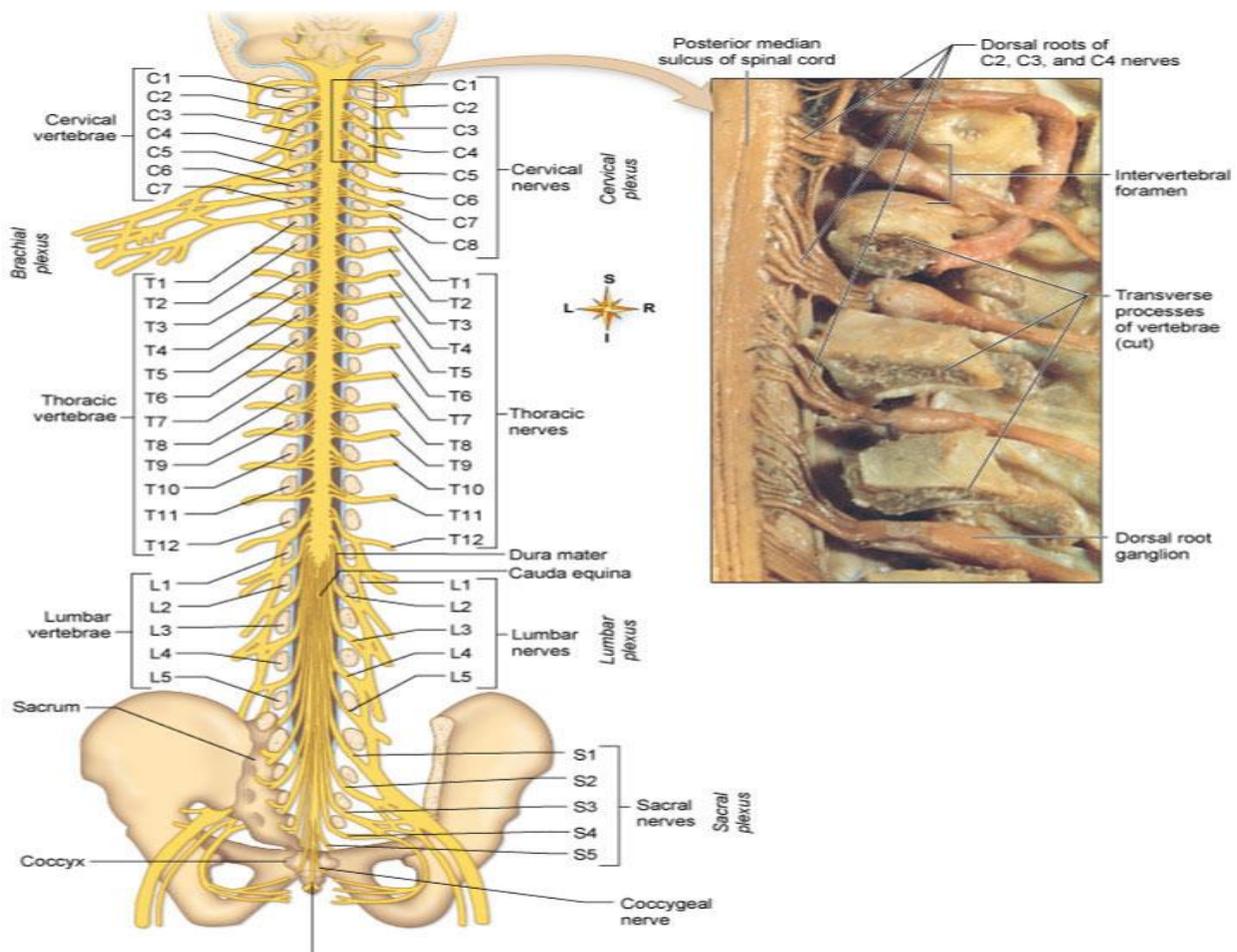


Peripheral Nervous System

Dr. Gary Mumaugh

Spinal Nerves Overview

- Thirty-one pairs of spinal nerves are connected to the spinal cord
- No special names; numbered by level of vertebral column at which they emerge from the spinal cavity
 - Eight cervical nerve pairs (C1 through C8)
 - 12 thoracic nerve pairs (T1 through T12)
 - Five lumbar nerve pairs (L1 through L5)
 - Five sacral nerve pairs (S1 through S5)
 - One coccygeal nerve pair
- Lumbar, sacral, and coccygeal nerve roots descend from point of origin to the lower end of the spinal cord (level of first lumbar vertebra) before reaching the intervertebral foramina of the respective vertebrae, through which the nerves emerge
- Cauda equina describes the appearance of the lower end of the spinal cord and its spinal nerves as a horse's tail

