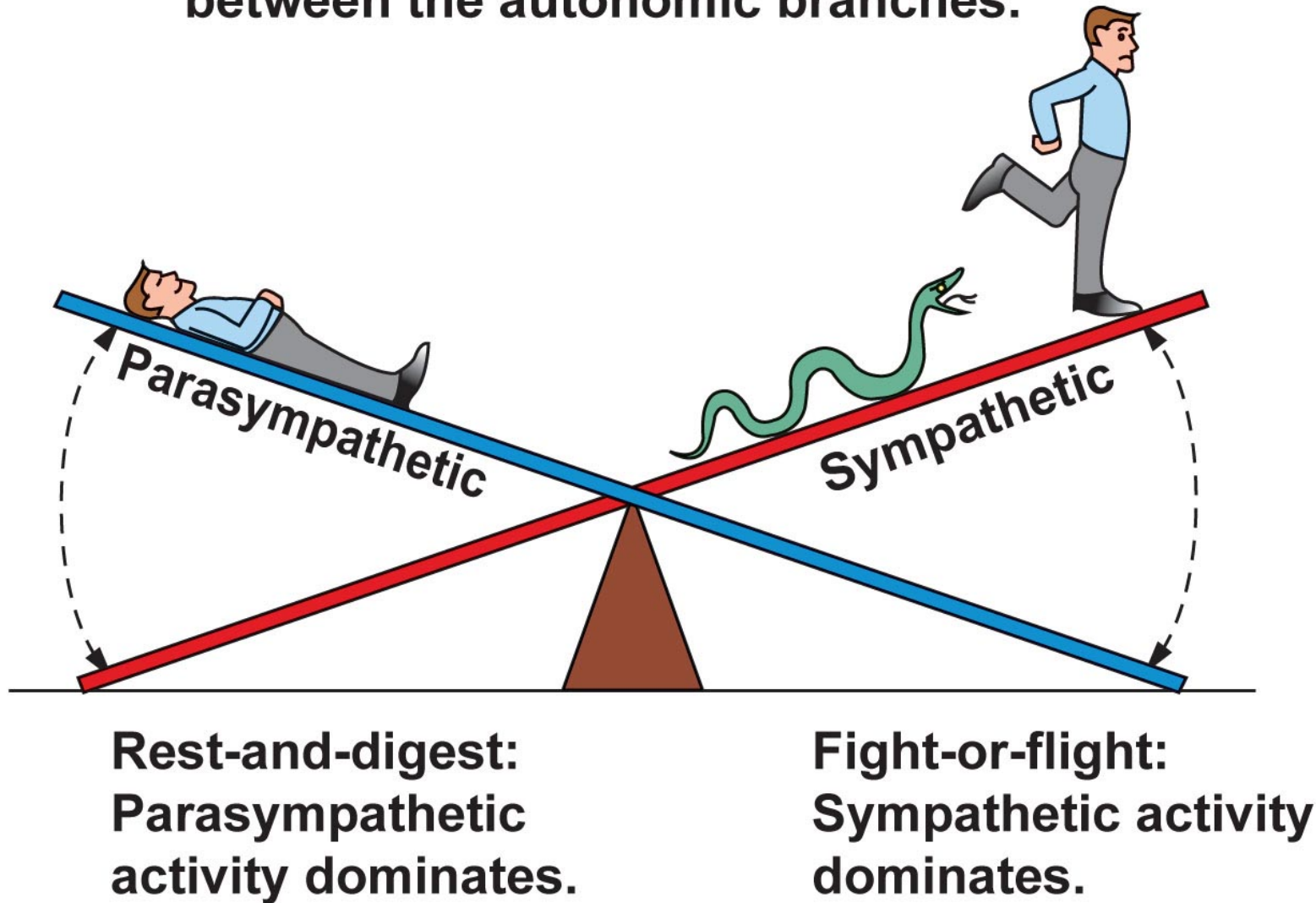


**Table 11-5**

<b>TABLE 11-5 Comparison of Somatic and Autonomic Divisions</b>		
	<b>SOMATIC</b>	<b>AUTONOMIC</b>
<b>Number of neurons in efferent path</b>	1	2
<b>Neurotransmitter/receptor at neuron-target synapse</b>	ACh/nicotinic	ACh/muscarinic or NE/ $\alpha$ - or $\beta$ -adrenergic
<b>Target tissue</b>	Skeletal muscle	Smooth and cardiac muscle; some endocrine and exocrine glands; some adipose tissue
<b>Neurotransmitter released from</b>	Axon terminals	Varicosities and axon terminals
<b>Effects on target tissue</b>	Excitatory only: muscle contracts	Excitatory or inhibitory
<b>Peripheral components found outside the CNS</b>	Axons only	Preganglionic axons, ganglia, postganglionic neurons
<b>Summary of function</b>	Posture and movement	Visceral function, including movement in internal organs and secretion; control of metabolism

Figure 11-1

**Homeostasis is a dynamic balance between the autonomic branches.**



**Table 11-4**

<b>TABLE 11-4 Comparison of Sympathetic and Parasympathetic Branches</b>		
	<b>SYMPATHETIC</b>	<b>PARASYMPATHETIC</b>
<b>Point of CNS origin</b>	1st thoracic to 2nd lumbar segments	Midbrain, medulla, and 2nd–4th sacral segments
<b>Location of peripheral ganglia</b>	Primarily in paravertebral sympathetic chain; 3 outlying ganglia located alongside descending aorta	On or near target organs
<b>Structure of region from which neurotransmitter is released</b>	Varicosities	Varicosities
<b>Neurotransmitter at target synapse</b>	Norepinephrine (adrenergic neurons)	ACh (cholinergic neurons)
<b>Inactivation of neurotransmitter at synapse</b>	Uptake into varicosity, diffusion	Enzymatic breakdown, diffusion
<b>Neurotransmitter receptors on target cells</b>	Adrenergic	Muscarinic
<b>Ganglionic synapse</b>	ACh on nicotinic receptor	ACh on nicotinic receptor
<b>Neuron-target synapse</b>	NE on $\alpha$ - or $\beta$ -adrenergic receptor	ACh on muscarinic receptor

