

Western university · canada

Tutorial 9 Sections 009/010

TA: Greydon Gilmore Physiology 2130 Nov 12th, 2019



Your TA reminding you...

Same place!

- 2nd Peerwise assignment (1.5%)
 - Post 2 MC questions: due Nov 27th @ midnight
 - Answer 5 MC questions: due Nov 29th @ midnight
- 2nd Quiz (1%)
 - Opens: Dec 2nd @ 4pm
 - Closes: Dec 3rd @ 4pm
- 2nd Midterm (15%)
 - When: Dec 19th @ 9am-10am
 - Room Assignments:
 - ABBA-GANE: Alumni Hall 15
 - GHAB-POSA: Alumni Hall 201 —
 - PRIM-WOOD: Alumni Hall Stage -
 - WU-ZIA: Somerville House 2316



Today

- Group work activity
- Midterm Review
- Learning Catalytics Question
- Autonomic nervous system
- Muscle anatomy



Suggestion Box Questions



Explain what reproductive organs do in both parasympathetic and sympathetic. How do they work together? What do they influence and what type of reaction happens once they are activated?





Explain what reproductive organs do in both parasympathetic and sympathetic. How do they work together? What do they influence and what type of reaction happens once they are activated?

- Cooperative effect: sexual function
 - PNS
 - Males: induces erection
 - Females: engorgement and secretions
 - SNS
 - Males: Induces ejaculation
 - Females: stimulates contraction
- Complimentary effect: saliva production
 - PNS \rightarrow stimulate water and enzymes
 - SNS \rightarrow stimulate thick mucous





Explain the Sliding Filament Theory and how a crossbridge forms. Also, I'm not really sure what a crossbridge is and what happens after that. Thanks

- Ca²⁺ binds troponin, causes tropomyosin to roll off and expose myosin binding site
- 2. Myosin head binds actin binding site, cross-bridge formation
- P_i released from myosin head causing power stroke (muscle contraction)
- ADP released, myosin still bound to actin until new ATP attached, myosin head detaches (cross-bridge broken)
- 5. ATP hydrolyzed to ADP + P_i

/esterr

Cross-bridge is the connection of myosin head to actin (once binding site is clear). Crossbridge will allow power stroke to occur (muscle contraction)



Group Work



Play-DOH!

Out of Play-DOH, construct a model of a myofilament, containing both thin and thick myofilaments. Use your notes from Prof. Stavraky's first muscle lecture and your workbook to reconstruct a 3D version of these filaments and show how the two can bind to each other. Place your model on a piece of paper and indicate with labels the different structures (ie. Troponin, G-actin, ATP binding site etc.). Take a picture and upload.





Midterm Question Take-up



Q11: Compared to a weaker mechanical stimulus, which of the following statements best describes the effect of a stronger mechanical stimulus on a mechanoreceptor?

- A) the neuron gets more hyperpolarized
- B) the amplitude of action potentials increases
- C) more neurotransmitter is released
- D) the velocity of action potentials increases



Q12: Which statement is INCORRECT about special senses receptors?

- A) stimulation of the receptor alters their membrane potential
- B) they release neurotransmitter
- C) the special senses receptor generates action potentials
- D) they project to primary sensory neurons



Q14: Which of the following sensory neurons provides the smallest two-point discrimination?

- A) a secondary sensory neuron that receives inputs from few primary neurons with small receptive fields
- B) a secondary sensory neuron that receives inputs from many primary neurons with small receptive fields
- C) a secondary sensory neuron that receives inputs from many primary neurons with small receptive fields
- D) a secondary sensory neuron that receives inputs from few primary neurons with large receptive fields



Q20: How is the frequency of sound encoded in the cochlea?

- A) hair cells release more neurotransmitter for higher frequencies
- B) different hair cells are activated by different frequencies
- C) additional hair cells are activated for higher frequencies
- D) hair cells fire more action potentials for higher frequencies



Q21: In which part of the auditory system do we NOT find tonotopy?

- A) in the auditory cortex
- B) in the middle ear
- C) in the cochlear
- D) in the auditory thalamus



Q24: What happens when there is reduced dopaminergic input to the putamen?

- A) activity in the globus pallidus external segment increases
- B) activity in the globus pallidus internal segment decreases
- C) activity in the subthalamic nucleus increases
- D) activity in the thalamus increases



Q29: What is true about the anterior pituitary?

- A) all of the hormones released by the hypothalamus that act on the anterior pituitary are considered releasing hormones \rightarrow 94
- B) all of the hormones released by the anterior pituitary gland are peptide/protein hormones \rightarrow 103
- C) the anterior pituitary gland is made up of neurons
- D) the anterior pituitary gland secretes hormones that all cause secretion of hormones by other tissues/organs of the body



Q31: Which of the following would result in an increase in the permeability of the cell membrane to Na+?

- 1. decreasing the concentration gradient between the inside and outside of a cell
- 2. decreasing the membrane thickness
- 3. increasing the size of the Na⁺ ion
- 4. increasing the number of open channels that recognize Na⁺
- A) only 1, 2 and 3
- B) only 1 and 3
- C) only 2 and 4
- D) only 4
- E) all are correct



Q33: Which membrane transporters would you find at the Nodes of Ranvier?

