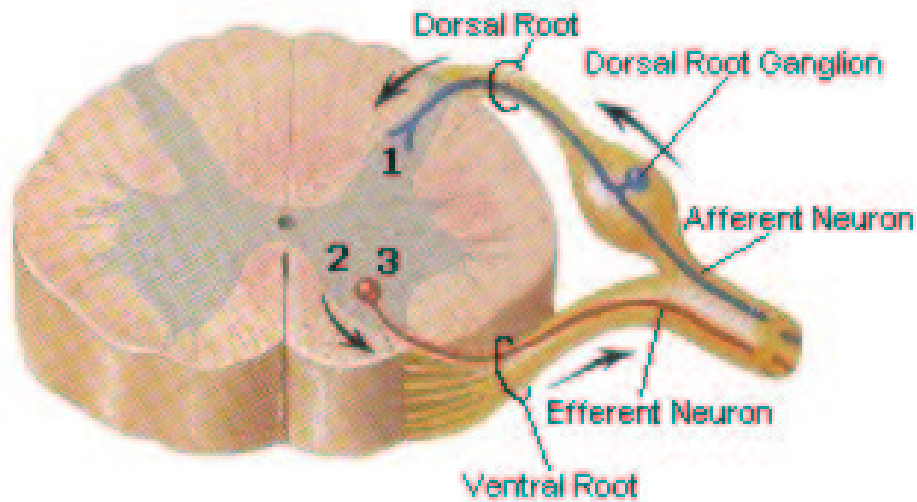


**Nervous System**  
**ANS 215**  
**Physiology and Anatomy of**  
**Domesticated Animals**

**Spinal Cord and Nerves**



Cross-section of the spinal cord. Located within the gray matter are 1 – nerve cell bodies for sensory neurons, 2 – somatic motor neurons, and 3 – autonomic motor neurons.

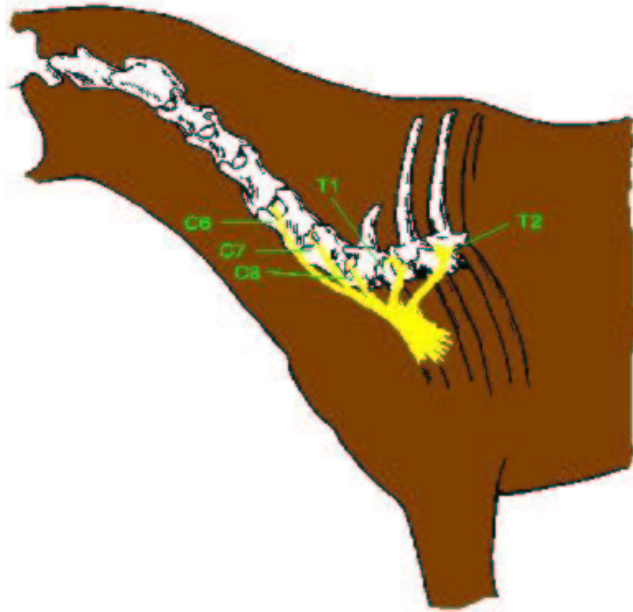
**Spinal Cord**

- Receives sensory afferent fibers by way of dorsal roots of spinal nerves
- Gives off efferent motor fibers to the ventral roots of the spinal nerves
- Centrally located gray matter consists of nerve cell bodies and processes
- Peripherally located white matter contains nerve tracts



## Innervation of Appendages

- Appendages are innervated by several spinal nerves.
- Near the limb they supply, the nerves join together in braid-like arrangements known as plexuses
  - Brachial plexus = forelimbs
  - Lumbosacral plexus = hindlimbs



Brachial plexus of the horse. It is formed by the contributions of the last three cervical and first two thoracic spinal nerves to supply the forelimbs. C = cervical, T = thoracic  
The corresponding numbers refer to their respective spinal nerve.

