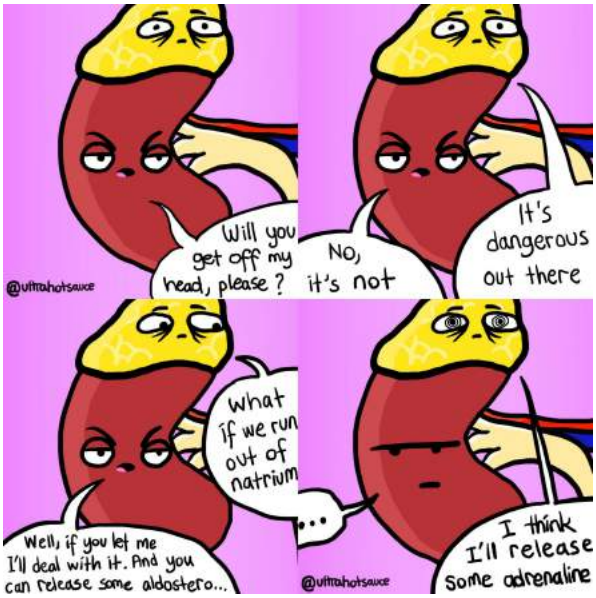
2022 SSSS Anatomy and Physiology Key

Written by BabaGanoush47



Directions:

- You are allowed one 8.5"x 11" cheat sheet and one non-graphing calculator, both in accordance to the 2022 National Science Olympiad rules
- You will have 50 minutes to complete this exam.
- Any unclear answers will be marked as incorrect
- If you have any questions, contact me at j.elsallal@gmail.com.
- Have fun and good luck!

Name: _____

Email: _____

Time: 50 minutes Resources: As specified in the 2022 National Science Olympiad Rules

Test Format - This test is organized into 4 sections. Each system has a section dedicated, with both multiple choice and free response questions. The last section consists of 20 fill in the blanks.

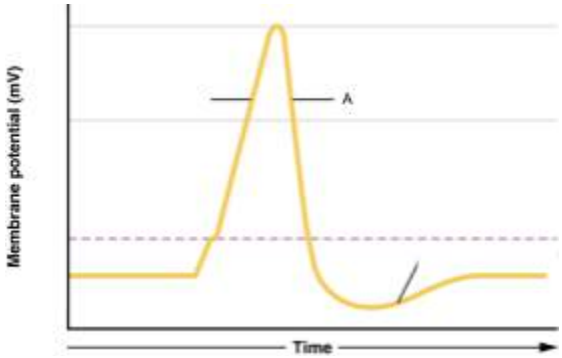
Scoring: DO NOT WRITE HERE, EVENT SUPERVISOR ONLY

Nervous: ___/90
Sensory:___/90
Endocrine: ___/90
Applied knowledge: ___/30

TOTAL: _____/300

Multiple Choice: (2 points each)

1. Which one of these is the resting membrane potential?
    a. 70 mV
    b. 0 mv
    c. -55 mv
    d. -70 mv



2. What step in the membrane potential process is indicated by A in the image above?
    a. Depolarization
    b. Repolarization
    c. Hyperpolarization
    d. Hypopolarization
3. Of the cranial nerves listed, which does not have to do with the movement of the eye?
    a. Optic nerve
    b. Oculomotor
    c. Trocheal
    d. Abducens

<u>Answer question 4 using the image above</u>

4. This cephalogram displays a pattern called ____, which is associated with _____
    a. Wave and spike, epilepsy
    b. Medium interval, drowsiness
    c. Delta type, deep sleep
    d. Tetha type, focal subcortical lesions

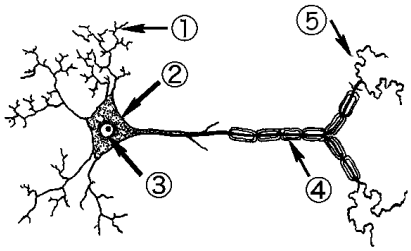
5. What wave type is pictured in the image above?
    a. Alpha
    b. Beta
    c. Gamma
    d. Omega
6. A EEG band of 5 can typically be associated with
    a. A coma
    b. Drowsiness in adults and kids
    c. REM sleep
    d. A bad dream
7. Which of the following correctly describes the function of the cerebellum?
    a. Coordinates movement
    b. Vison
    c. Voluntary movement
    d. Temperature control
8. In which of the following would you not find bipolar neurons
    a. The retina
    b. The nose
    c. The ears
    d. The spinal cord