Figure 11-2

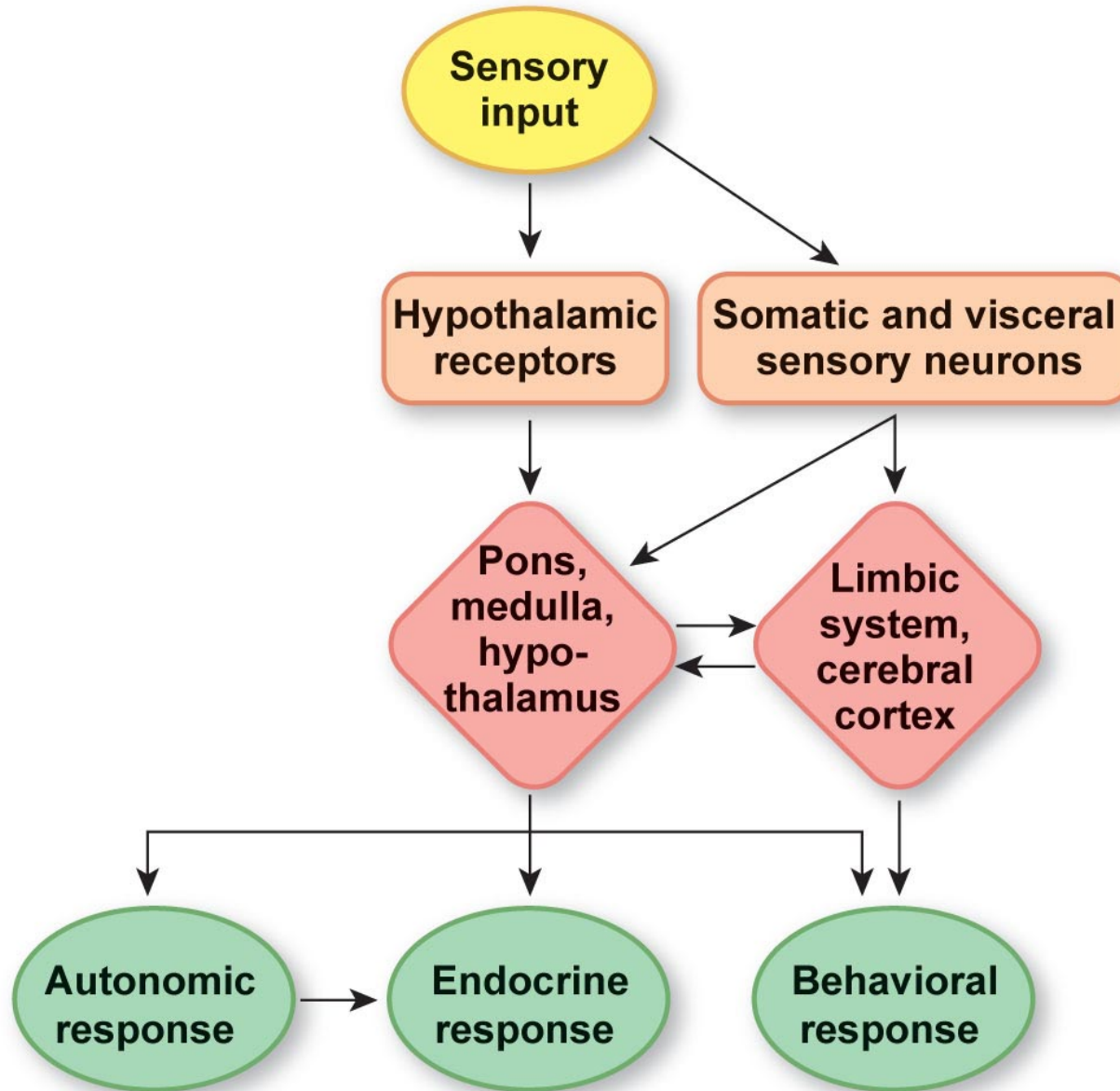


Figure 11-3

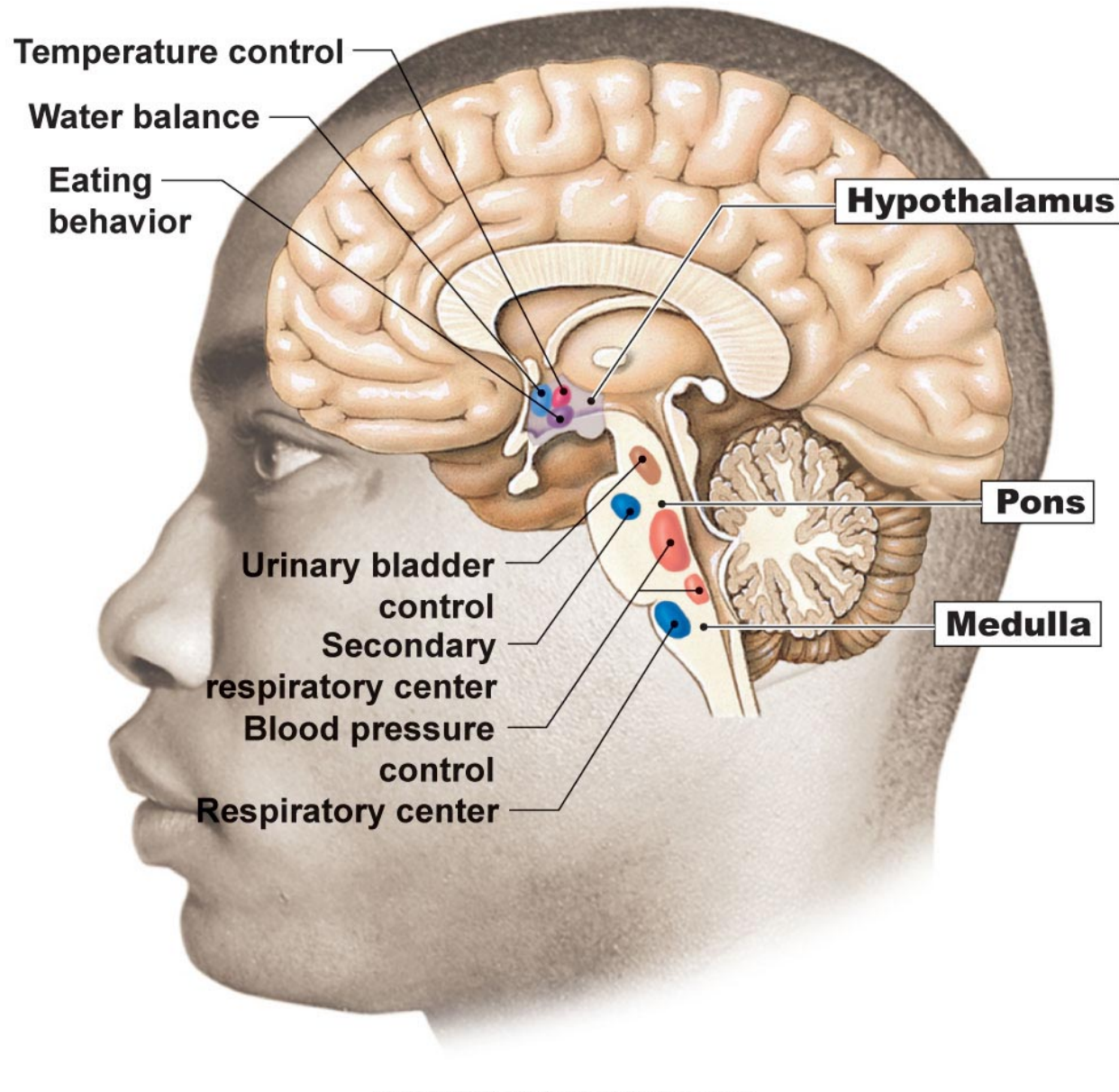


Figure 11-4

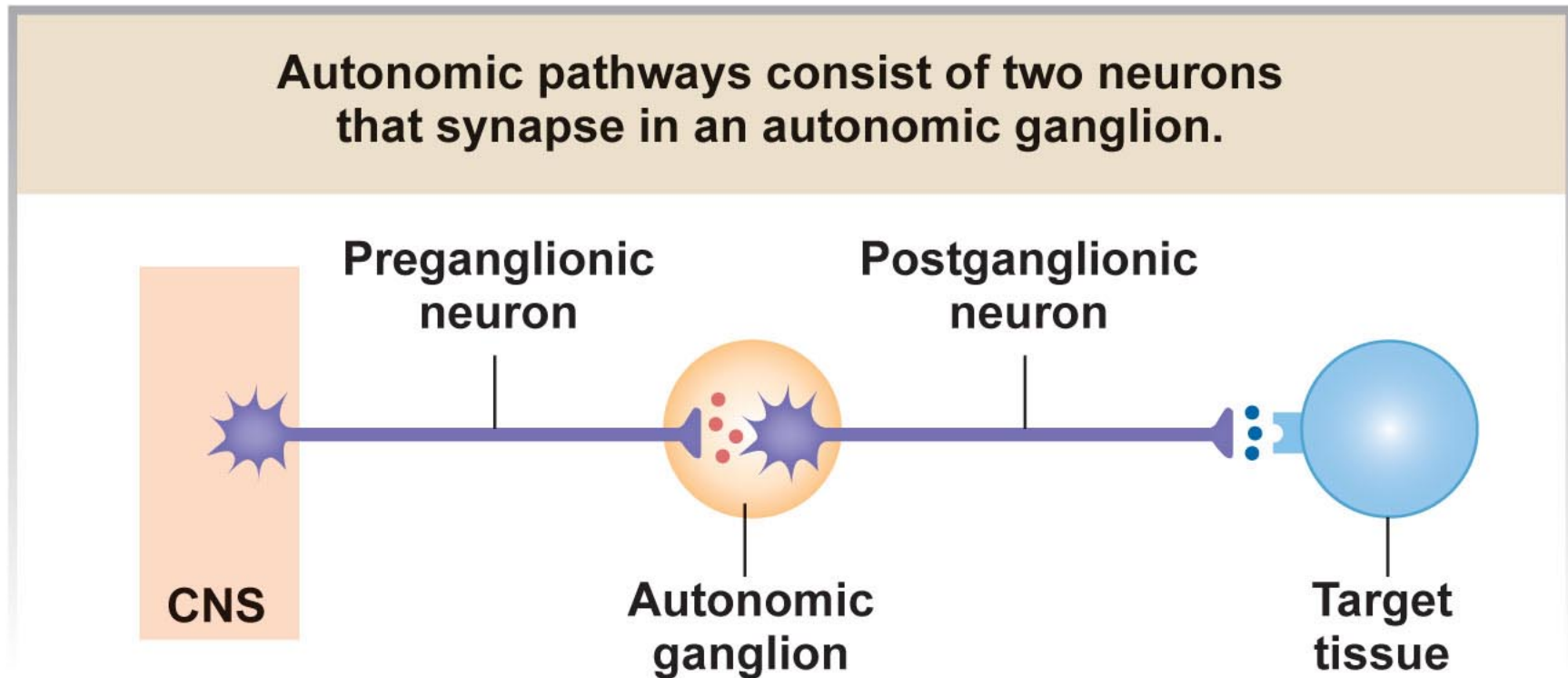
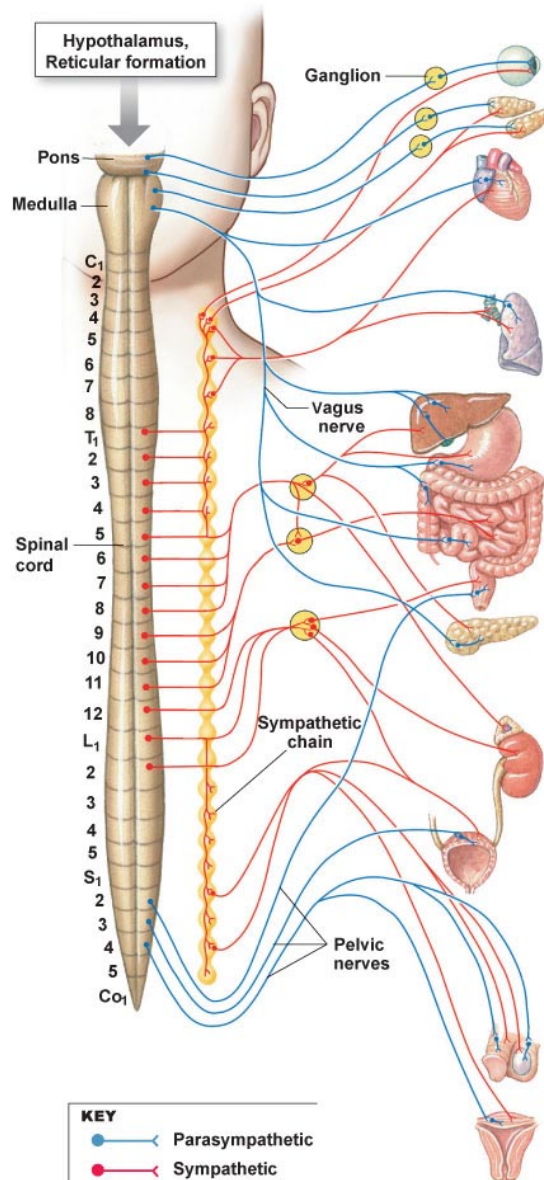


Figure 11-5, overview



Effector Organ	Parasympathetic Response **	Sympathetic Response	Adrenergic Receptor
Pupil of eye	Constricts	Dilates	$\alpha$
Salivary glands	Watery secretion	Mucus, enzymes	$\alpha$ and $\beta_2$
Heart	Slows rate	Increases rate and force of contraction	$\beta_1$
Arterioles and veins	—	Constricts Dilates	$\alpha$ $\beta_2$
Lungs	Bronchioles constrict	Bronchioles dilate	$\beta_2^*$
Digestive tract	Increases motility and secretion	Decreases motility and secretion	$\alpha, \beta_2$
Exocrine pancreas	Increases enzyme secretion	Decreases enzyme secretion	$\alpha$
Endocrine pancreas	Stimulates insulin secretion	Inhibits insulin secretion	$\alpha$
Adrenal medulla	—	Secretes catecholamines	—
Kidney	—	Increases renin secretion	$\beta_1$
Urinary bladder	Release of urine	Urinary retention	$\alpha, \beta_2$
Adipose tissue	—	Fat breakdown	$\beta$
Sweat glands	—	Localized sweating	$\alpha$
Male and female sex organs	Erection	Ejaculation (male)	$\alpha$
Uterus	Depends on stage of cycle	Depends on stage of cycle	$\alpha, \beta_2$
Lymphoid tissue (not illustrated)	—	Generally inhibitory	$\alpha, \beta_2$

\*\* All parasympathetic responses are mediated by muscarinic receptors.      \*Hormonal epinephrine only