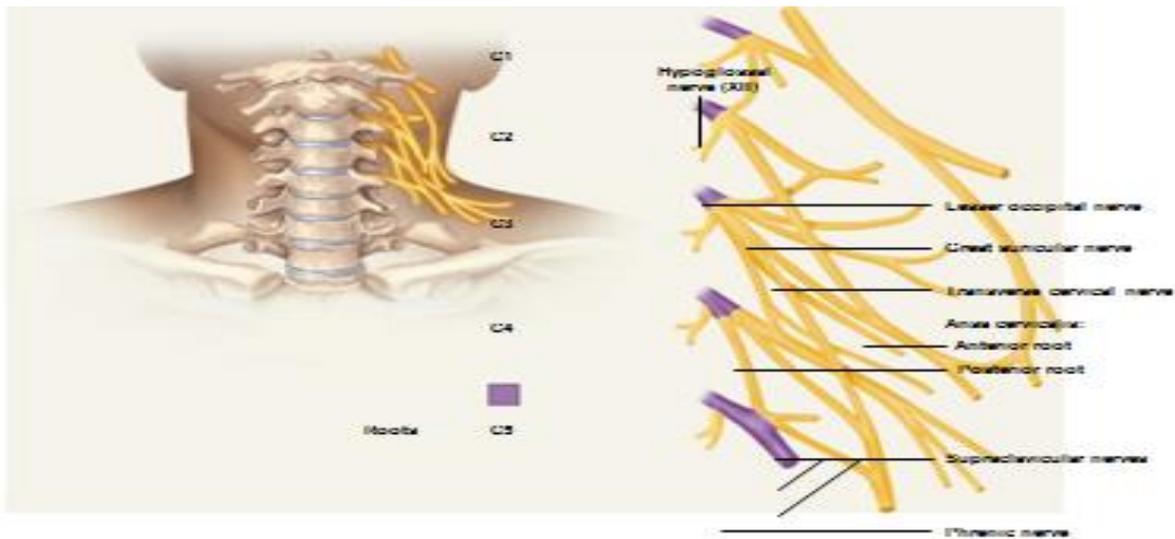


Spinal Nerves: Plexuses

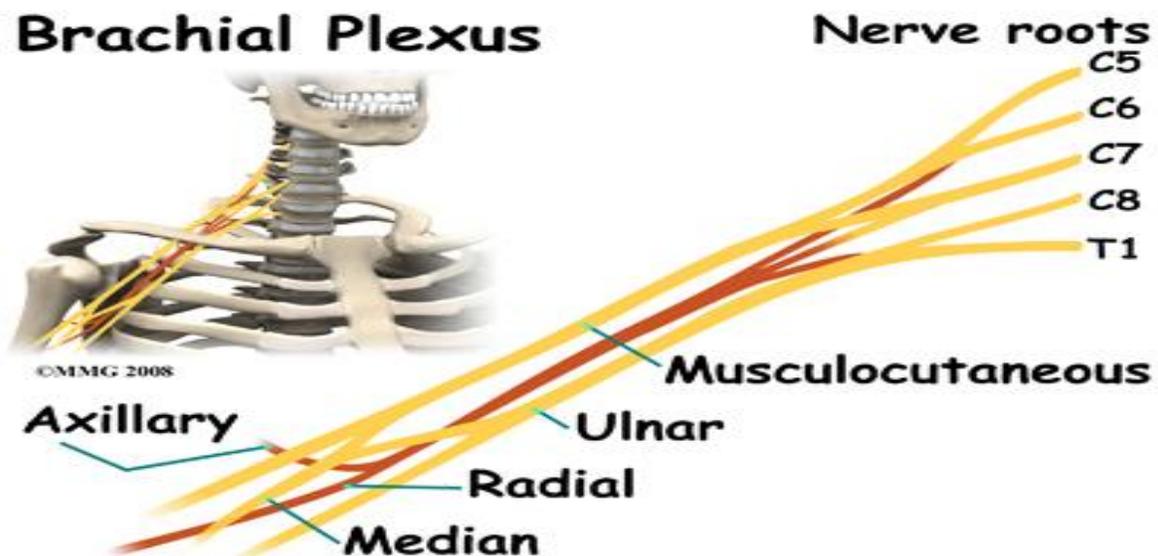
- Plexus: complex network formed by the ventral rami of most spinal nerves
- In plexuses, spinal nerve fibers are rearranged according to their ultimate destination, reducing the number of nerves needed to supply each body part

Four major pairs of plexuses

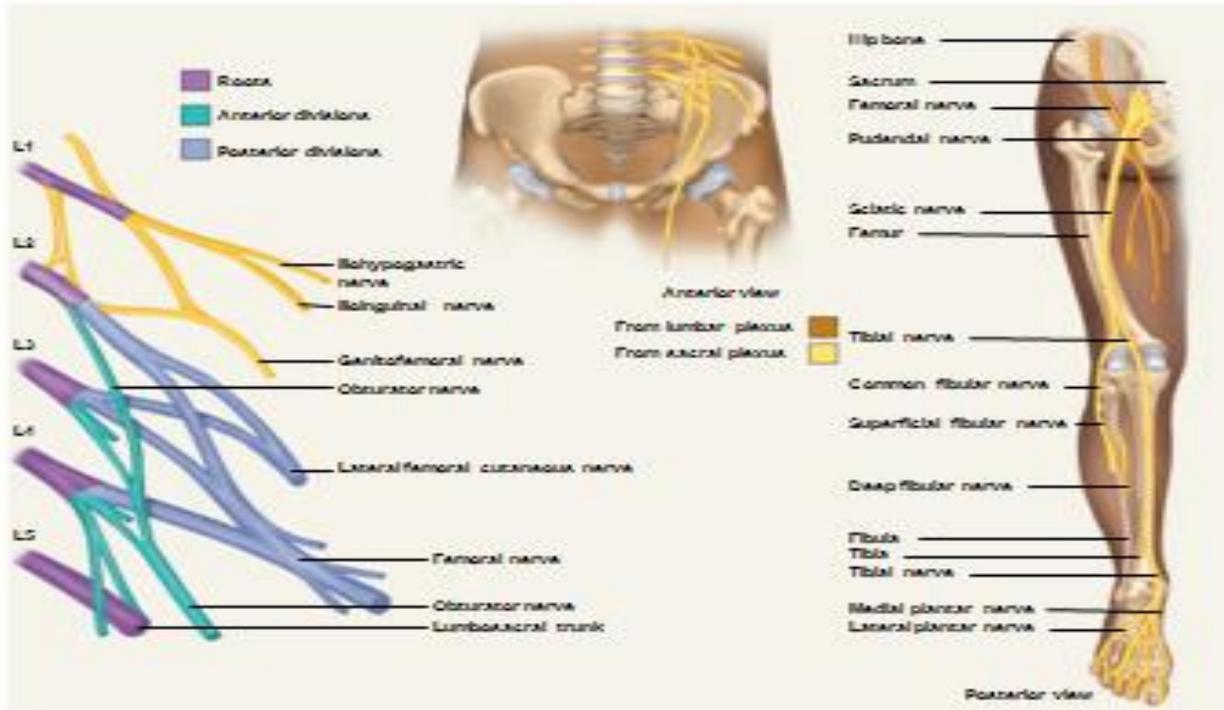
- Cervical plexus C1-C5
 - Located deep within the neck to the muscles and skin of the neck, upper shoulders, and part of the head
 - Phrenic nerve exits the cervical plexus and innervates the diaphragm



