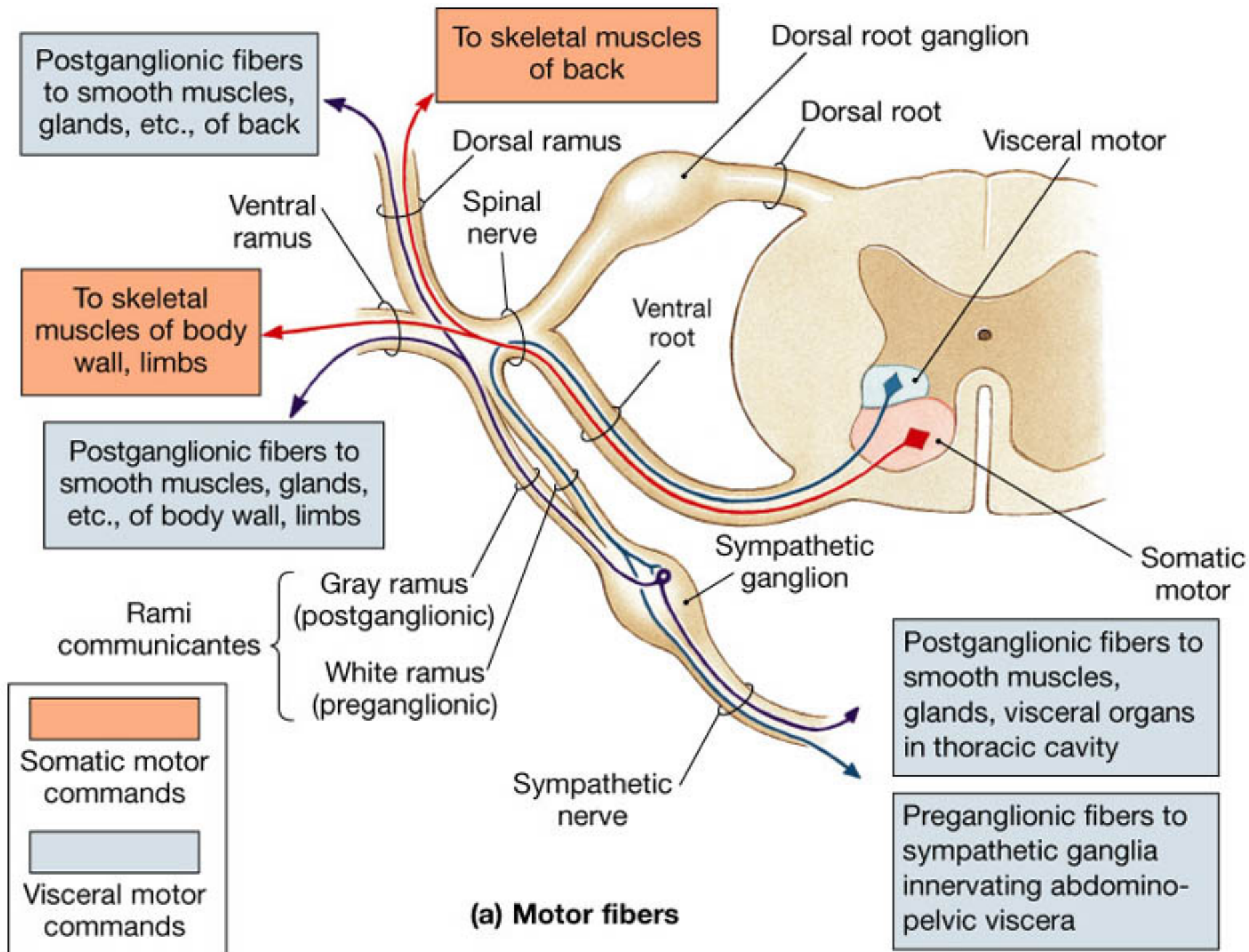
May be either monosynaptic or polysynaptic