Figure 11-6

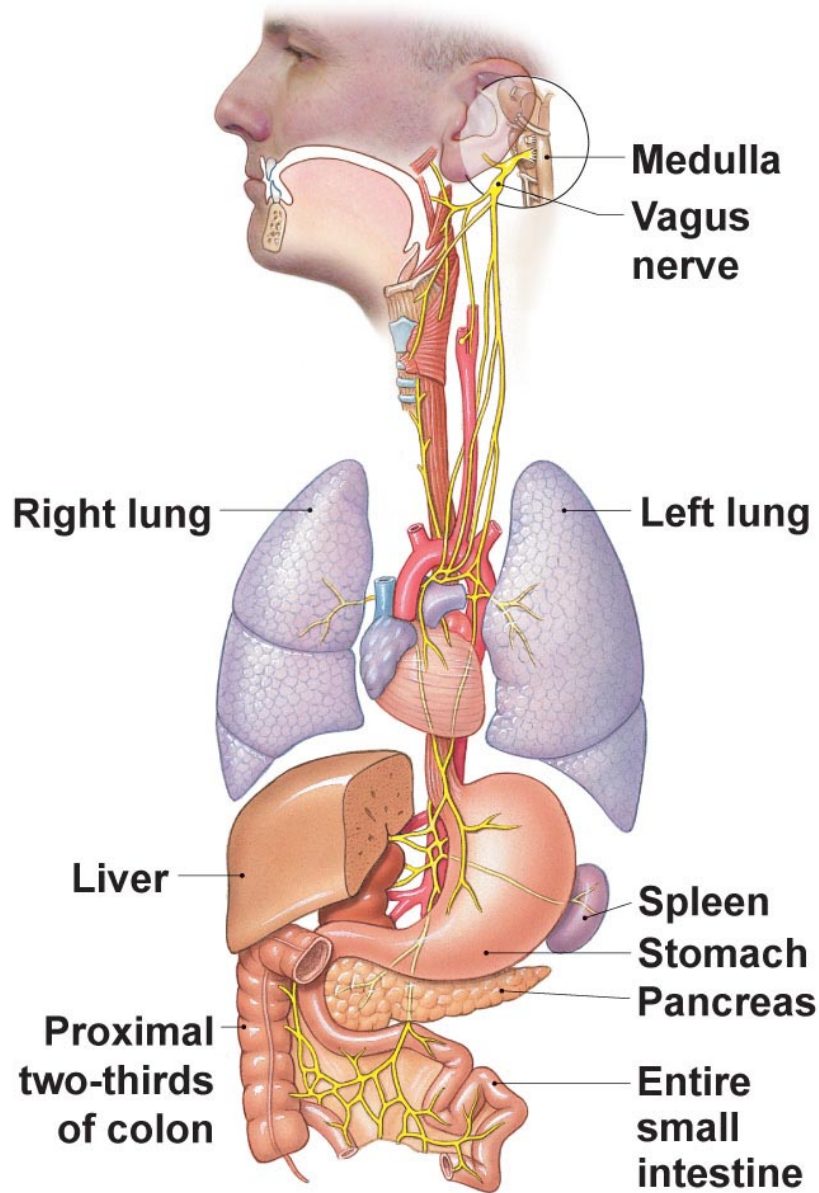




Figure 11-7

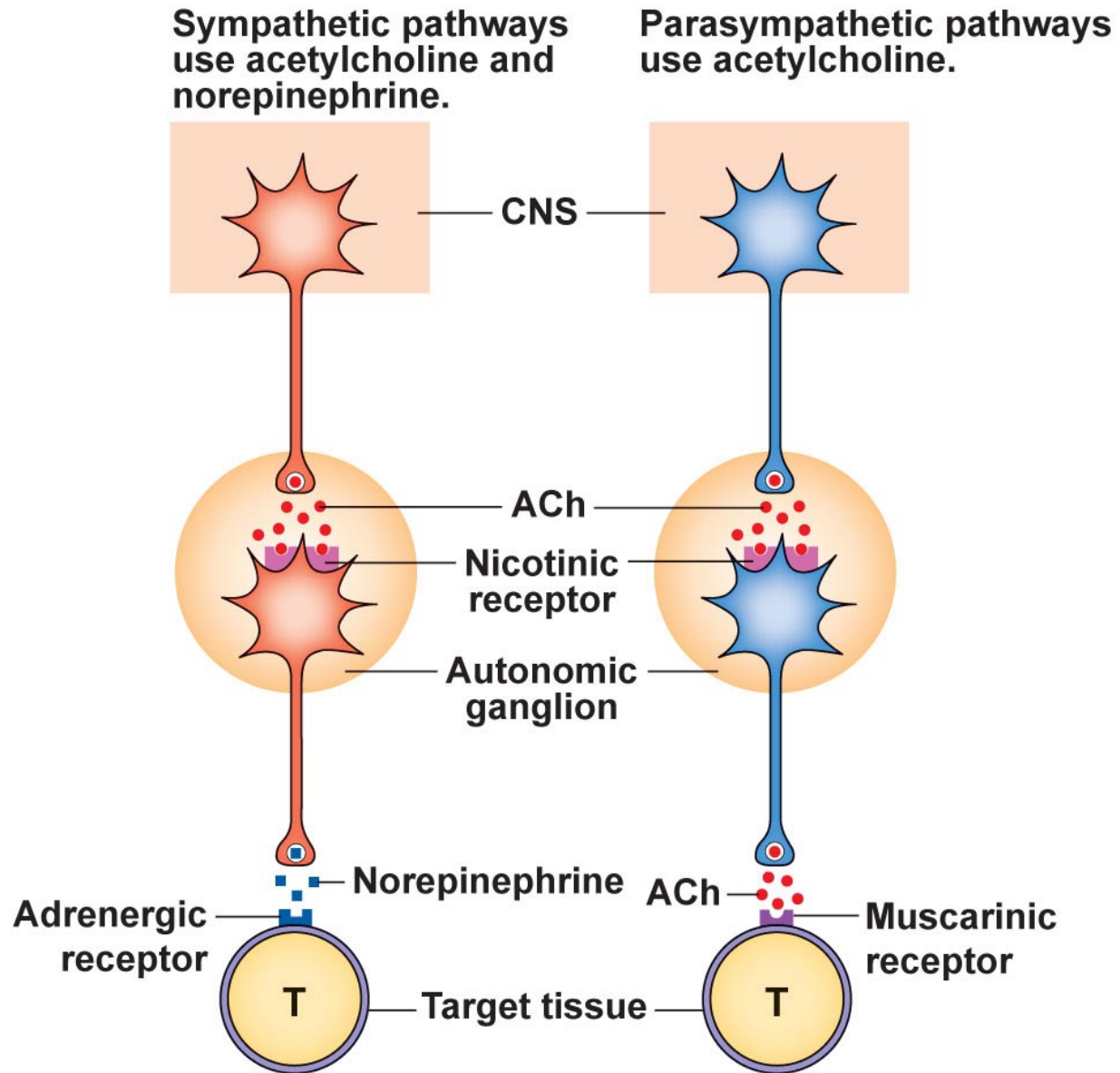