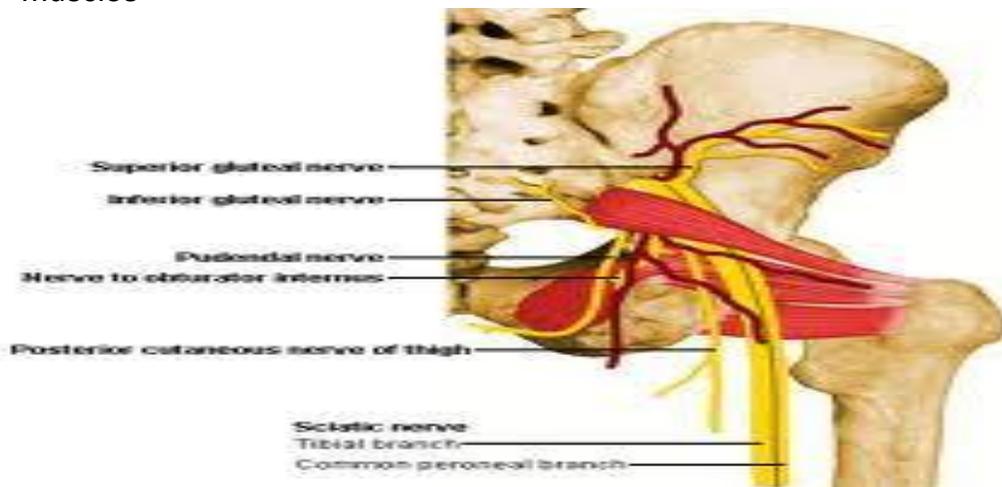
- Brachial plexus C5-T1
 - Located deep within the shoulder to the lower part of the shoulder and the entire arm



- Lumbar plexus L1-L5
 - Located in the lumbar region of the back in the psoas muscle
 - Formed by intermingling fibers of L1 through L5
 - Femoral nerve exits the lumbar plexus, divides into many branches, and supplies the thigh and leg

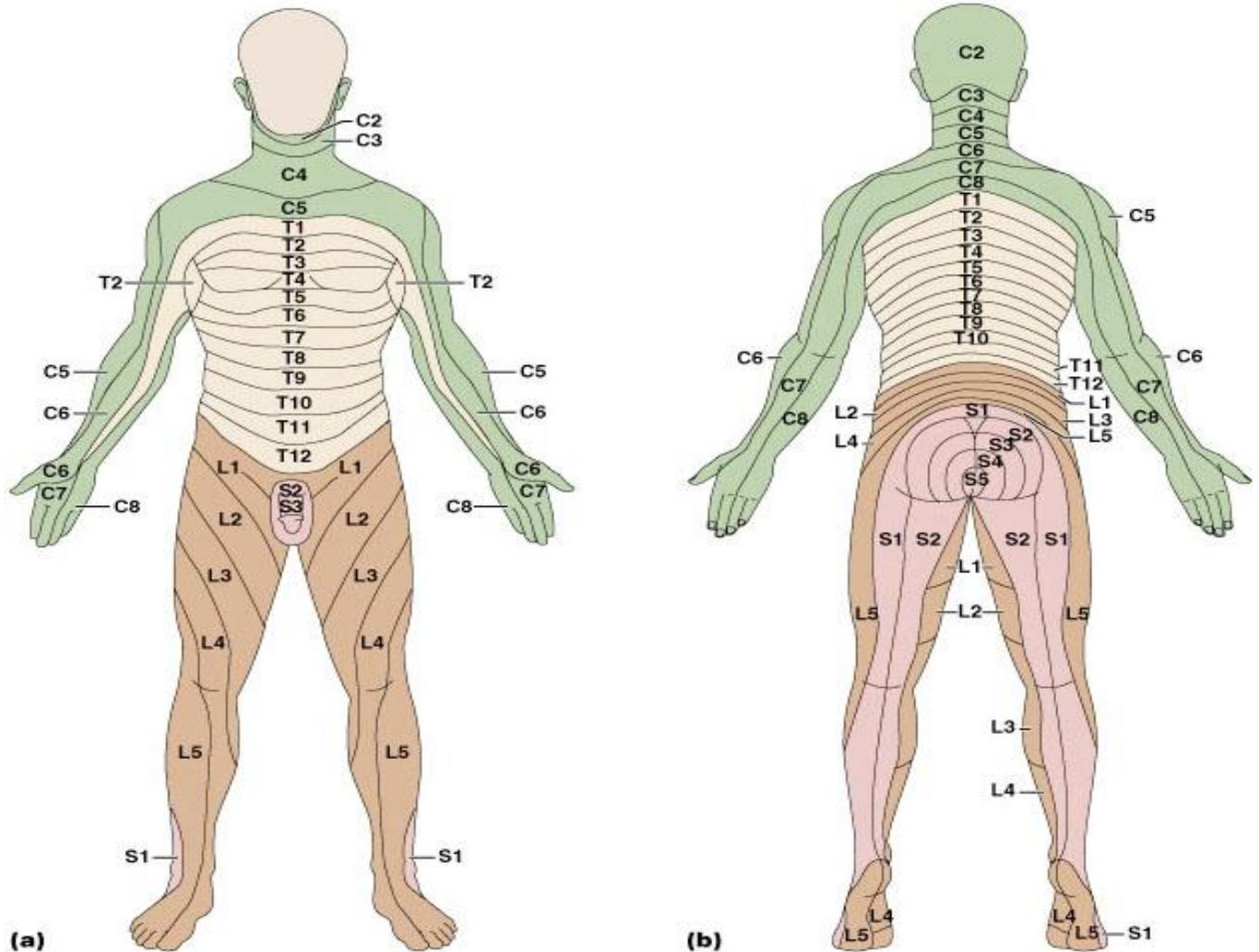
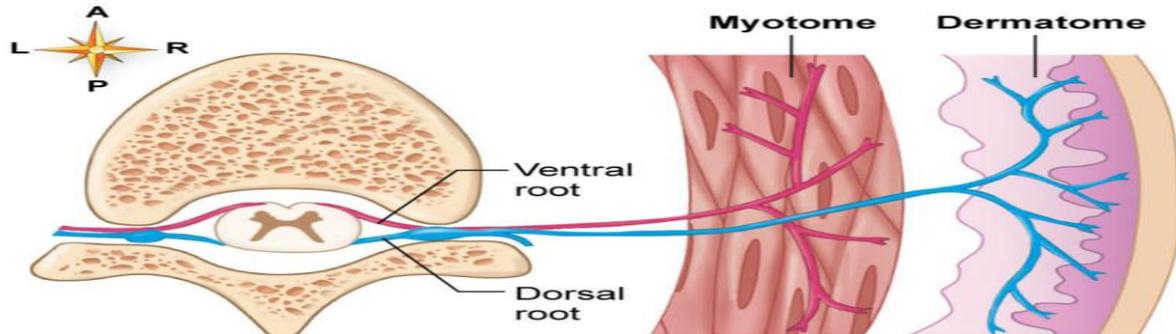