9. The brain consumes approximately _____ percent of the body's metabolic output.
    a. 20%

b. 12%
c. 40%
d. 60%

10. The connective tissue sheath that surrounds a fascicle of nerve fibers is the:
    a. Epineurium
    b. Endoneurium
    c. Perineurium
    d. Epimysium
11. After being allowed to drive the boat, Kodak black crashed and severely damaged his spinal cord, being left paralsyized waist down. This condition is known as:
    a. Podoplegia
    b. Paraplegia
    c. Quadriplegia
    d. Monoplegia
12. Which of the following statements is true?
    a. The parasympathetic postganglionic neurons are longer than their sympathetic counterparts
    b. The sympathetic postganglionic neurons are longer than their parasympathetic counterparts
    c. The parasympathetic preganglionic neurons are longer than their sympathetic counterparts
    d. The sympathetic preganglionic neurons are longer than their parasympathetic counterparts
13. Parkinson's Disease involves which of the following structures?
    a. Globus Pallidus
    b. Putamen
    c. Caudate Nuclei
    d. All of the above
14. Which pairing of nerves to function is incorrect?
    a. Vagus-sensory and motor
    b. **Facial nerve-motor**
    c. Hypoglossal-motor
    d. Acoustic-sensor

<u>Questions 15-18 refer to the image below</u>



15. Which part(s) contains receptors that receive neurotransmitters>
    a. 1
    b. 5
    c. 4
    d. 1&5
16. Which part(s) send signals to effectors?
    a. 1
    b. 5
    c. 4
    d. 1&5
17. Which part(s) process the incoming message?
    a. 2
    b. 4
    c. 2&4
    d. None of the above
18. Which part(s) contain the nodes of ranvier?
    a. 2
    b. 4
    c. 5
    d. 3
19. Oh no, you got a cavity! You go to the dentist. You nervously clutch the seat as the dentist prepares a needle by your side. You feel a sharp twang at the side of your face. Suddenly,

your face goes numb. The dentist is able to fill in that tooth with no pain at all, if the mental anxiety of going to the dentist isn't considered. This got you thinking, how does anesthetic work? Well the answer to that may lie in a very humble structure in your body: the neuron. (11)

a. Consider the pain which the numbing shot produces. Briefly describe the pathway which the signal for pain takes (2)

Nocireceptor->peripheral nerve fiber->spinal cord->thalamus->Somatosensory cortex, limbic system, frontal cortex

b. Contrast the structure of an electrical synapse to a chemical synapse. (1)

A chemical synapse is a gap between two neurons where information passes chemically, in the form of neurotransmitter molecules. An electrical synapse is a gap which has channel proteins connecting the two neurons, so the electrical signal can travel straight over the synapse. Electrical synapses are smaller.

.

c. Which type of synapse does the pain signal utilize? (1)

Both

d. Which two factors largely contribute to the speed of an action potential within a synapse? (2)

Axon diameter and degree of myelination

e. Explain each of your answers for d. (2)

As a rule, the larger the axon's diameter, the faster it conducts impulses. Larger axons conduct more rapidly because they offer less resistance to the flow of local currents, bringing adjacent areas of the membrane to threshold more quickly. Action potentials propagate because they are regenerated by voltage-gated channels in the membrane. In continuous conduction, AP propagation involving unmyelinated axons, these channels are immediately adjacent to each other. Continuous conduction is relatively slow

f. If electrical synapses are faster than chemical, then why aren't all of the body's synapses electrical? (2)

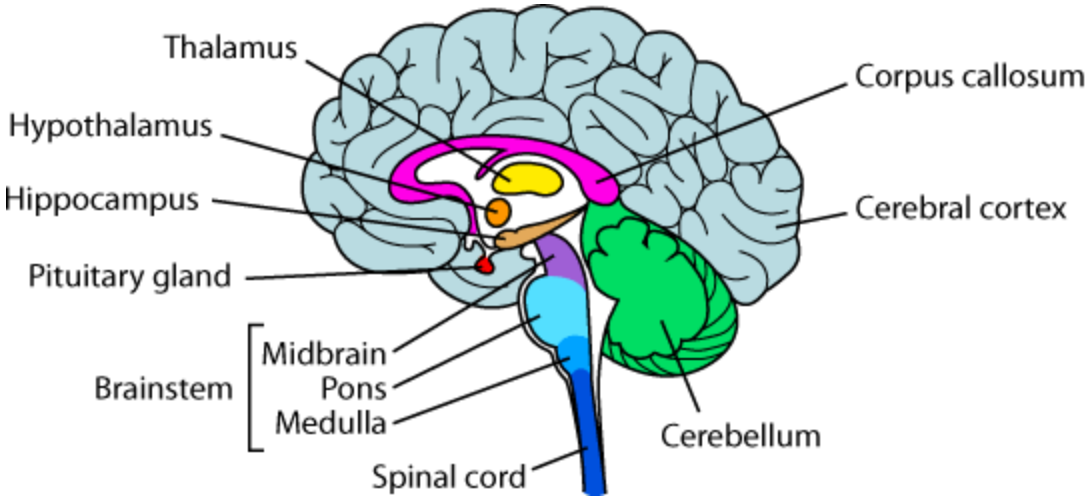
Electrical synapses activate all nearby neurons while chemicals are generally unidirectional. In some instances, it is better to have unidirectional communication.

