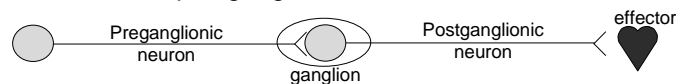


The Peripheral Nervous System

- The Autonomic Motor Division of the PNS is called the ANS (autonomic nervous system)
 - Contains two divisions
 - Sympathetic
 - “fight, flight or fight” division
 - Parasympathetic
 - “rest and digest” division
 - What do these divisions do?
 - Regulate autonomic body functions
 - How do they accomplish this?
 - By pathways and neurotransmitters

The Peripheral Nervous System

- ANS characteristics
 - A two neuron pathway that is divergent with a ganglion at the junction of the two neurons
 - 1st neuron = preganglionic neuron
 - 2nd neuron = postganglionic neuron



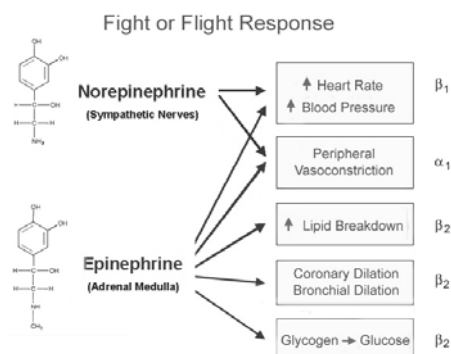
- Features common to both divisions
 - Both division's preganglionic neurons utilize Ach as a neurotransmitter
 - Excitatory in both divisions
 - Both divisions have ganglia
 - Pathway allows for divergence

The Peripheral Nervous System

- Differences
 - Location
 - **Sympathetic** neurons arise from the thoracic and lumbar regions of the spinal cord ("thoracolumbar division")
 - **Parasympathetic** neurons arise from cranial nerves and spinal nerves of the sacral regions (craniosacral division)
 - Neurotransmitters
 - **Sympathetic** postganglionic neurons catecholamines (epinephrine & norepinephrine)
 - » Bind to adrenergic receptors (alpha & beta) on effector membrane to cause effect
 - **Parasympathetic** postganglionic neurons release acetylcholine
 - » Bind to cholinergic receptors (nicotinic or muscarinic) on the effector membrane to cause effect
 - Ganglia locations
 - Sympathetic ganglion are located more "midline"
 - Parasympathetic ganglion are located close to the effector
 - What does this do to the relative length of the pre and postganglionic neurons?

The Peripheral Nervous System

- The effects of the ANS are due to the effects of the neurotransmitters on the target tissues
 - Sympathetic division's effects are excitatory on those organs that increase energy use
 - Increases (+):
 - Heart rate, respiration rate, blood flow to muscles and brain, pupil dilation
 - Decreases (-):
 - Digestive and urinary function (activity and blood flow)
 - Epinephrine is released from the adrenal medulla which is a sympathetic ganglia
 - From here epinephrine enters the bloodstream

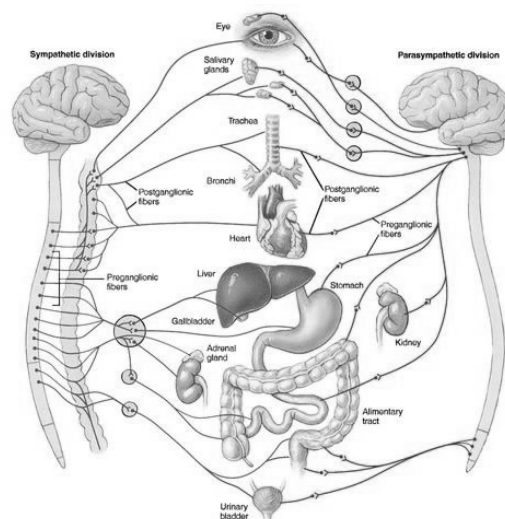


The Peripheral Nervous System

- Parasympathetic division's effects are opposing
 - Increases (+) digestive and urinary function
 - Decreases (-) heart rate, respiration rate blood flow to muscles
- **Dual innervation** occurs when effectors are controlled by both divisions of the ANS.

The Peripheral Nervous System

- The ANS layout



Autonomic Effects on Various Organs of the Body			
Effector organs		Effects of sympathetic stimulation	Effects of parasympathetic stimulation
Eye	Radial muscle of the iris	(α) Contraction (mydriasis)	
	Sphincter muscle of the iris		Contraction (miosis)
	Ciliary muscle of the lens	(β) Relaxation Lens flattens	Contraction (Lens curves)
Heart	SA node	(β) \uparrow heart rate	\downarrow heart rate
	Atria	(β) \uparrow heart rate and force	\downarrow heart force
	AV node	(β) \uparrow conduction velocity	\downarrow conduction velocity
	Purkinje system	(β) \uparrow conduction velocity	
	Ventricles	(β) \uparrow heart rate and force	
Blood vessels	Coronary	(α) Constriction	Dilatation
		(β) Dilatation	
	Cutaneous	(α) Constriction	
		(ACh) Dilatation	
	Skeletal muscle	(α) Constriction	
		(β) Dilatation	
		(ACh) Dilatation	
	Abdominal visceral	(α) Constriction	
		(β) Dilatation	
	Renal	(α) Constriction	
	Salivary glands	(α) Constriction	Dilatation
Stomach	Motility and tone	(β) Decrease (usually)	Increase
	Sphincters	(α) Contraction (usually)	Relaxation (usually)
	Secretion	Inhibition (?)	Stimulation
Intestine	Motility and tone	(α , β) Decrease	Increase
	Sphincters	(α) Contraction (usually)	Relaxation (usually)
	Secretion	Inhibition (?)	Stimulation

Autonomic Effects on Various Organs of the Body Continued			
Effector organs		Effects of sympathetic stimulation	Effects of parasympathetic stimulation
Gallbladder and ducts		Relaxation	Contraction
Urinary bladder	Detrusor	(β) Relaxation (usually)	Contraction
	Trigone and sphincter	(α) Contraction	Relaxation
Ureter	Motility and tone	Increase (usually)	Increase (?)
Male sex organs		Ejaculation	Erection
Skin	Pilomotor muscles	(α) Contraction	
	Sweat glands	(α) Slight, localized secretions	
		(ACh) Generalized secretions	
Spleen capsule		(α) Contraction	
Lung (bronchial muscles)		(β) Relaxation	Contraction
Adrenal medulla			Secretion of epinephrine and norepinephrine
Liver		(β) Glycogenolysis	
Pancreas	Acinar cells	\downarrow secretion	Secretion
	Islet cells	(α) Inhibition of insulin and glucagon secretion	Insulin and glucagon secretion
		(β) Insulin and glucagon secretion	
Salivary glands		(α) Thick, sparse secretion	Profuse, watery secretion
Lacrimal glands			Secretion
Nasopharyngeal glands			Secretion
Adipose tissue		(β) Lipolysis	
Juxtaglomerular cells		(β) Renin secretion	
Pineal gland		(β) Melatonin synthesis and secretion	