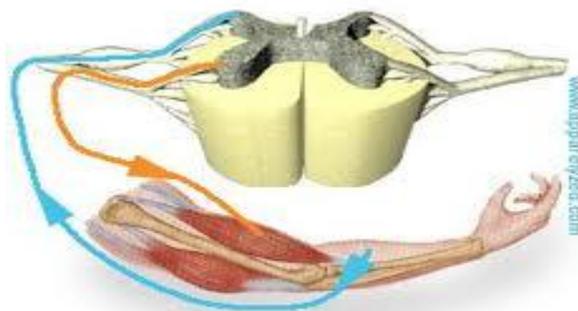
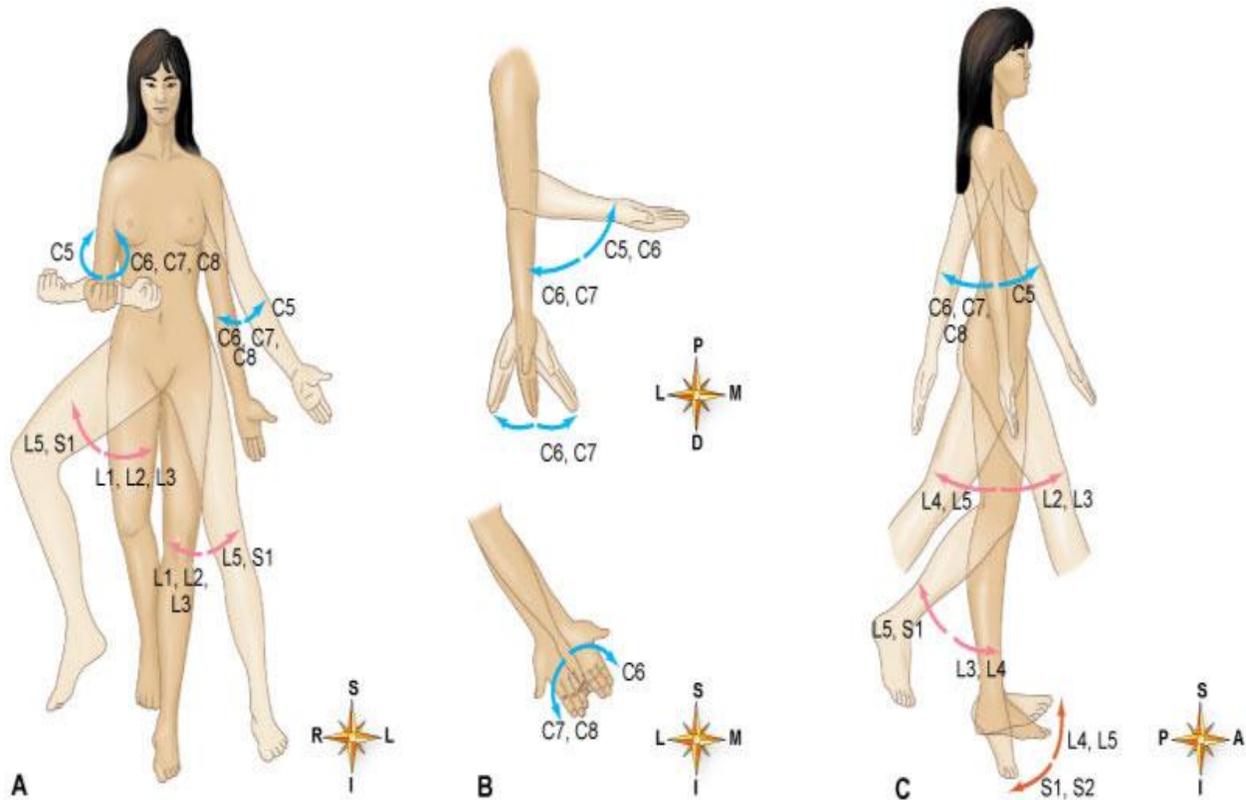
- Sacral plexus and coccygeal plexus L4-S4
 - Located in the pelvic cavity in the anterior surface of the piriformis muscle
 - Formed by intermingling of fibers from L4 through S4
 - Tibial, common peroneal, and sciatic nerves exit the sacral plexus and supply nearly all the skin of the leg, posterior thigh muscles, and leg and foot muscles