- 1. Na⁺ voltage-gated channel
- 2. Na⁺/K⁺ ATPase
- 3. K⁺ voltage-gated channel
- 4. Ca²⁺ ligand-gated channel
- A) only 1, 2 and 3
- B) only 1 and 3
- C) only 2 and 4
- D) only 4
- E) all are correct



Q34: Which would be true about the hormone oxytocin?

- 1. it is synthesized/made in the posterior pituitary
- 2. it travels through the hypothalamic-hypophyseal portal system to the pituitary
- 3. it acts on the cells of the kidney
- 4. it is a peptide/protein neurohormone
- A) only 1, 2 and 3
- B) only 1 and 3
- C) only 2 and 4
- D) only 4
- E) all are correct



Q35: Why is thyroglobulin important for the thyroid?

- 1. it is the source of tyrosines to make thyroid hormones
- 2. it allows thyroid hormones to be stored in the colloid
- 3. it prevents too much thyroid hormone from diffusing into the blood
- 4. it pumps iodide into the follicle from the blood
- A) only 1, 2 and 3
- B) only 1 and 3
- C) only 2 and 4
- D) only 4
- E) all are correct



Learning Catalytic Question



The autonomic nervous system

Chapter 5: Professor Stavraky



Nervous System Divisions





Autonomic Nervous system: Intro

Where is the ANS?

• EVERYWHERE!

Control center: Hypothalamus Function: maintain homeostasis

- Body temperature
- gastrointestinal motility
- secretion from glands
- sexual functions

Two divisions:

- 1. Sympathetic: fight or flight
- 2. Parasympathetic: rest and digest





Comparison of Autonomic and Somatic Motor Systems

Somatic

 Motor neuron releases Ach directly onto muscle cells/fibers → contraction

Parasympathetic

- Preganglionic long, postganglionic short
- Preganglionic release Ach
- Postganglionic release Ach

Sympathetic

- Preganglionic short, postganglionic long
- Preganglionic release Ach
- Postganglionic release NE
- Adrenal gland only has preganglionic, which releases Ach → epinephrine





Sympathetic vs. Parasympathetic

Responses are usually antagonistic

But there are exceptions:

- Complimentary effect: saliva production
 - PNS → stimulate water and enzymes
 - SNS \rightarrow stimulate thick mucous
- Cooperative effect: sexual function
 - PNS → induces erection, engorgement and secretions
 - SNS → Induces ejaculation, stimulates contraction





Parasympathetic vs. Sympathetic

	Parasympathetic (PSNS)	Sympathetic (SNS)
Preganglionic Neurotransmitter	Acetylcholine	Acetylcholine
Postganglionic Neurotransmitter	Acetylcholine	Norepinephrine
Location of autonomic ganglion?	Close to organ	Close to spinal cord
Innervates adrenal medulla?	No	Yes
When would you observe more activation?	Rest & Digest	Fight & Flight
If activated, what is the effect on heart rate?	Slows heart rate	Increases heart rate
If activated, what is the effect on breathing?	Constricts airways	Relaxes airways
Give an example of an organ/function with antagonistic effect.	 Constricts pupils Increases digestion (ie. increases bile secretion, stomach motility increased Increases secretions from pancreas 	 Dilates pupils Decreases digestion (reduces bile secretions, decreases stomach motility) Decreases secretions from pancreas
Give an example of a cooperative effect.	 Genitalia M/induces erection F/engorgement and secretions 	 Genitalia M/induces ejaculation F/stimulates contractions



ANS and Adrenal Gland

- Outer adrenal cortex releases cortisol
- Inner adrenal medulla releases epinephrine and norepinephrine
- Sympathetic NS is the only innervation of adrenal by preganglionic neuron
 - Release Ach into adrenal medulla
 - Adrenal medulla cells release 80% epinephrine and 20% norepinephrine





Muscle Anatomy

Chapter 6: Professor Stavraky



Muscle Structure





Thin Myofilament



- 1. G-actin: forms alpha-helical chain with other G-actins and contains a myosin binding site
- 2. Tropomyosin: in relaxed state, tropomyosin works to cover the myosin binding sites on g-actin
- 3. Troponin: attached to tropomyosin and actin to hold tropomyosin over the myosin binding sites in relaxed state



Thick Myofilament



- Thick filament contains many myosin molecules
- Each head has a binding site for Actin and an ATPase
 - Breaks down ATP into ADP + P_i and releases energy for contraction





- 1. Z-line: where thin myofilaments are joined together ^{(d) Myosin molecule}
- 2. Sarcomere: area between the z-lines, which is smallest functional unit of muscle

Myosin head binds to G-actin on thin filament forming a cross-bridge. A Power Stroke is initiated an a muscle contraction will occur.



The Sliding-Filament Theory

- Ca²⁺ binds troponin, causes tropomyosin to roll off and expose myosin binding site
- 2. Myosin head binds actin binding site, cross-bridge formation
- 3. P_i released from myosin head causing power stroke (muscle contraction)
- ADP released, myosin still bound to actin until new ATP attached, myosin head detaches (cross-bridge broken)
- 5. ATP hydrolyzed to ADP + P_i

Western 😹



Next Tutorial (Nov 19th)

• Muscle physiology!



What Questions Do You Have?

You can ask in the **Owl forums** as well!

Also anonymously ask questions in the **online dropbox**!!