Figure 11-8

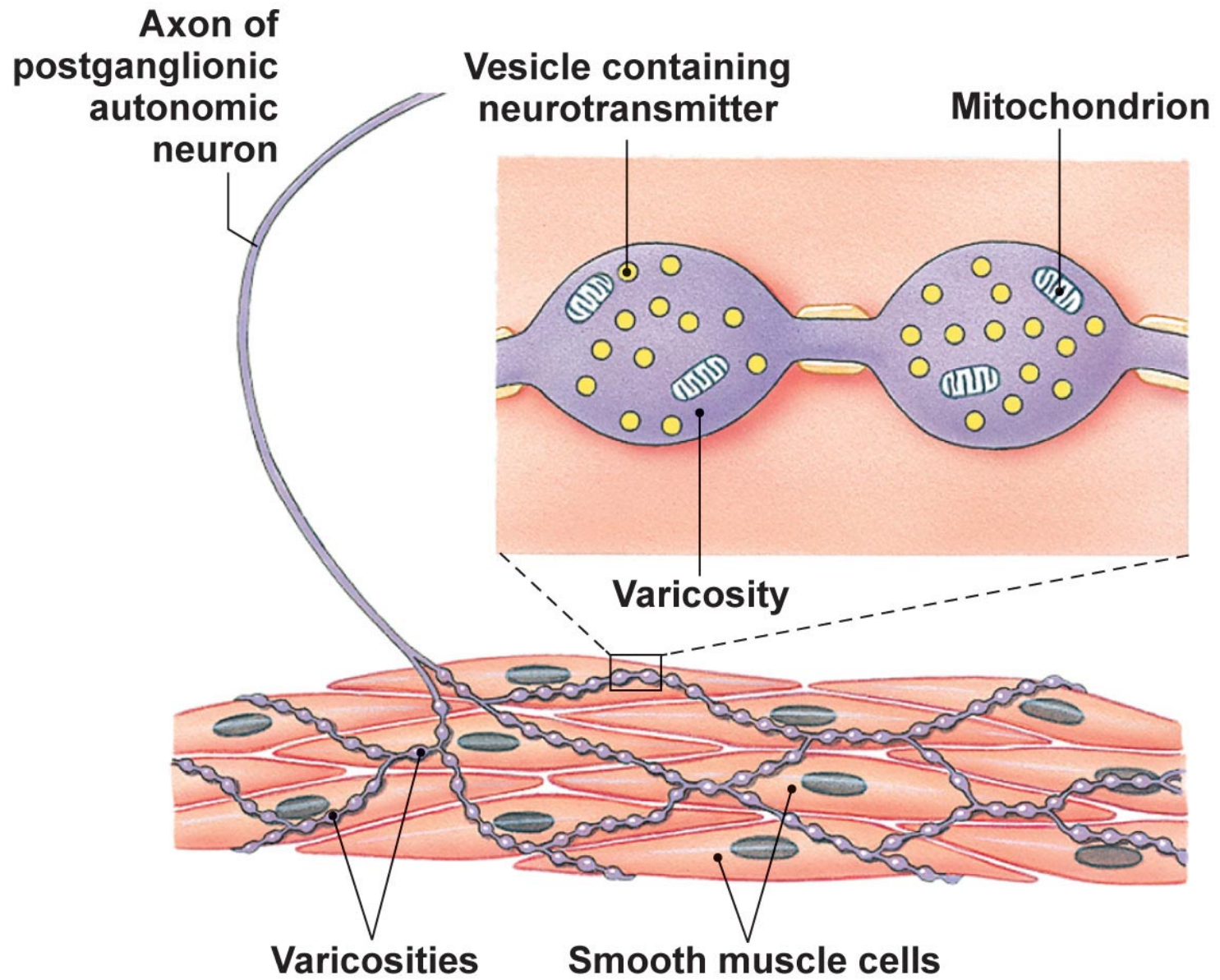
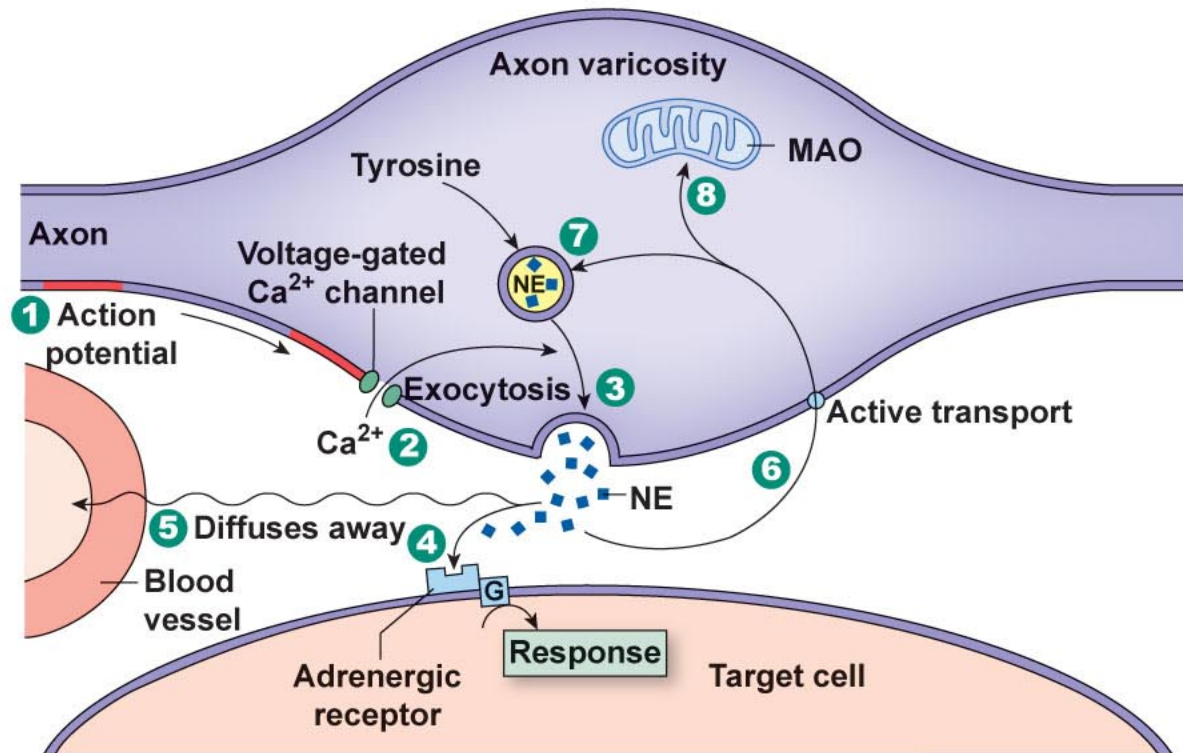