Dermatomes and Myotomes

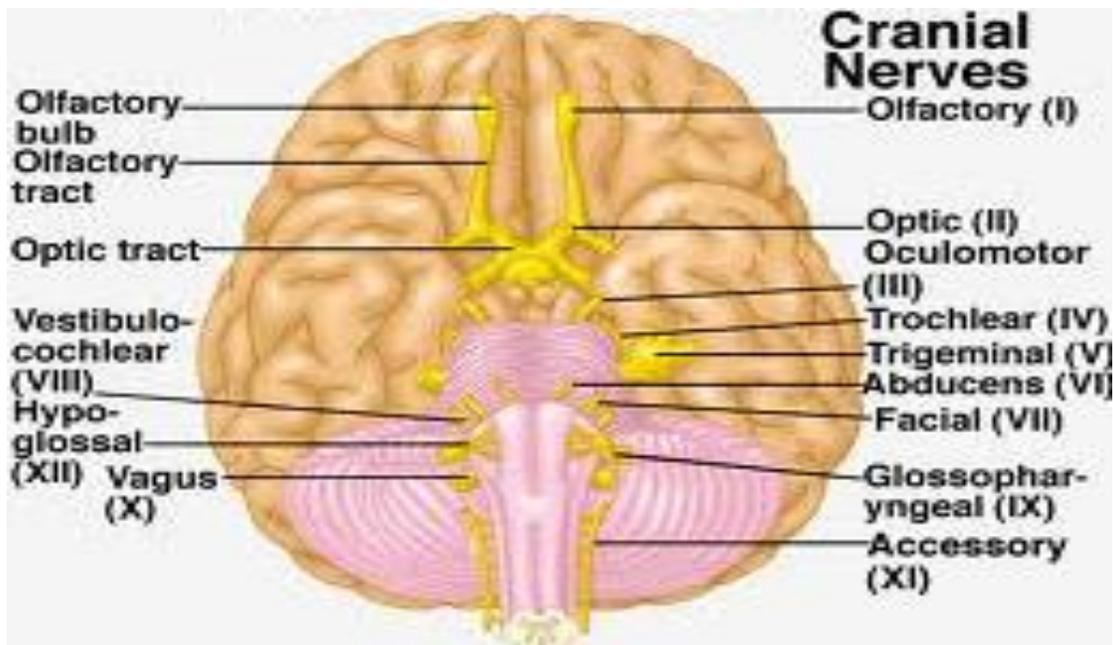
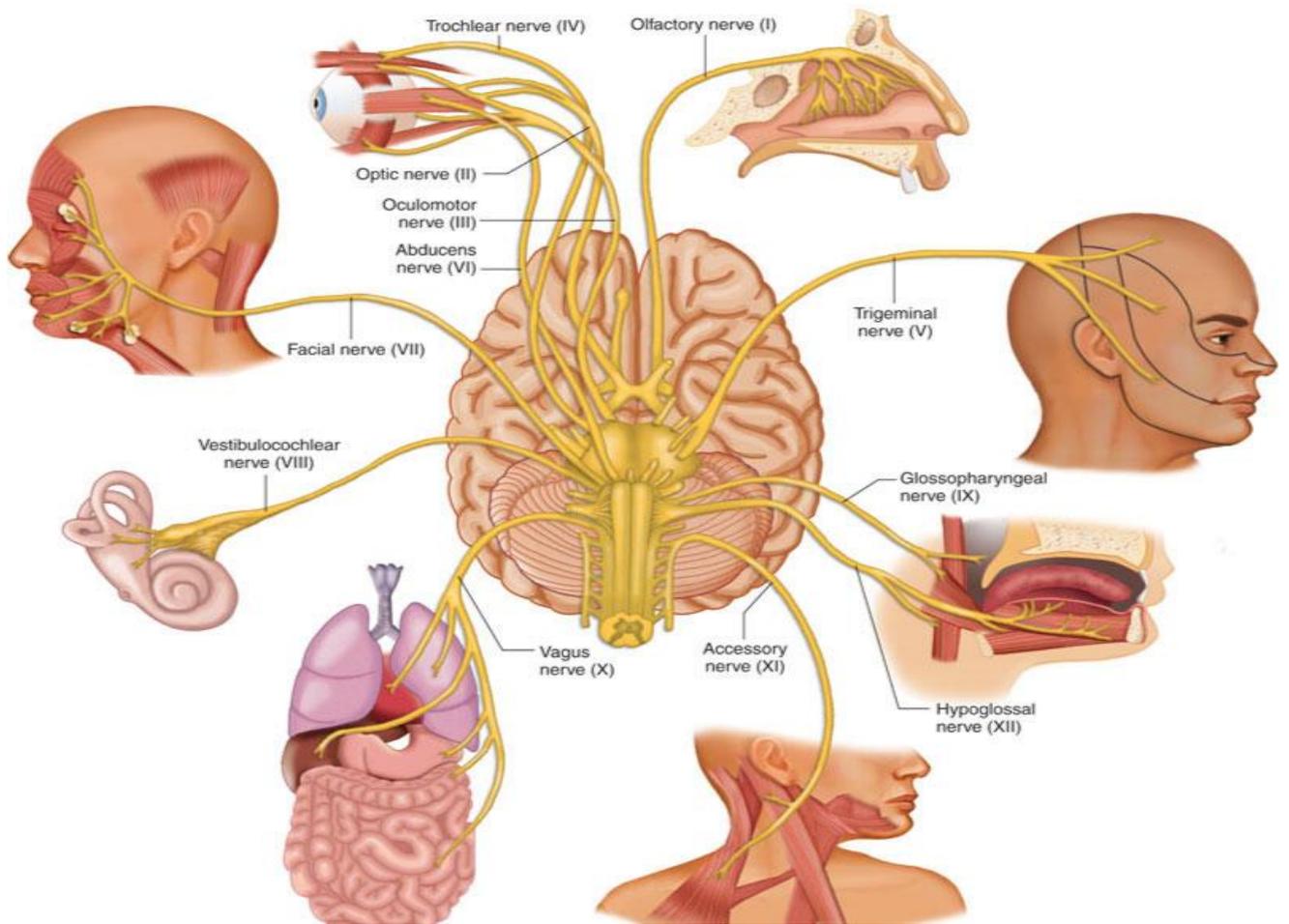
- Dermatome: region of skin surface area supplied by afferent (sensory) fibers of a given spinal nerve
- Myotome: skeletal muscle or muscles supplied by efferent (motor) fibers of a given spinal nerve

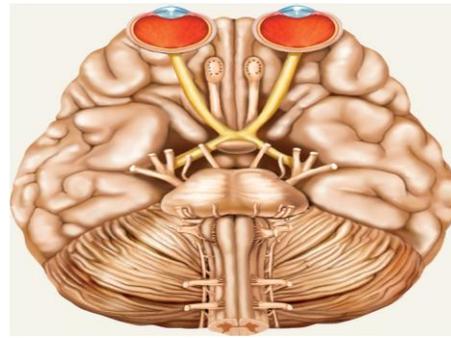
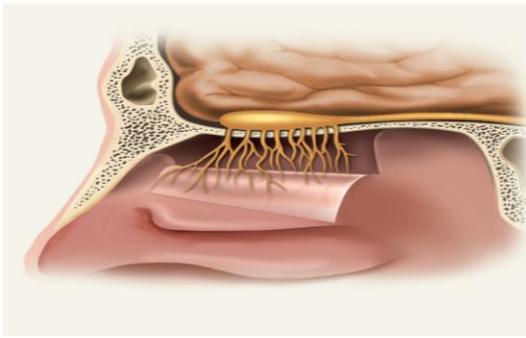




Cranial Nerves Overview

- 12 pairs of cranial nerves connect to the brain, mostly the brainstem
- Identified by name (determined by either distribution or function) or number (order in which they emerge, anterior to posterior) or both
- Composed of bundles of axons
 - Mixed cranial nerve: axons of sensory and motor neurons
 - Sensory cranial nerve: axons of sensory neurons only
 - Motor cranial nerve: mainly axons of motor neurons and a small number of sensory fibers (proprioceptors)