g. Explain how a numbing agent can block the transmission of pain. (3)

Anesthetic functions by preventing the movement of ions across a neuron's membrane, so if it can not go under action potential, no pain will be transmitted.

20. Label the parts on the brain diagram below (1/2 pt each)

1. _____
2. _____
3. _____
4. _____
5. _____
6. _____
7. _____
8. _____
9. _____
10. _____
11. _____
12. _____



a. Name structure A. List two functions. (3 pts)

Frontal lobe. Executive function, attention, memory, speech production, and language, voluntary behavior, emotion.

b. Name structure B. List two functions. (3 pts)

Parietal Lobe. Perception of the body, Perception and integration of somatosensory information, Spatial mapping and attention, Visuospatial processing/Coordination of movement, Reading, and Writing Number representation (mathematics)

21. Caffeine and Marijana. Two vastly different drugs, or are they? You, a researcher, got curious. While doing some reading, you found that both of these drugs take effect by acting in a place of a neurotransmitter. However, the effects that both produce are astoundingly different. (16)

a. What neurotransmitter(s) does caffeine replace? (1)

Adenosine

b. What is the function of this neurotransmitter? (2)

Adenosine produces drowsiness by slowing down activity when it binds.

c. What neurotransmitter(s) does marujina replace? (1)

cannabinoids

d. What is the function of this neurotransmitter (2)

In general, cannabinoids function like a "dimmer switch" for presynaptic neurons, limiting the amount of neurotransmitter (e.g., dopamine) that gets released, which in turn affects how messages are sent, received, and processed by the cell.

e. Explain how replacing the ligand with a substance doesn't enervate the receptor? (1)

Neurotransmitter does not bind, so no signal will be sent.

f. Based on your answers above, explain why mariujana and caffeine do not produce the same effect. (1)

The different neurotransmitters and receptors they bind to have different functions and thus the effects are different.

g. While reading, you come across the research passage below:

Researchers confirmed that THC exerts its most prominent effects via its actions on two types of receptors, the CB1 receptor and the CB2 receptor, both of which are G protein-coupled receptors.[139] The CB1 receptor is found primarily in the brain as well as in some peripheral tissues, and the CB2 receptor is found primarily in peripheral tissues, but is also expressed in neuroglial cells.[140] THC appears to alter mood and cognition through its agonist actions on the CB1 receptors, which inhibit a secondary messenger system (adenylate cyclase) in a dose-dependent manner.

i. Explain how a G coupled receptor works (2)

Binding of a signaling molecule to a GPCR results in G protein activation, which in turn triggers the production of any number of second messengers.

ii. Which side-effects of marijauna usage may be a direct result of inhibition of CB2 (2)

Irregular heart rhythms, dizziness, irregular blood pressure, numbness

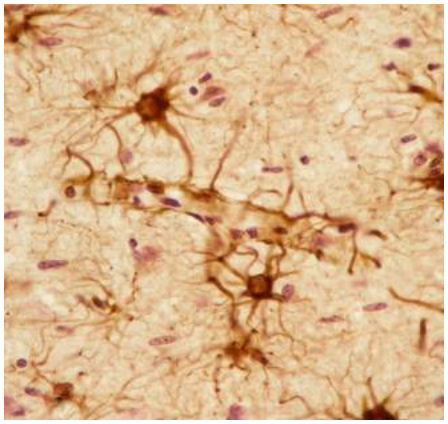
iii. Suppose a laboratory creates a drug that acts by denaturing any THC within a cell. Why would or wouldn't this be effective against THC? (3)

No because THC acts outside of the cell

iv. Suppose a laboratory wants to eliminate the cognitive impairment of marujina by making an antidote that targets CB2 receptors. Would this be effective? (3)

No because CB2 is only peripheral system which does not take a part in cognition

22. Oh no! While turning into a convertible, Professor DaBaby misplaced his neuroglial histologies! Lend a hand to your favorite CEO and identify the histology bellow. (5)



a. What cell does the histology above depict? How can you tell? (2)

Astrocyte, star shaped=etymology

b. What role does the cell play structurally? (.75)

They are the most abundant glial cells in the brain that are closely associated with neuronal synapses. They regulate the transmission of electrical impulses within the brain.