## Cranial Nerves

- There are 12 pairs of cranial nerves, each having a left and right nerve
- Innervate the head and neck, exception being the vagus nerve
- Have no dorsal or ventral roots and emerge through foramina in the skull
- Designated by number and name

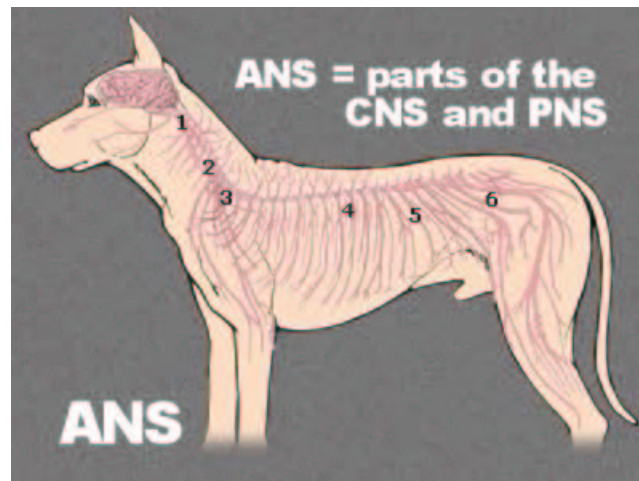
## Cranial Nerves

Number	Name	Type	Distribution
I	Olfactory	Sensory	Nasal mucous membrane (sense of smell)
II	Optic	Sensory	Retina of eye (sight)
III	Oculomotor	Motor	Most Muscles of eye Parasympathetic to ciliary muscle and circular muscle of iris
IV	Trochlear	Motor	Dorsal oblique muscle of eye
V	Trigeminal	Mixed	Sensory - to eye and face; motor - to muscles of mastication
VI	Abducens	Motor	Retractor and lateral muscles of eye
VII	Facial	Mixed	Sensory - region of ear and taste to cranial two-thirds of tongue; motor - to muscles of facial expression; parasympathetic - to mandibular and sublingual salivary glands
VIII	Vestibulocochlear	Sensory	Cochlea (hearing); semicircular canals (equilibrium)
IX	Glossopharyngeal	Mixed	Sensory - to pharynx and taste to caudal third of tongue; motor - muscle of pharynx; parasympathetic - to parotid salivary glands
X	Vagus	Mixed	Sensory - to pharynx and larynx; motor - to muscles of larynx; parasympathetic - to visceral structures in the thorax and abdomen
XI	Spinal accessory	Motor	Motor - to muscles of shoulders and neck
XII	Hypoglossal	Motor	Motor - to muscles of tongue

## Autonomic Nerves

- Portion of the peripheral nervous system that innervates smooth muscle, cardiac muscle and glands

- Two divisions
  - Sympathetic
  - Parasympathetic
- Most organs receive both sympathetic and parasympathetic innervation