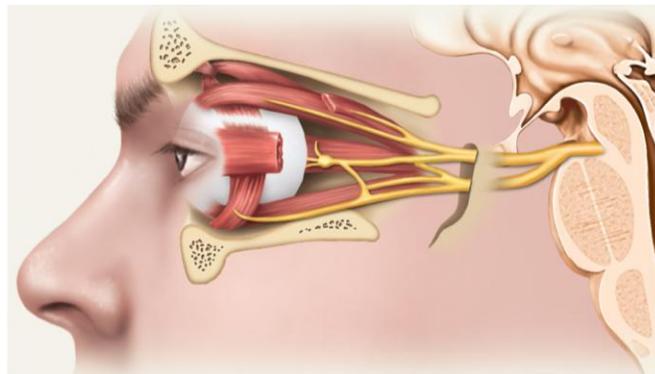


I Olfactory Nerve

- sense of smell
- damage causes impaired sense of smell

II Optic Nerve

- provides vision
- damage causes blindness in part or all of the visual field



III Oculomotor Nerve

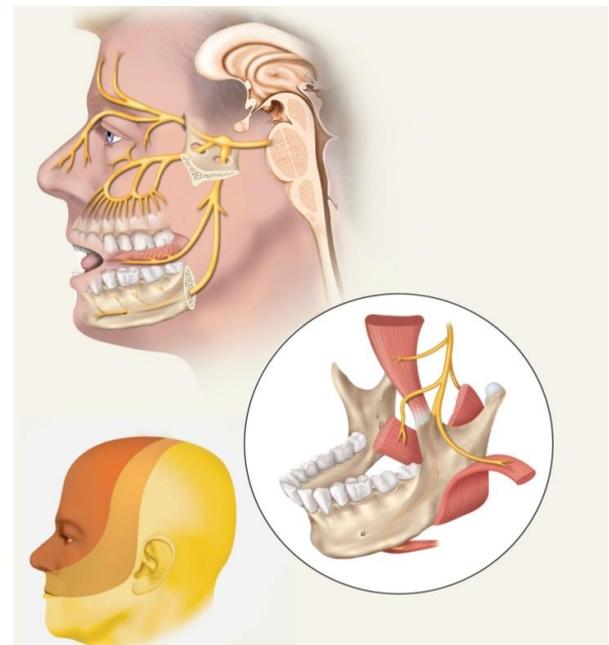
- controls muscles that turn the eyeball up, down, and medially, as well as controlling the iris, lens, and upper eyelid
- damage causes drooping eyelid, dilated pupil, double vision, difficulty focusing and inability to move eye in certain directions

IV Trochlear Nerve

- eye movement (superior oblique muscle)
- damage causes double vision and inability to rotate eye inferolaterally

V Trigeminal Nerve

- largest of the cranial nerves
- most important sensory nerve of the face
- forks into three divisions:
 - ophthalmic division (V_1) – sensory
 - maxillary division (V_2) – sensory
 - mandibular division (V_3) - mixed

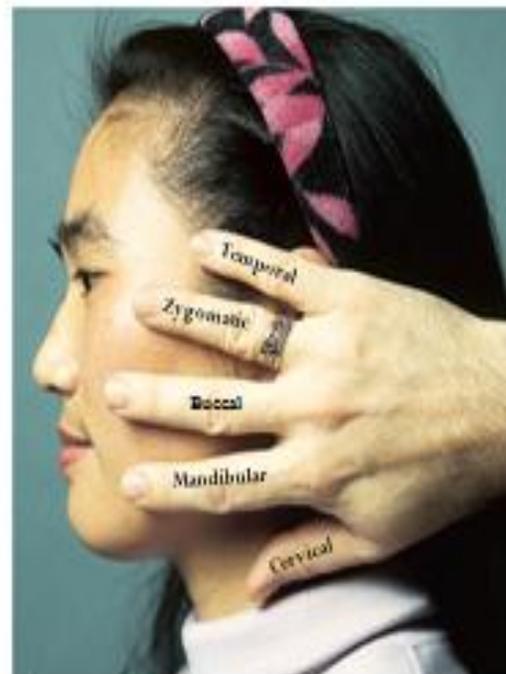
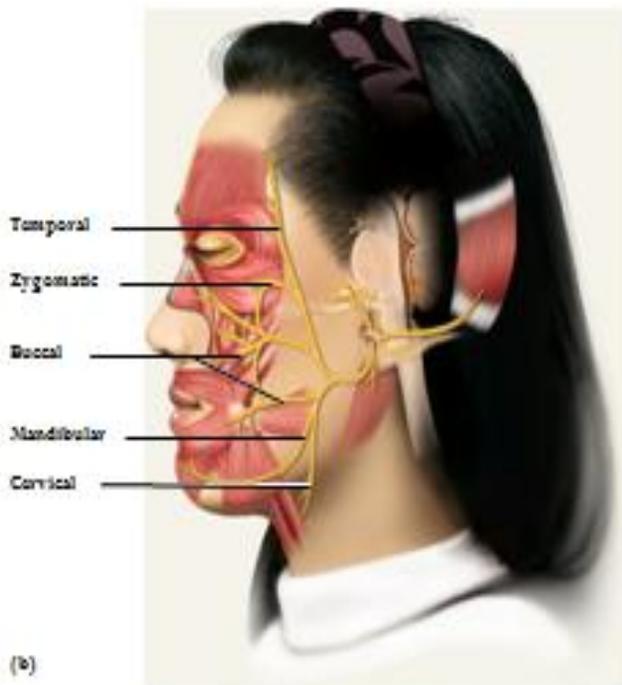


VI Abducens Nerve

- provides eye movement (lateral rectus m.)
- damage results in inability to rotate eye laterally and at rest eye rotates medially

VII Facial Nerve

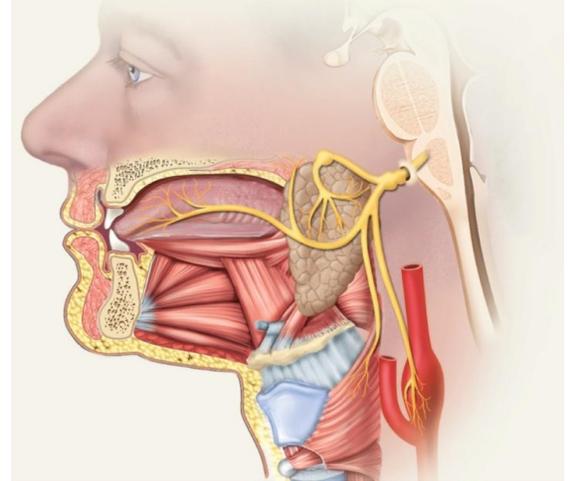
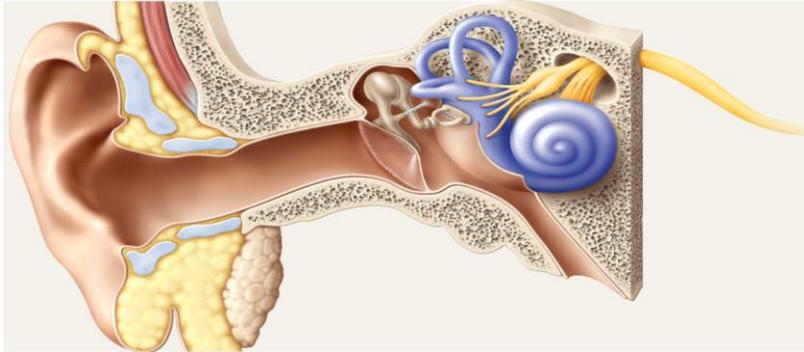
- motor – major motor nerve of facial muscles: facial expressions; salivary glands and tear, nasal and palatine glands
- sensory - taste on anterior 2/3's of tongue
- damage produces sagging facial muscles and disturbed sense of taste (no sweet and salty)
- Five Branches of Facial Nerve
 - clinical test: test anterior 2/3's of tongue with substances such as sugar, salt, vinegar, and quinine; test response of tear glands to ammonia fumes; test motor functions by asking subject to close eyes, smile, whistle, frown, raise eyebrows, etc.



