

AUTONOMIC NERVOUS SYSTEM

Sympathetic & parasympathetic divisions

Sympathetic division = (fight/flight)

Parasympathetic division = (rest/digest)

Organ function:

balance between sympathetic/parasympathetic stimulation

ANS motor fibers share a 2-neuron system

1) Pre-ganglionic fiber (CNS) synapse onto...

autonomic ganglia found throughout body

2) Post-ganglionic fiber synapse onto target organ

REVIEW OF NEURON TYPES

GSA - general somatic afferent (sensory)
= skin, skeletal muscle, joints, etc. to the CNS

GSE - general somatic efferent (motor)
= CNS to the skin, skeletal muscle, etc.

SSA - special sensory afferent (sensory)
= ears, eyes, nose, tongue

GVA - general visceral afferent (sensory)
= blood vessels, gut, lungs, etc. to the CNS

GVE - general visceral efferent (motor)
= CNS to gut, blood vessels, lungs, etc.

Pardon the pun, but... GVE's are the "guts" of the ANS!

Sympathetic Division (*Flight or Fight Response*)

Thoracolumbar division

Pregang. GVE fibers exit from T1-L2

Sympathetic "Chain" ganglia

1. segmental string of autonomic ganglia
2. located along posterior body wall [T₁-L₂]
3. conduit that integrates other spinal levels = C₆-Co₁

Thoracolumbar division

1. **MOST** pregang. GVE fibers pass through chain ganglia
2. preganglionic GVE synapse @ collateral ganglia
3. postganglionic GVE synapse at target (gut wall)
4. **SOME** pregang. GVE fibers synapse @ chain ganglia
- postganglionic GVE synapse at target (skin)
5. postgang. & pregang. fibers about equal in length
6. preganglionic synapse = acetylcholine (Ach)
7. postganglionic synapse = norepinephrine

Why so complicated?

Integration of the Fight/Flight response

1. mental alertness, increased metabolism
2. increases respiratory and heart rate
3. activates sweat glands
4. stops urinary & digestive functions
5. cuts the blood supply to urinary & digestive organs

Parasympathetic Division (*Rest and Digest*)

Cranio-Sacral division

1. Preganglionic GVE fibers bundled with cranial nerves
CN's III, VII, IX, X
- vagus is largest parasympathetic nerve to GI
2. Preganglionic GVE fibers bundled with sacral nerves
sacral: S₂₋₄ = pudendal nerve
3. Preganglionic GVE fibers travel to:
 - a. parasympathetic ganglia throughout head
 - b. ganglia in tissue walls of target organs
4. Postgang. fibers radiate through target organs
5. Postgang. fibers are short compared to pregang. fibers
6. BOTH postgang./pregang. fibers utilize acetylcholine

Why so complicated?

Integration of the Rest/Digest response

1. decreases metabolism
2. decreases respiratory & heart rates
3. activates salivary & digestive glands
4. increases blood supply to urinary & digestive organs
5. increases GI activity, urination & defecation

Why the different Neurotransmitters?

Neurotransmitter acetylcholine (ACh) is short-acting

- parasympathetic responses are of short duration
- easily turned 'off'

Neurotransmitter norepinephrine = Long acting

- sympathetic responses may be long in duration
- not easily turned 'off'

Endocrine System & Homeostasis

- * homeostasis - maintain the 'status quo'
- * requires physiological coordination of many organs
- * integration = nervous + endocrine systems

Nervous system "instruction" to a target organ:

1. via cranial/peripheral nerves
2. localized affects on target organs
3. short-term affects with immediate recovery

Endocrine system "instruction" to a target organ:

1. via chemical messengers = hormones
2. via blood supply = widespread, systemic affects
3. long term affects with slow recovery

Hormone activity

1. hormones enter blood stream from endocrine glands
2. typically, abundant capillary beds are present
3. hormones:
 - a. circulate through the blood freely
 - b. attach to various proteins (carriers)
4. target cells have specific receptors for each hormone
5. circulating hormones are effective @ 2-60 minutes
6. hormones are inactivated by:
 - a. broken down by liver tissues
 - b. broken down by enzymes in the blood
 - c. loss by diffusion out of the blood (kidneys/urine)

Hormones directly alter cellular function:

- a. by penetrating cell & entering cell nucleus
- b. by attaching to specific DNA segments
- c. stimulating new protein/enzyme synthesis