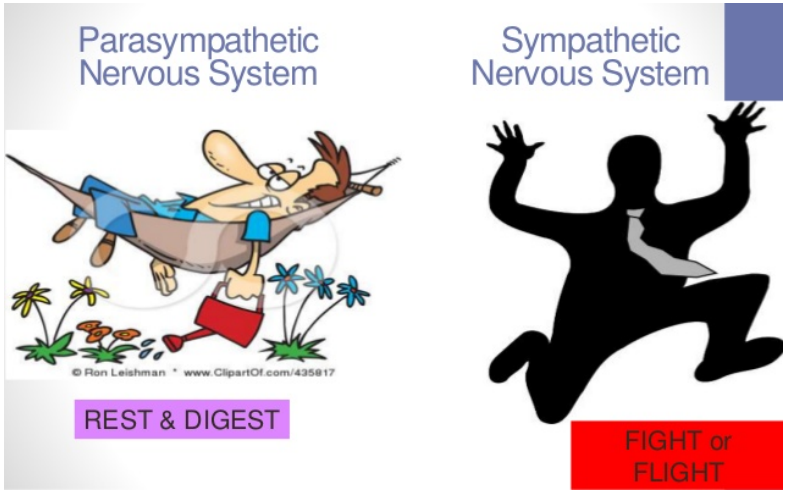
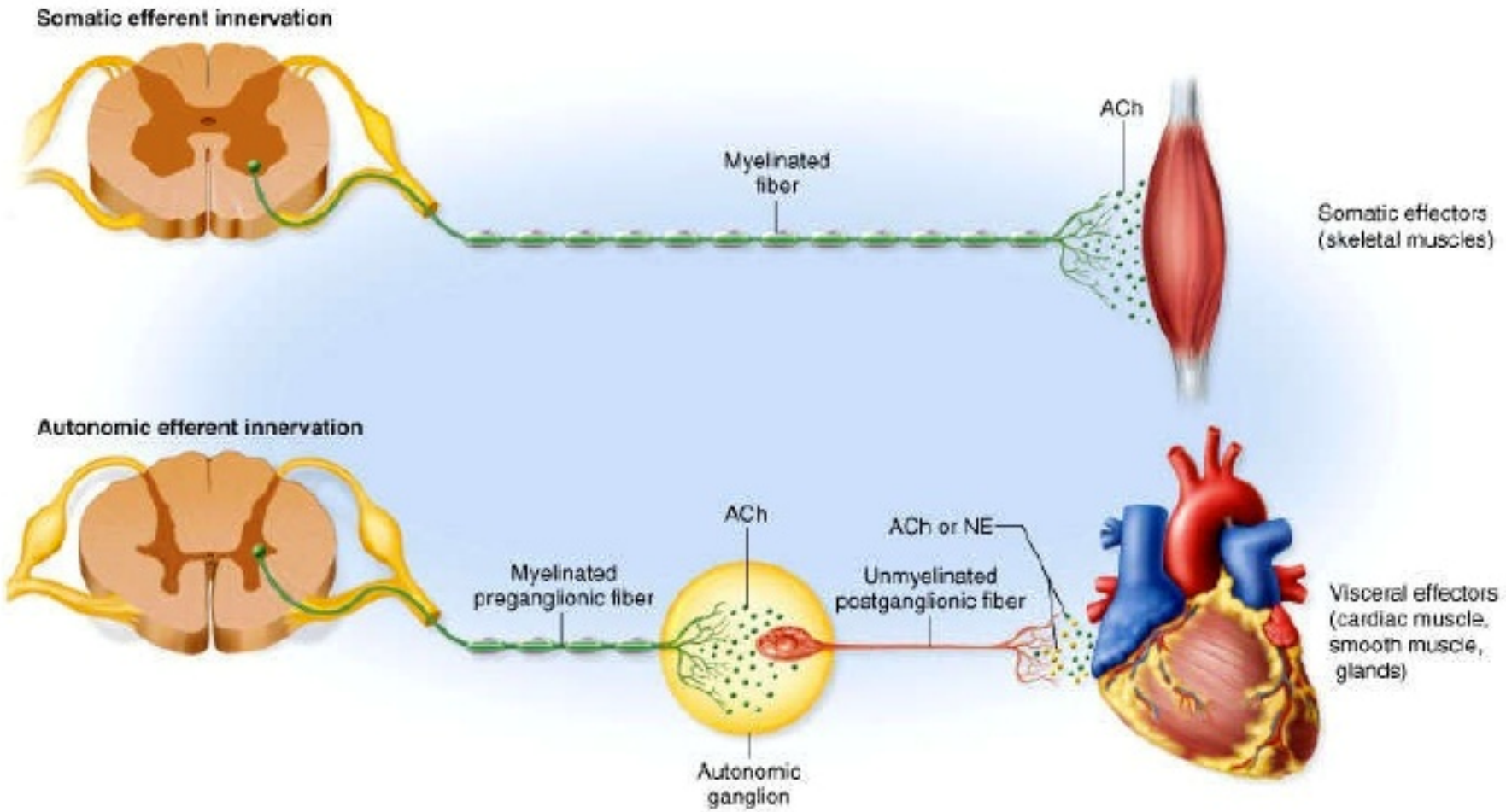
# EFFERENT DIVISION: AUTONOMIC AND SOMATIC MOTOR CONTROL