clinical test: test anterior 2/3's of tongue with substances such as sugar, salt, vinegar, and quinine; test response of tear glands to ammonia fumes; test motor functions by asking subject to close eyes, smile, whistle, frown, raise eyebrows,

VIII Vestibulocochlear Nerve

- nerve of hearing and equilibrium
- damage produces deafness, dizziness, nausea, loss of balance and nystagmus (involuntary rhythms oscillation of the eyes from side to side)

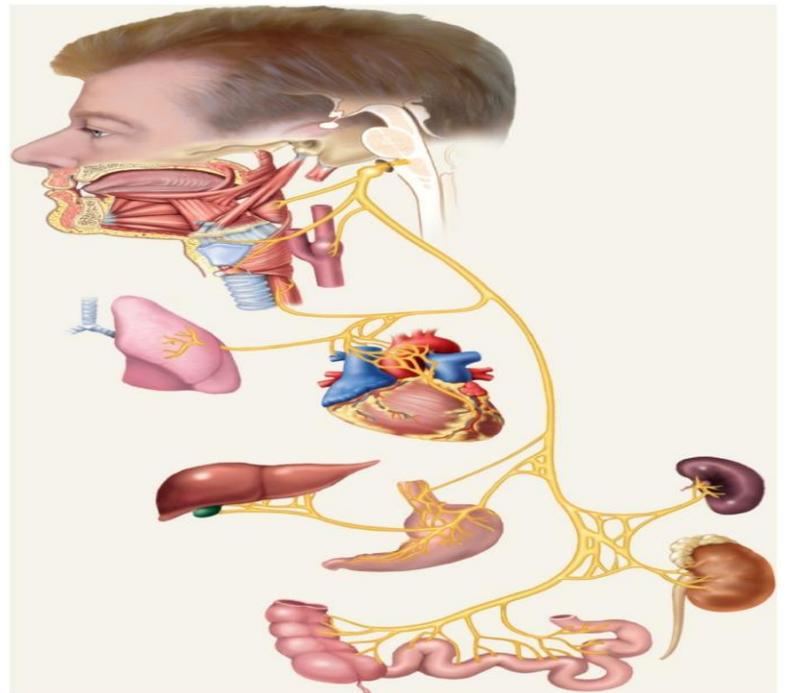


IX Glossopharyngeal Nerve

- swallowing, salivation, gagging, control of BP and respiration
- sensations from posterior 1/3 of tongue
- damage results in loss of bitter and sour taste and impaired swallowing

X Vagus Nerve

- most extensive distribution of any cranial nerve
- major role in the control of cardiac, pulmonary, digestive, and urinary function
- swallowing, speech, regulation of viscera
- damage causes hoarseness or loss of voice, impaired swallowing and fatal if both are cut

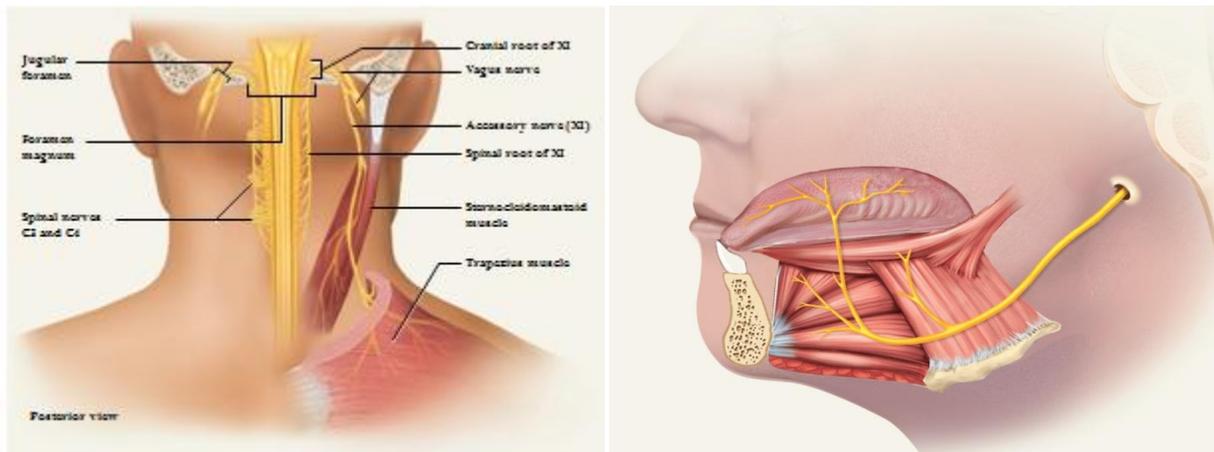


XI Accessory Nerve

- swallowing, head, neck and shoulder movement
- damage causes impaired head, neck, shoulder movement; head turns towards injured side

XII Hypoglossal Nerve

- tongue movements for speech, food manipulation and swallowing
- if both are damaged – can't protrude tongue
- if one side is damaged – tongue deviates towards injured side; see ipsilateral atrophy



Autonomic Nervous System

Autonomic Nervous System Overview

- Contains afferent (sensory) and efferent (motor) components (the efferent components are emphasized here)
- Major function: to regulate heartbeat, smooth muscle contraction, and glandular secretions to maintain homeostasis
- Two efferent divisions: sympathetic division and parasympathetic division
- Many autonomic effectors are dually innervated, which allows remarkably precise control of effector

