Medical School Histology Basics
Peripheral Nerve

VIBS 289 lab

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NERVOUS TISSUE

FUNCTIONS: SPECIALIZED FOR THE TRANSMISSION, RECEPTION, AND INTEGRATION OF ELECTRICAL IMPULSES

DISTINGUISHING FEATURES:
NEURONS – VERY LARGE EXCITABLE CELLS WITH LONG PROCESSES CALLED AXONS AND DENDRITES. THE AXONS MAKE CONTACT WITH OTHER NEURONS OR MUSCLE CELLS AT A SPECIALIZATION CALLED A SYNAPSE WHERE THE IMPULSES ARE EITHER ELECTRICALLY OR CHEMICALLY TRANSMITTED TO OTHER NEURONS OR VARIOUS TARGET CELLS (e.g., MUSCLE). OTHERS SECRETE HORMONES.
NERVE IS LIKE EPITHELIUM

ORIGIN OF NERVE IS ECTODERM

LIKE EPIDERMIS (EPITHELIUM) OF SKIN
Peripheral Nerve: Nodes of Ranvier and Axons. Stain: Masson's trichrome. 100×
Peripheral ganglion monkey

Myelinated axons
Nucleus contains a large, prominent nucleolus and an abundant amount of euchromatin

= Neurons are metabolically active cells

Satellite cells

Surrounding each cell body should be a variable number of nuclei of Satellite cells
Peripheral ganglion monkey

Nissl substance
Ganglion cell bodies in pancreas
Bile ducts in monkey

Ganglion cell body in cystic bile duct

vein
DEMO SLIDE BOX 78. Dorsal root ganglion & nerve, cat. Small ganglion and a cross-section of nerve.
**DEMO SLIDE BOX 78.** Dorsal root ganglion & nerve, cat. small ganglion and a cross-section of nerve

dark “dots” (these are the axons) surrounded by “white circles” (myelin sheath)
Remember Connective Tissue
Layers of Skeletal Muscle

Epimysium, Perimysium, and Endomysium
Organization of Peripheral Nerves

Nerve fibers - axons invested by connective tissue

**Epineurium** - surrounding entire nerve
**Perineurium** - surrounding fascicles – constitutes the PNS blood barrier via **tight junctions** between fibroblasts
**Endoneurium** - between individual nerve axons
Organization of Peripheral Nerves

- Spinal cord
- Sensory ganglion
  - Dorsal root
  - Ventral root
- Cell body of motor neuron
- Interneuron
- Motor neuron
- Schwann cell
- Myelin
- Perineurium
- Endoneurium
- Epineurium
- Sensory neuron
- Skin
- Striated muscle
DEMO SLIDE BOX 78. Dorsal root ganglion & nerve, cat. small ganglion and a cross-section of nerve

**Epineurum** - surrounding entire nerve

**Perineurum** - surrounding fascicles –

**Endoneurum** - between individual nerve axons
Types of Nerves

- Unipolar
- Bipolar
- Pseudounipolar
- Multipolar
Bipolar neurons

bipolar neurons of the inner ear Slide HISTO0280 at the left hand side of the cochlea on the bottom circle
Duodenum (small intestine)

- Nerve (Auerbach's plexus)
- Circular and longitudinal smooth muscle layers
- Submucosal glands
- Mucosa
- Gut lumen
Auerbach’s plexus, which can be found in between the circular and longitudinal smooth muscle layers
Smooth muscle cells

Meissner’s plexus cell bodies

Epithelium

(Auerbach's plexus) Nerve cell bodies
EM 10c: postganglionic neuronal cell body in an Auerbach’s plexus; 22,000x

1. Nissl substance

2. Neurosecretory vesicles
SCHWANN CELLS    MYELIN
DEMO SLIDE BOX 78. Dorsal root ganglion & nerve, cat. Small ganglion and a cross-section of nerve axons, myelin sheath, node of Ranvier.
Peripheral nerve, monkey nodes of Ranvier
Nerve in connective tissue of a salivary gland

Perineurum
Nerve nodes of Ranvier
SCHWANN CELL STRUCTURE / FUNCTION
MYELINATION and SCHWANN CELLS
Skin hand monkey

nerve

Fibroblasts

Endoneurum

Perineurum

Nerve
Nerves in tissues/organs

Perineurum

Nerves
Human spermatic cord with vessels and nerve
EM 10d: Schwann cells and axons; 21,000x print