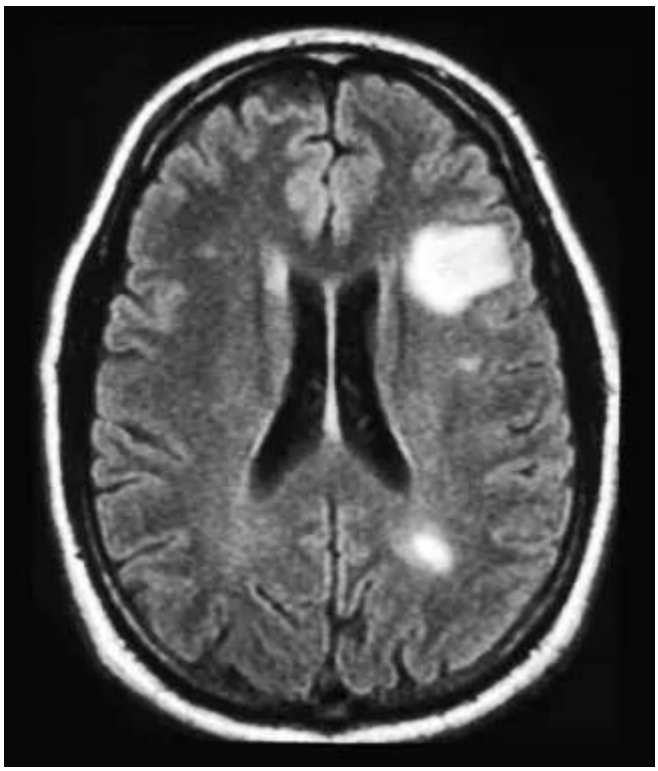
c. What role does the cell take in the blood-brain barrier? (.75)

Facilitate it OR new research says not much

d. What neurotransmitters can this cell receive? (1.5)

Most of them

23. A 30 year old woman is referred to your neurology clinic's office. On her record, it states that she is currently going through an episode of burning electrical sensations running across her spine, blurred vision, and impaired speech. You request for the image below to be taken (11).



a. The image was created using what tool? (1)

Magnetic resonance imaging (MRI)

b. What do the white patches represent? What are they caused by? (2)

Brain lesion caused by scarring and build up of pack from remyelination

c. What is likely this condition? How can you tell? (2)

Multiple sclerosis. The multiple white patches indicate a dissemination of plaque build up and brain lesions caused by the fialite of oligodendrocytes.

d. What cells are most affected by this condition? (1)

Oligodendrocytes

e. What can be done to treat the condition? (1)

Although there is no known cure for multiple sclerosis, several therapies have proven helpful. The primary aims of therapy are returning function after an attack, preventing new attacks, and preventing disability. Starting medications is generally recommended in people after the first attack when more than two lesions are seen on MRI

f. Using the 2017 McDonald criteria, do you have enough information to diagnose her with the condition? (1)

No

g. If you answered yes to f., explain why you can reach a diagnosis. If you answered no to f., explain what more evidence you would need. (3)

A Dissemination in time (DIT), shown by a second clinical attack, demonstration of DIT by MRI, or demonstration of cerebrospinal fluid-specific oligoclonal bands

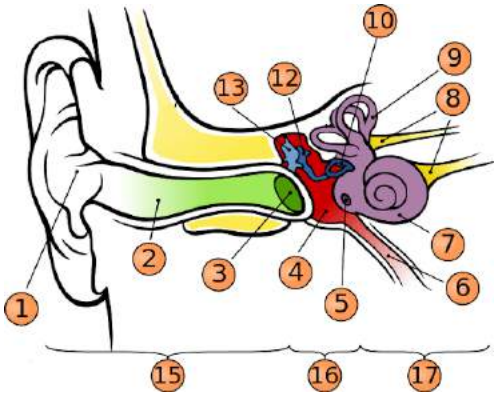
Multiple Choice: (2 points each)