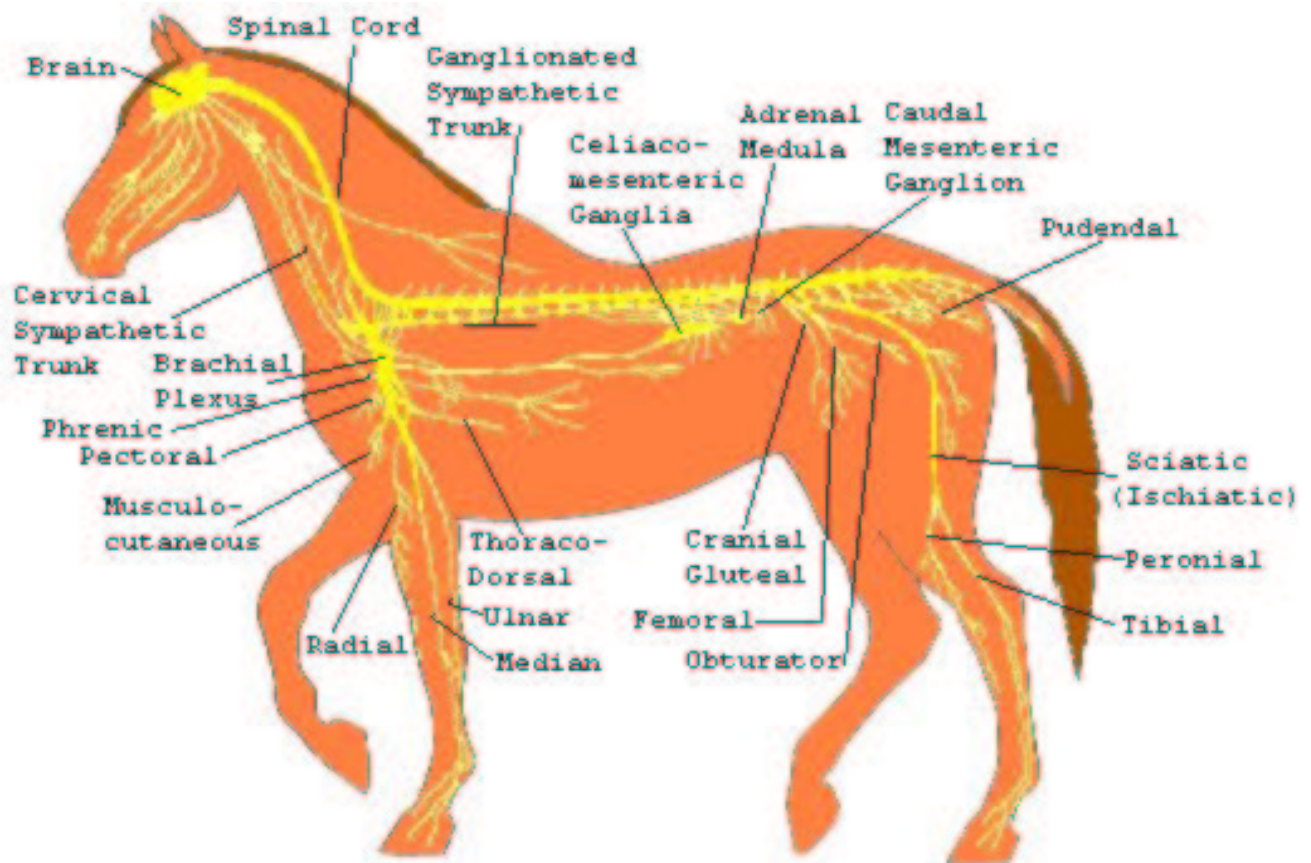


The autonomic nervous system (ANS) of the dog. Numbers indicate the sympathetic ganglia. 1 – cranial cervical, 2 – middle cervical, 3 – stellate, 4 – celiac, 5 – cranial mesenteric, 6 – caudal mesenteric

### **Autonomic Nervous System**

- Cells of origin for sympathetic nerves are located in the thoracic and lumbar segments of the spinal cord.
- Cells of origin for the parasympathetic nerves are located in the brain and sacral segments of the spinal cord.
- For both sympathetic and parasympathetic activity, two neurons are utilized for transmission from the cells of origin.
- Cells of origin for the second neuron are located in ganglia.
- The first neuron is called preganglionic and the second is called postganglionic.
- Ganglia for the sympathetic nerves are located in or near the vertebral column.

