Peripheral Nervous System Overview

• What is the PNS?
  – Continuation of the CNS
  – Relays all information to and from the CNS
  – Has its own integration centers
    • Ganglia of the autonomic nervous system
    • Plexuses of the enteric nervous system
• Where does the CNS end and the PNS begin?
  – PNS begins when the spinal nerves exit the vertebral column
• What are the functional systems of the PNS?
  – Somatic System
  – Autonomic System
    • Enteric System

Peripheral Nervous System Somatic Division

• Somatic Division has
  – Afferent components
    • Senses
      – Special & General
  – Efferent components
    • Motor
      – Somatic
        » voluntary muscle control
        » Utilize ACh at all neuromuscular junctions
Peripheral Nervous System
Autonomic System Design & Function

- ANS is designed to
  - Maintain homeostasis by
    - Working with the endocrine system
    - Being influenced by emotional/behavioral states
    - Utilizing reflex pathways that trend towards being antagonistic in nature
- The link between the CNS and the ANS is the hypothalamus which
  - monitors
    - Blood chemistry
    - Temperature
    - Hunger
  - Influences ANS, endocrine and behavioral responses

Peripheral Nervous System
Autonomic System Design & Function

- ANS consists of two antagonistic systems
  - Sympathetic Division
    - Fright
    - Flight
    - Fight
  - Parasympathetic Division
    - Rest and Digest Processes

Peripheral Nervous System
Autonomic System Design & Function

- ANS Pathway is two neurons + ganglia
  - 1st neuron
    - Exits the CNS
    - preganglionic neuron
  - 2nd neuron
    - postganglionic Neuron that goes to target cells
    - point of Synapse creates autonomic ganglion

Peripheral Nervous System
Autonomic System Design & Function

- How does a two neuron system achieve antagonizing results?
  - Different neurotransmitters released by the postganglionic neurons
    - Effect is determined by
      - the receptors on the target cells

Peripheral Nervous System
Autonomic System Design & Function

- ACh is used by postganglionic neurons of the parasympathetic division
  - mainly muscarinic receptors
- Norepinephrine is used by postganglionic neurons of the sympathetic division
  - mainly adrenergic receptors
Peripheral Nervous System
Autonomic System Design & Function

- **Parasympathetic Division Specifics**
  - Preganglionic neurons exit at the cranial and sacral regions
  - Majority of parasympathetic outflow is via the vagus nerve (75%)
  - Utilize mainly muscarinic receptors and to a lesser extent nicotinic receptors
    - Nicotinic = ICR events
      » Ionotropic for Na⁺, K⁺ and Ca²⁺
    - Muscarinic = GPCR events
      » Metabotropic
      » May be + or –
      » 5 different forms of receptors

- **Sympathetic Division Specifics**
  - Two neuron pathway uses norepinephrine (NE)
    - Binds to preferentially to alpha 1&2 receptors and Beta-3 receptors
    - NE binds equally (with E) to Beta-1 receptors
    - NE binds less preferentially to Beta-2 receptors
  - Adrenal sympathetic pathway uses epinephrine
    - Binds to preferentially to Beta-2 and equally with Beta-2 receptors
  - Receptors:
    - α₁ receptors when activated activates phospholipase C
    - α₂ receptors when activated decreases cAMP production
    - β₁, β₂, β₃ receptors all increase cAMP production

Peripheral Nervous System
Autonomic System Integration
Peripheral Nervous System
Enteric System

- Enteric System
  - Controls motility and secretion within the digestive system
  - Consists of a neural network that is
    - Influenced by the ANS
    - Capable of autonomic controls via reflexes
    - Made up of ~100 million neurons within the
      - Submucosal plexuses
      - Myenteric plexuses