All require

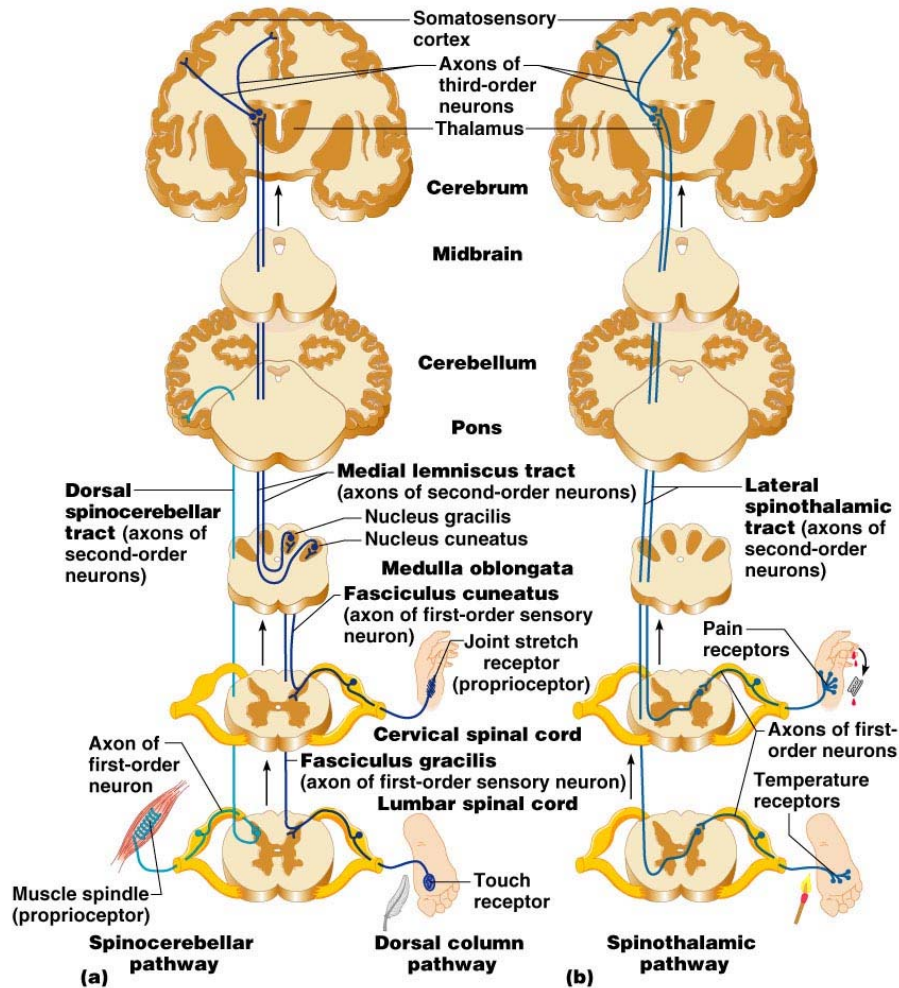
- stimulus at receptor
- sensory information relay
- processing at CNS level
- activation of motor response
- response of peripheral effector



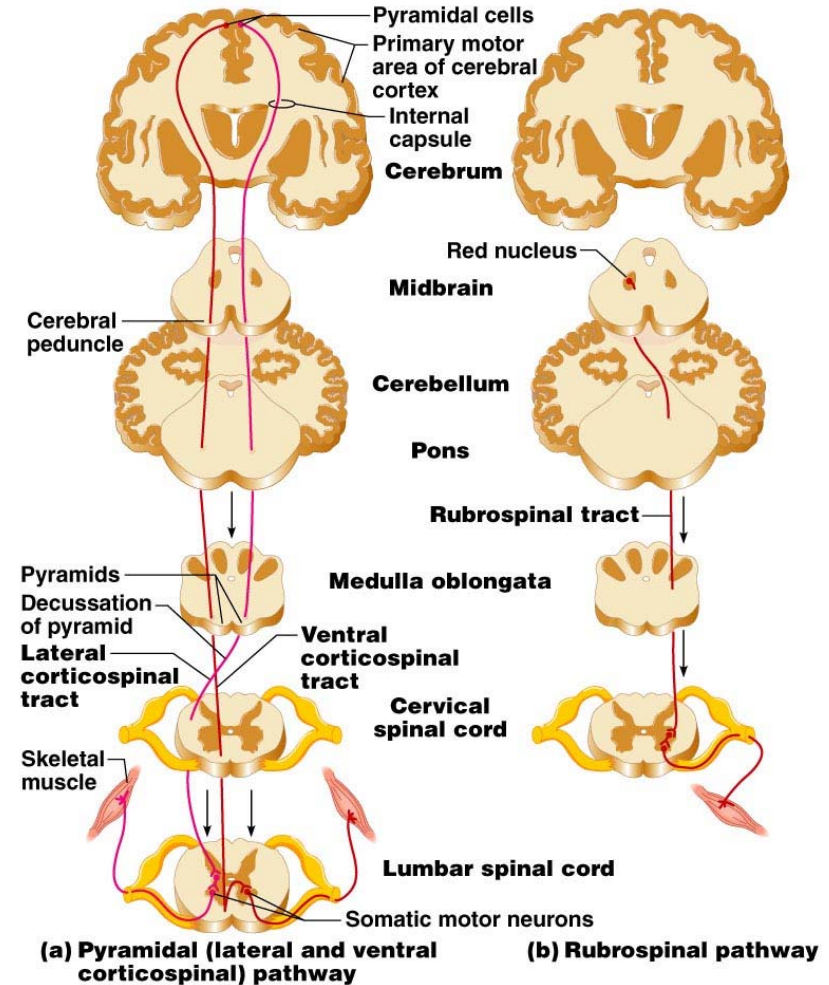




Ascending and Descending Tracts



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Dermatomes

- **Sensory innervations by specific spinal nerves** \Rightarrow Each pair of spinal nerves monitors specific region of body surface.