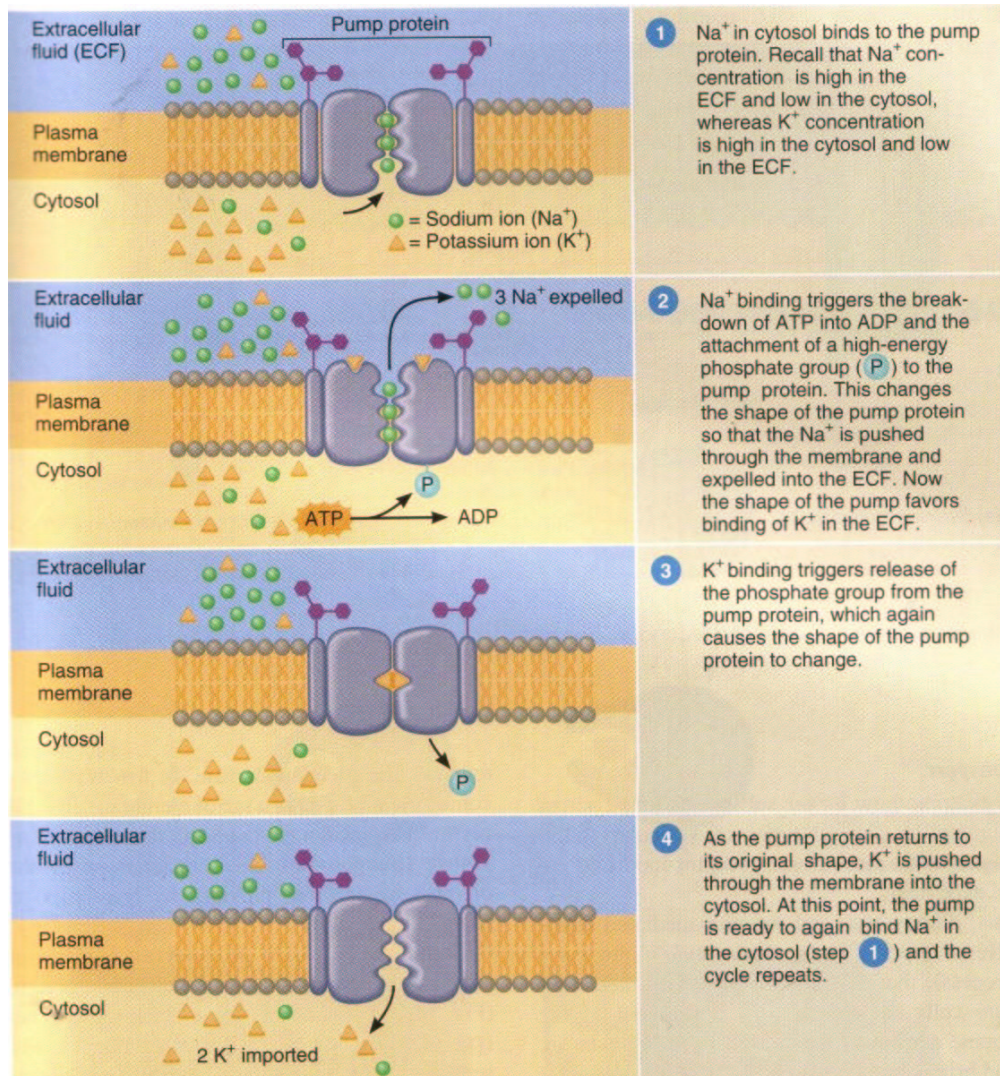
- Ganglia for the parasympathetic nerves are located near the organs they innervate.
- Preganglionic fibers of the parasympathetic nerves are therefore longer than preganglionic fibers of the sympathetic nerves.
- Autonomic reflexes involve afferent transmission of impulses away from the structures supplied to the spinal cord and then back again as an efferent impulse.
- The receptive nerve endings for autonomic reflexes are located in the viscera.



## Nerve Transmission

- Difference in electrical charge between inside and outside of neuron is called “potential”.
- In a resting neuron the potential between the two sides of the cell membrane is called the “resting potential”.

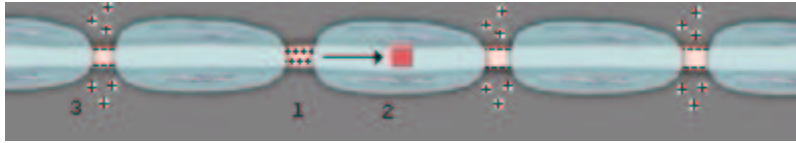
- The resting potential arises from unequal distribution of  $\text{Na}^+$  and  $\text{K}^+$  ions inside and outside the cell.



## Nerve Transmission

- Begins with inflow of  $\text{Na}^+$  at point of stimulation
- This depolarizes the region causing current flow from the point of depolarization to adjacent regions.

- The process of depolarization followed by current flow is repeated throughout the nerve fiber resulting in a nerve impulse.



1 – Depolarization results in current flow, 2 – Signal conduction proceeds toward end of nerve fiber, 3 – Repolarization occurs shortly after signal conduction