# Somatic vs. Autonomic

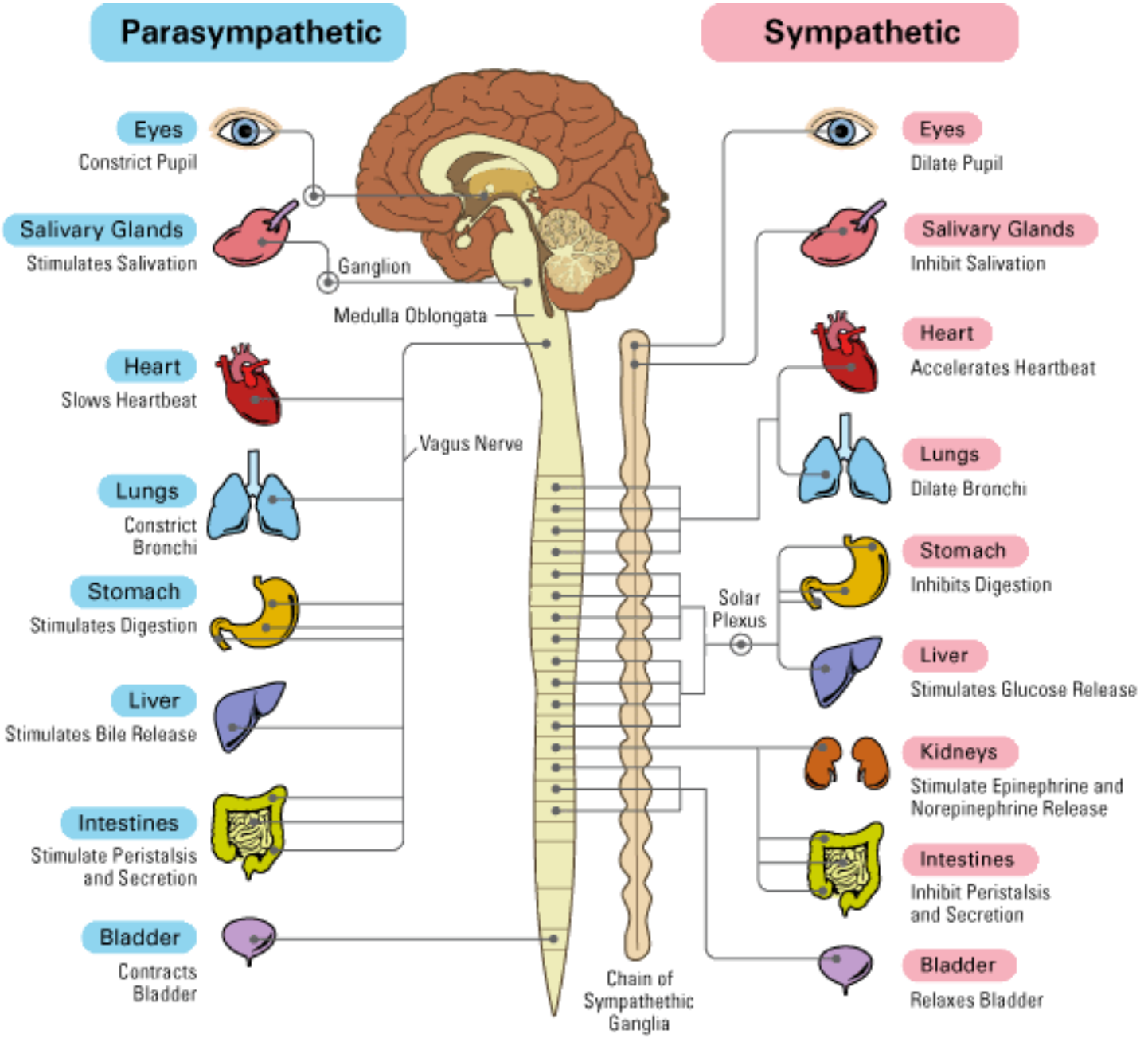





Voluntary/involuntary

# Autonomic Control Centers

- Hypothalamus
  - Water balance, temperature, and hunger
- Pons
  - Respiration, cardiac, and urinary
- Medulla
  - Respiration




**Schema Explaining How Parasympathetic and Sympathetic Nervous Systems Regulate Functioning Organs**

# Two Efferent Neurons in Series

- **CNS**- tracts coming from brain to spinal cord
- **Preganglionic neuron-** exits spinal cord and goes to ganglion
- **Ganglion**- sympathetic chain ganglion runs along vertebral colum
- **Postganglionic neuron-** runs down spinal nerve
- **Target tissue-** can be muscle or gland

## Sympathetic and Parasympathetic Branches Originate in Different Regions

Sympathetic neurons
- originate in **thoracic** and **lumbar** regions
- sympathetic ganglia are found in two chains along the vertabral column or near descending aorta
- They have short preganglionic neurons and long postganglionic neurons.

