

Unit 4 Lecture 2 Notes

I. Smooth Muscles

- A. Single Unit or Visceral smooth muscle – (examples: hollow organs, such as stomach and intestine's)
 - i. Outer longitudinal layer – runs the length of the structure and contracts to dilate (expand) and shorten muscle
 - ii. Inner circular layer – contracts to constrict and elongate organ
 - iii. Rhythmicity – repeated contractions without external stimulation; self exciting fibers act as pacemakers (depolarize)
 - 1. Gap junctions transmit stimulus to adjacent fibers
 - 2. Fibers contract as a single unit
 - iv. Peristalsis – wave-like series of contractions that move material through digestive track
- B. Multiunit smooth muscle – occurs in separate fibers and require stimulation by motor nerves (examples: irises of eyes, arrector pili of muscles, large airways of lungs)

II. Nervous System – control and communication center of body

- A. Afferent – toward a structure or SENSORY information
 - i. Info being sent and the structures carrying it to the brain or spinal cord
 - ii. Visceral afferents: information from visceral organs
 - iii. Somatic afferents: information from body (muscle joints and skin)
- B. Efferent – away from a structure or motor information
 - i. Information and structures carrying it FROM brain/spinal cord TO muscles/glands
 - ii. Somatic Nervous System (SNS) – conducts impulses to skeletal muscles (voluntary)
 - iii. Autonomic Nervous System (ANS) – regulates smooth muscle, cardiac muscle, and glands (involuntary)
 - 1. Sympathetic and Parasympathetic – one excitation, one inhibition
- C. Functions:
 - i. Collecting information – receptors monitor changes inside and outside the body; gathers afferent input
 - ii. Evaluating – decision making – processes and interprets sensory input
 - iii. Triggers responses – activate muscles and glands; motor or efferent output
- D. Central Nervous System – Function: integration and command centers
 - i. Dictate response based on: past experience, reflexes, and current conditions
- E. Peripheral Nervous System (PNS) – carry sensory information to and motor information from the brain/spinal cord
 - i. Cranial nerves – peripheral nerves of brain
 - ii. Spinal nerves – innervate most skeletal muscle

F. Supporting Cells

- i. (9X more numerous) and provide support for neurons – framework or scaffolding; assist, segregate, insulate neurons
 1. undergo mitosis – repair and reproduce
- ii. Schwann cells – in PNS – form myelin Sheaths and wrap around nerves (phagocytes)
- iii. Satellite cells – in PNS - Arranged around cell bodies of neuron in peripheral ganglia; help control chemical environment
- iv. Neuroglial or glial cells – CNS supporting cells – framework for neurons, electrically insulate neurons, regulate fluid and gas exchange with neurons and environment
 1. Astrocytes – Largest, most elaborate, most numerous; lots of radiating projections with bulbous ends to cling to neurons and capillaries
 - a. form a living barrier between capillaries and neurons, function in neuron metabolism; control chemical environment around neurons
 2. Microglia – scavengers of CNS; increase with injury; phagocytize microorganisms and dead tissue
 3. Ependymal cells – squamous to columnar shape and ciliated; line central ventricles; form permeable barrier between cerebrospinal fluid and tissue fluid
 4. Oligodendrocytes – small cells that wrap around nerve fibers in CNS and produce myelin sheaths

G. Neuron or Nerve cells – conducting cells; basic functional unit of NS; conduct impulses throughout system (information)

- i. Long lived, high metabolic rate, requires lots of O₂ and Glucose
- ii. Amitotic – can't reproduce
- iii. Cell body usually in CNS and protected by cranial bones and vertebrae
 1. Plasma membrane – regulates exchange of materials in and out of cell
 - a. Assist in reception, propagation, and transmission of nerve impulse
 2. Nucleus – contains DNA
 3. Nucleolus – large amounts of RNA
 4. Cytoplasm – mitochondria, Golgi complex, lysosomes, no centrioles (no mitosis), rough ER or Nissl Bodies
 - a. Neurofibrils – bundles of microtubules and microfilaments that intracellular transport (from body to processes)
- iv. Processes extend out from cell body
 1. Dendrites – Afferent process – info to cells in body
 - a. Spines – thorn like extensions that increase surface area to receive impulses
 2. Axon – efferent process (info away from cell body)
 - a. Arises from axon hillock

- b. Telodendria – branching filaments at distal end – end in bulbous ends called axon terminal or synaptic knobs
- c. May contain contralateral branches
- d. Axolemma – plasma membrane of axon (myelinated)
- 3. Myelin – whitish, fatty, segmented sheath covering some nerve fibers (ex. Schwann cells and Oligodendrocytes)
 - a. Protects and insulates fibers
 - b. Increases propagation speed
 - c. Creates Nodes of Ranvier - spaces/nodes between cells
 - d. Extends to telodendria
 - e. Myelination in PNS
 - i. Schwann cells indent to receive axon, myelin wraps around axon
 - ii. Cytoplasm and nucleus squeeze to outer part forming plasma membrane and cytoplasm
 - iii. Neurilemma – surrounds myelin sheath
 - iv. Unmyelinated fibers - Schwann cells indents and partly encloses axons.
 - f. Myelination in CNS
 - i. Oligodendrocyte extensions coil around axon (1: many axons)

H. Neuron Structural Classes

- i. Bipolar Neurons – axon and dendrites on opposite ends
 - 1. Always afferent (ex. Retina, Olfactory mucosa)
- ii. Unipolar neurons – single process from cell body, divides: axon/dendrite
 - 1. Always afferent (ex. found in PNS ganglia)
 - 2. Carry sensory impulses from receptors to CNS
- iii. Multipolar neurons – many processes (1 axon any dendrites)
 - 1. BOTH afferent and efferent

I. Neuron Functional Classes

- i. Afferent or Sensory (unipolar)
- ii. Association – between afferent and efferent (multipolar)
- iii. Efferent or Motor - muscles and glands (multipolar)

J. Nerve – Bundle of nerve fibers in PNS

- i. Endoneurium – connective tissue sheath surrounds each nerve fiber
- ii. Fascicle – group of nerve fibers held together by Perineurium CT sheath
- iii. Epineurium – hold together nerves or groups of fascicles

K. Nerve Tract – bundle of nerve fibers in CNS (fibers are axon and dendrites both myelinated and unmyelinated)