Figure 11-9, overview



- 1 Action potential arrives at the varicosity.
- 2 Depolarization opens voltage-gated Ca<sup>2+</sup> channels.
- 3 Ca<sup>2+</sup> entry triggers exocytosis of synaptic vesicles.
- 4 NE binds to adrenergic receptor on target.
- 5 Receptor activation ceases when NE diffuses away from the synapse.
- 6 NE is removed from the synapse.
- 7 NE can be taken back into synaptic vesicles for re-release.
- 8 NE is metabolized by monoamine oxidase (MAO).

Figure 11-10

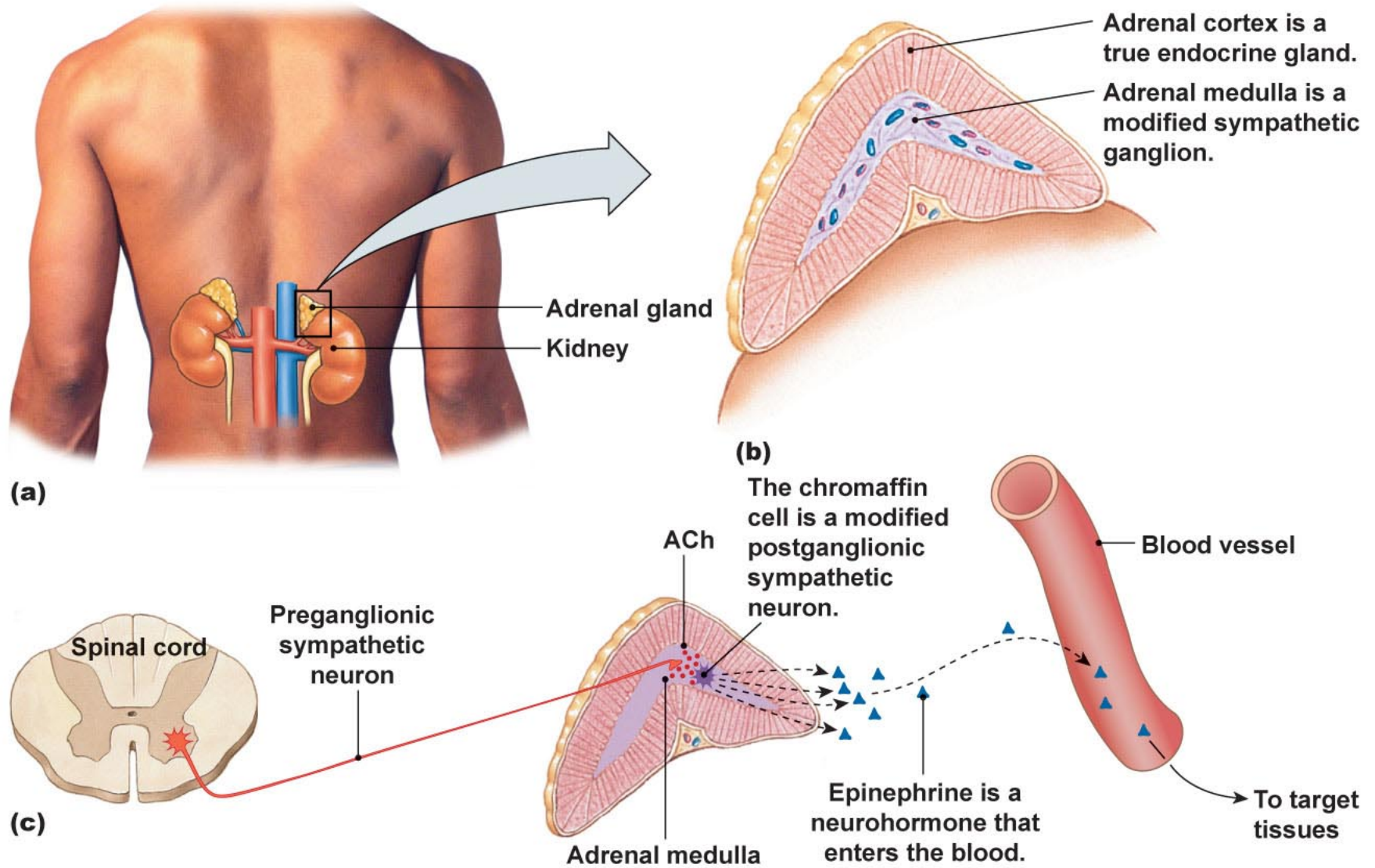
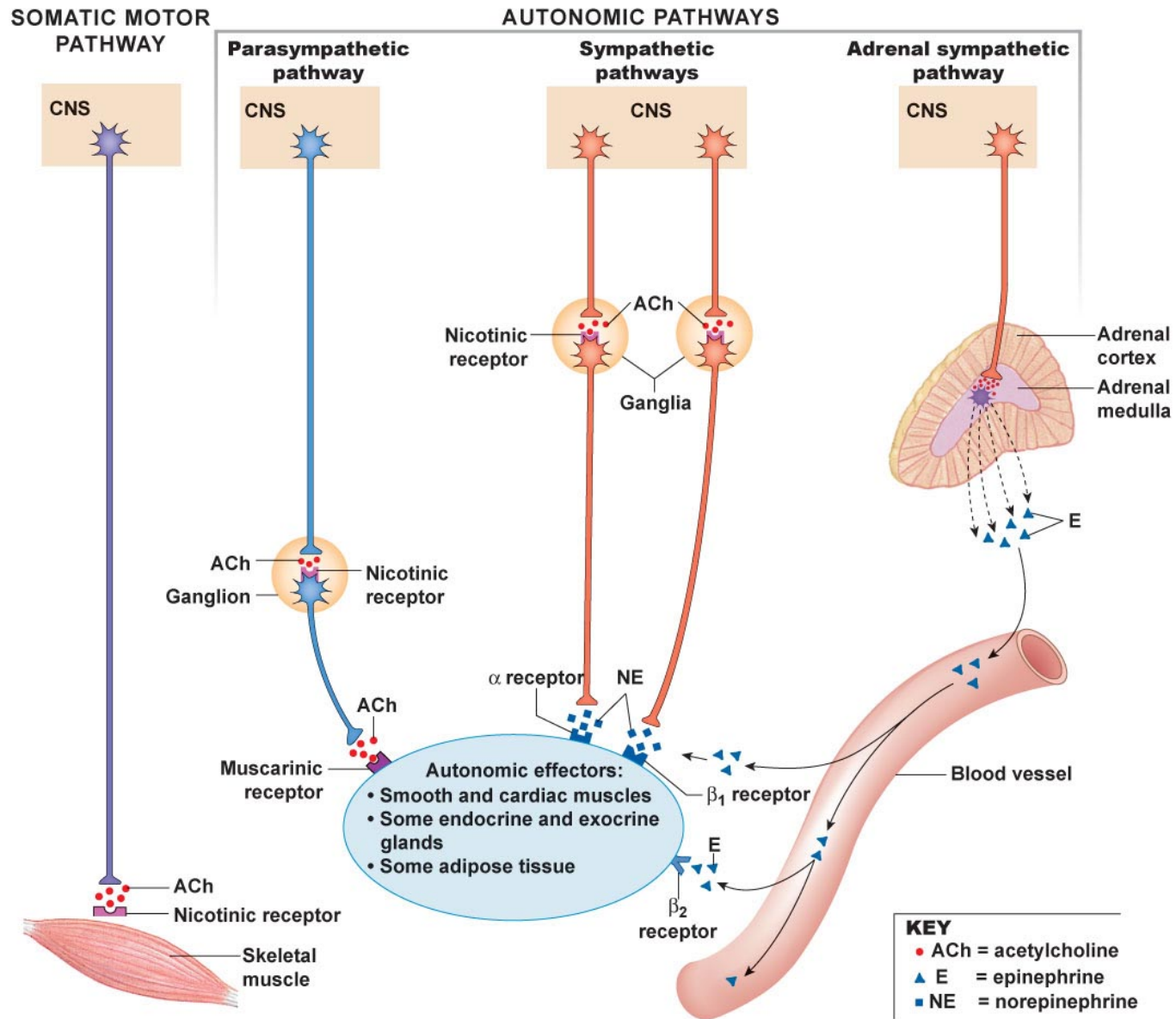


Figure 11-11, overview



**Table 11-1**

<b>TABLE 11-1 Postganglionic Autonomic Neurotransmitters</b>		
	<b>SYMPATHETIC DIVISION</b>	<b>PARASYMPATHETIC DIVISION</b>
<b>Neurotransmitter</b>	Norepinephrine (NE)	Acetylcholine (ACh)
<b>Receptor types</b>	$\alpha$ - and $\beta$ -adrenergic	Nicotinic and muscarinic cholinergic
<b>Synthesized from</b>	Tyrosine	Acetyl CoA + choline
<b>Inactivation enzyme</b>	Monoamine oxidase (MAO) in mitochondria of varicosity	Acetylcholinesterase (AChE) in synaptic cleft
<b>Varicosity membrane transporters for</b>	Norepinephrine	Choline