Functions of the autonomic nervous system

- Overview of autonomic function
 - The autonomic nervous system functions to regulate visceral effectors in ways that tend to maintain or quickly restore homeostasis
 - Sympathetic and parasympathetic divisions are often exerting antagonistic influences on visceral effectors
 - Doubly innervated effectors continually receive both sympathetic and parasympathetic impulses; summation of the two determines the controlling effect
- Functions of the sympathetic division
 - Under resting conditions, the sympathetic division can act to maintain the normal functioning of doubly innervated autonomic effectors
 - Sympathetic impulses function to maintain normal tone of the smooth muscle in blood vessel walls
 - Major function of sympathetic division is as an “emergency” system—the “fight or flight” reaction
- Functions of the parasympathetic division
 - Dominant controller of most autonomic effectors most of the time
 - Acetylcholine: slows heartbeat and promotes digestion and elimination

Lifespan Changes

- Brain cells begin to die before birth
- Over average lifetime, brain shrinks 10%
- By age 90, frontal cortex has lost half its neurons
- Decreased levels of neurotransmitters with age
- Fading memory
- Slowed responses and reflexes
- Increased risk of falling
- Changes in sleep patterns that result in fewer sleeping hours

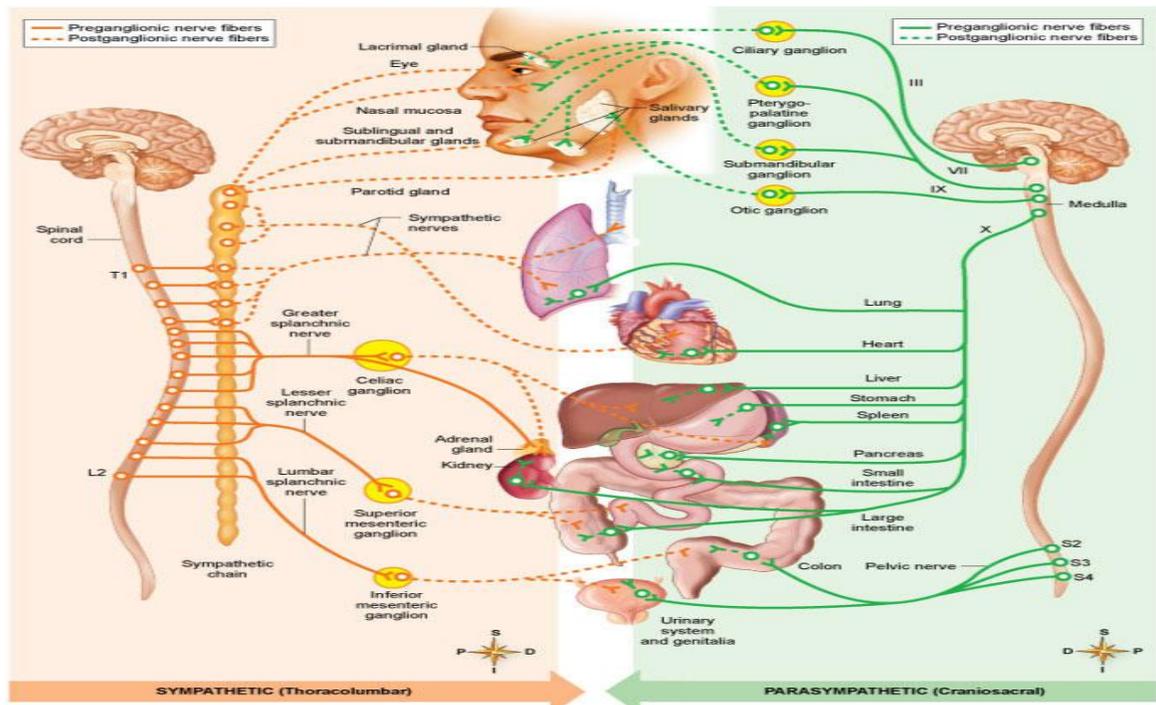
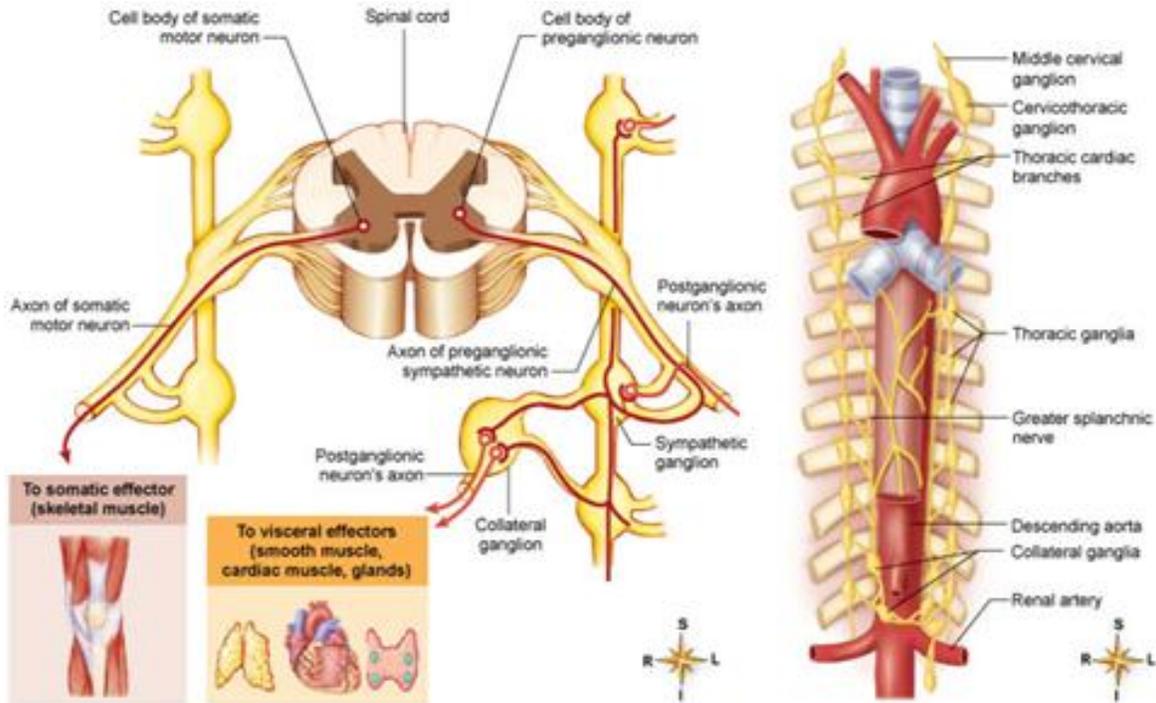


Fig. 14-18. Major autonomic pathways.
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