Autonomic Nervous System

Medical Neuroscience
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Autonomic Nervous System
- Enteric System
- Sympathetic Nervous System
- Parasympathetic Nervous System

All systems have GVE and GVA components

Primarily considered a
two neuron chain motor system

Autonomic Nervous System

- Limbic System
- Hypothalamus
- Reticular Formation
- Spinal Level
- Periphery

Autonomic Nervous System

Afferent Input (GVA)
Skeletal vs. Smooth Muscle Motor Systems

PSNS & SNS – Similarities

PSNS & SNS – Differences

- SNS
  - activate body
  - thoracolumbar (T1-L2)
  - short preganglionic/long postganglionic fibers
  - global responses
  - postganglionic transmitter: norepinephrine (except sweat glands – ACH)

- PSNS
  - prepare body for rest
  - craniosacral (CN III, VII, IX, X & S2-4)
  - long preganglionic/short postganglionic fibers
  - discrete/local responses
  - postganglionic transmitter: acetylcholine

PSNS

- Spinal cord or brainstem
- Periphery
- “B” fiber
- “C” fiber
- Ganglia
- Acetylcholine
- PSNS & SNS
- Nuclei

SNS

- activate body
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- prepare body for rest
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Sympathetic Nervous System

- "Fight or Flight" system
- Activation
  - increases heart rate
  - increases sweating
  - dilates pupil
  - inhibits GI movement
  - closes sphincters
  - diverts blood from skin and GI tract to skeletal muscles
Sympathetic Nervous System - Preganglionic Neuron May:

1. terminate on postganglionic neuron in the sympathetic chain ganglia
2. ascend or descend to higher or lower ganglia and terminate on postganglionic neuron in the sympathetic chain ganglia
3. pass through the sympathetic chain to prevertebral ganglia (celiac, inferior or superior mesenteric)
4. pass through the sympathetic chain ganglia to adrenal medulla

Referred pain:
- heart – T1-4
- gall bladder – T6-8
- stomach – T7-8
preganglionic fibers from T1-5 ascend
postganglionic fibers from sup. cervical ganglia follow carotid a.
fibers follow III and V ophthalmic
innervate dilator m., levator palpebrae, sweat & lacrimal glands

Parasympathetic Nervous System
- prepares body for rest
  - promotes digestion, GI peristalsis
  - slows heart rate
  - constricts pupil
  - empties bladder
  - relaxes sphincters
  - mediates genital erection
Horner’s Syndrome
- Damage to the descending fibers from the hypothalamus or the superior cervical ganglia
- Miosis – pupillary constriction
- Anhidrosis – lack of sweating
- Ptosis – drooping of the eye lid
- Enophthalmos – eye appears to sink in to the orbit

Bladder
- SNS – retention
- PSNS – voiding (micturation)

SNS input from L1-2 (int. urinary sphincter)
- PSNS input from S2-4 (detrusor mm)
- GSE (Onuf) to ext. urinary sphincter
- GSA (pain, temp & pressure to T12/L1 & S2-4)
- GVA to S2-4
- Paracentral lobule & brainstem
Autonomic Nervous System and the Bladder

- "UMN bladder" = "spastic bladder" = automatic reflex bladder
- "LMN bladder" = "flaccid bladder" = "atonic bladder" = autonomous reflex bladder