Parasympathetic neurons
- originate in **cranial** nerves and in the **sacral** region
- Their ganglia are found on or near their targets
- they have long preganglionic neurons and short postganglionic neurons.

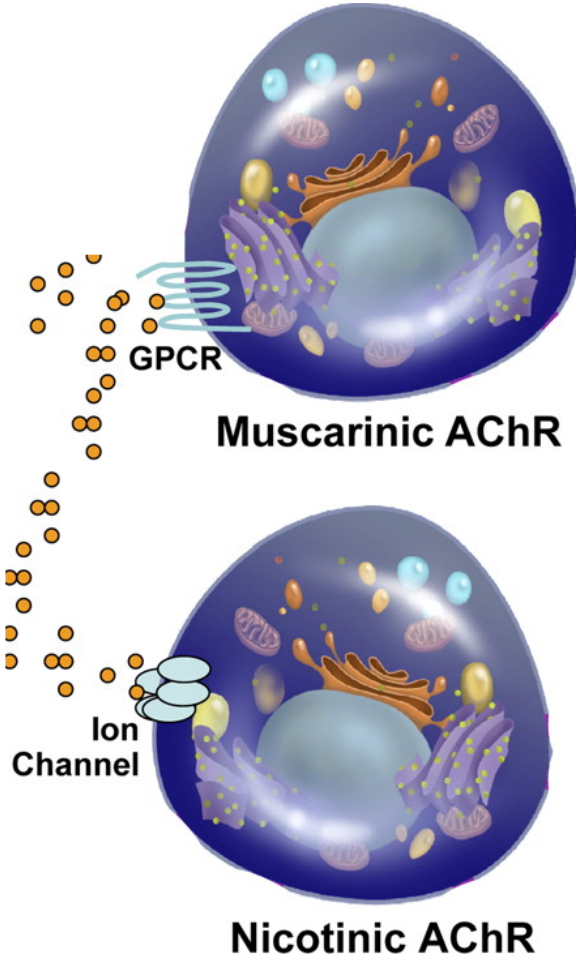
Both preganglionic neuron release Ach onto nicotinic cholinergic receptor on the postganglionic cell.
Most postganglionic sympathetic neuron release NE onto adrenergic receptors on the target cell.
Most postganglionic parasympathetic neuron release Ach onto muscarinic cholinergic neurons.

# Autonomic Neuron Structure

- **Neuroeffector junction** - synapse between a postganglionic autonomic neuron and target cell
- **Postganglionic axon** - exits spinal cord to target cell
  - Varicosities

# Sympathetic receptors


# Parasympathetic receptors



Adrenal Medulla;

- is associated with SNS
- is like a modified sympathetic ganglion.

Both sympathetic and parasympathetic pathways consist of two neurons (preganglionic and postganglionic) in series. One exception is adrenal medulla, in which postganglionic sympathetic neurons have been modified into a neuroendocrine organ.

All preganglionic autonomic neurons secrete Ach onto nicotinic receptors.
Most sympathetic neurons secrete NE onto adrenergic receptors.
Most parasympathetic neurons secrete Ach onto muscarinic receptors.

The sympathetic branch controls functions that are useful in stress or emergencies (fight-or-flight).
The parasympathetic branch is dominant during rest-and-digest activities.

# Somatic Motor Division

- Single neuron
  - CNS origin
  - Myelinated
- Terminus
  - Branches
  - Neuromuscular junction

The synapse of a somatic motor neuron on a muscle fiber is called neuromuscular junction.

Motor neuron's presynaptic axon terminal filled with synaptic vesicles and mitochondria.

# Events at the Neuromuscular Junction

a. Ach binds with its receptor or is metabolized by AchE.
b. The nicotinic cholinergic receptor binds two Ach molecules, opening a nonspecific monovalent cation channel.

Ach acting on a skeletal muscle's motor end plate is always excitatory and creates muscle contraction.

The post-synaptic membrane is **folded.** This is to increase the surface area and therefore the number of receptors (*in the synaps the post-synaptic membrane is not folded*)

The post-synaptic membrane always **depolarizes** and never hyperpolarizes (*in the synaps it can also hyperpolarize*)

There is only **one type** of transmitter: Acetycholine (*in synapses in the brain, there are many types of transmitters*)

Transmission from nerve to muscle is **always** successful (*in the chemical synaps, successful transmission depends on the number of EPSP's and IPSP's generated*).