1. Microtubule
2. Myelinated coat around a myelinated axon
3. Schwann cell cytoplasm around an unmyelinated axon
4. Vesicle in axoplasm
5. Nucleus of a Schwann cell
Axonal transport

**Anterograde** - toward terminal - kinesin

**Retrograde** - toward cell body - dynein

- Tetanus toxin
- Neurotropic viruses (herpes and rabies) use path to get to cell body in CNS
Neuronal Structure / Function

1. INJECTION OF HRP

HRP is injected at the site of interest and is taken up by endocytosis into axon terminals in the vicinity.

2. TRANSPORT OF HRP

Several hours or days are allowed to elapse to give time for the vesicles containing HRP to travel back along the axon by retrograde transport.

3. LOCALIZATION OF HRP

Tissue sections are treated with reagents to generate colored products wherever HRP is located. Nerve cell bodies that send axons to the remote site of HRP injection are thus identified.
Neuronal Structure/Function

In general, the left brain seems to be good at language, mathematics, and logical thinking. The right is important in spatial perception, art and music appreciation, creativity, and intuitive thinking. Why this specialization? No one is sure, but in any case, it lets you do many things at one time.

The limbic system (seen in cross section within the cerebrum) includes the thalamus, which relays information from the senses to the cortex; the hypothalamus, which regulates sexual urges and other motivational states; the amygdala, which controls anxiety and fear; and the hippocampus, which plays a role in learning and memory.

This cutaway shows the motor cortex of one hemisphere and the somatosensory cortex of the other. The disproportionately large area devoted to face and hands explains their sensitivity to touch.
Motor end plates in skeletal muscle
One nerve innervates several muscle cells

Slide HISTO007
Summary of the Physiological Events at the Synapse

- Arrival of action potential at axon terminal
- Opening Ca++ channels
- Influx of Ca++ into axon terminal
- Exocytosis of neurotransmitter
- Diffusion of neurotransmitter across synaptic cleft
- Binding of neurotransmitter to receptors on target cell
- Opening of Na+ channels causing depolarization of target cell
- Removal of neurotransmitter
1. Synaptic cleft
2. Synaptic vesicles
3. Smooth muscle
Skeletal muscle fibers (cells)

Muscle spindles

Intrafusal muscle fibers inside the capsule
Fingertip, monkey - sweat glands and ducts among Pacinian corpuscles
Skin hand monkey

Eccrine sweat glands
Adipocytes
Pacinian corpuscles
Reticular layer
Papillary layer
Dermal papillae
Epidermal peg
Hypodermis
Slide HIST0 29: Thick Skin (ventral surface of finger)

Meissner’s corpuscles are found in dermal papillae.

Meissner’s corpuscle is a mechanoreceptor nerve ending for sensitivity to light touch; you would find more on your fingers because they are more sensitive to touch than your elbow.
Meissner’s corpuscles
Smooth muscle cells, peripheral nerve fibers and bundles of collagen fibers

Fibroblasts
Bundles of collagen fibers
Fibroblasts
Smooth muscle cells
Peripheral nerve fibers

109 : Skin, hand, monkey
Slide 196: Spermatic cord

- Bundles of collagen fibers
- Peripheral nerve fibers
- Fibroblasts
- White fat cells
- Nerve
- Smooth muscle cells
34460 Human spermatic cord with nerve toluidine blue

- Endothelium
- Perineurum
- Peripheral nerve fibers
- Bundles of collagen fibers
- Smooth muscle cells
- Fibroblasts
- Nerve
Questions on nerves

Which is **not** a distinguishing feature of the nervous system
a. Comprise the central and peripheral nervous system.
b. **Individual peripheral nerves are found in limited places in the body.**
c. Individual neurons and clusters of neurons (called ganglia) are found in most organs
d. a and b
e. a, b, and c

Which embryonic origin – tissue type(s) match(s)?
a. **Ectoderm – nerve**
b. Endoderm – muscle
c. Mesoderm – nerve
d. a and b
e. a, b, and c
Many illustrations in these VIBS Histology YouTube videos were modified from the following books and sources: Many thanks to original sources!

The end of

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