1. Approximately _____ of taste is smell
    a. 20%
    b. 40%
    c. 60%
    d. 80%
2. The eye house approximately ____ of all sensory receptors in the body
    a. 5%
    b. 15%
    c. **70%**
    d. 85%
3. Which list of pairings is correct?
    a. Sweet= lead salts
    Sour=acid
    Salty=inorganic salt
    Bitter=alkaloids
    Umami=glutamate
    b. Sweet=sugar
    Sour= acids
    Salty=metal ions
    Bitter=lipids
    Umami=alkaloids
    c. Sweet=lead salts
    Sour=high amount of metal ions
    Salty=salt ions
    Bitter= alkaloid
    Umami=Aspartate
    d. Sweet=sugars
    Sour=glutamate
    Salty= bases
    Bitter=acids
    Umami=aspartate

Use the diagram below to answer question 4

4. In the diagram above, the magenta indicates where the taste buds are located?
    a. Sweet
    b. Salty
    c. Bitter
    d. None of the above
5. Which of the following is not part of the vascular layer?
    a. Sclera
    b. Iris
    c. Lens
    d. Choroid

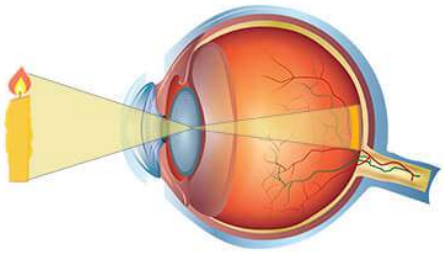
6-8 refers to the image below

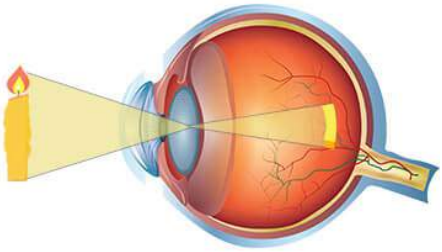


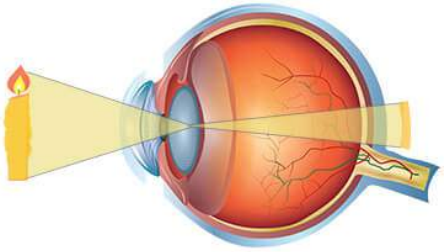
6. Name translates to “hammer”
    a. 5
    b. 10
    c. 12
    d. 13
7. Contains ceruminous glands
    a. 2
    b. 4
    c. 6
    d. 9

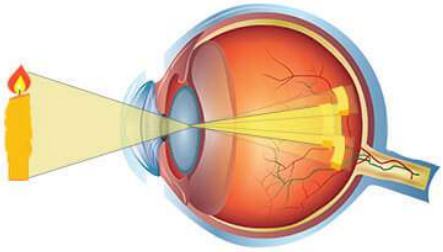
8. Can become red and inflamed due to otitis media
    a. 1
    b. 3
    c. 8
    d. 15
9. Which describes the state chemicals must be to excite olfactory neurons?
    a. Odorous
    b. Volatile
    c. Inflammatory
    d. Ligand
10. Which cells send impulses to the olfactory cortex?
    a. Mitral
    b. Astrocytes
    c. Olfactory epithelial
    d. Glomeruli
11. The blind spot of the eye is:
    a. where more rods than cones are found
    b. where the macula lutea is located
    c. where only cones occur,
    d. **where the optic nerve leaves the eye**
12. Myopia is caused by:
    a. Excess build up of fats and lipids on the lens
    b. **Longer than normal eye**
    c. Shorter than normal eye
    d. Faulty synaptic terminals in the rods and cones
13. Which of the following best tracks the usage of rhodopsin in a specialized receptor in the retina?
    a. Pigment genesis, pigment degradation, pigment regeneration
    b. Pigment genesis, pigment bleaching, pigment renaitre
    c. Pigment synthesis, pigment bleaching, pigment regeneration
    d. Pigment expansion, pigment depletion, pigment conversion
14. Select the correct pathway for the generation and flow of tears:
    a. Lacrimal Gland -> Lacrimal Sac -> Inferior Lacrimal Canaliculi -> Lacrimal Ducts -> Nasal Cavity
    b. Lacrimal Sac -> Lacrimal Gland -> Nasolacrimal Duct -> Lacrimal Duct -> Nasal Cavity
    c. Lacrimal Gland -> Lacrimal Ducts -> Superior Lacrimal Canaliculi -> Lacrimal Sac -> Nasal Cavity
    d. Lacrimal Sac -> Lacrimal Duct -> Inferior Lacrimal Canaliculi -> Nasolacrimal Duct -> Nasal Cavity
15. Which of the following takes up the most space in the somatosensory cortex relative to the rest?
    a. Lips
    b. Head
    c. Arms
    d. Internal organ

16. Which receptor would be activated if one were to rub menthol cream onto their legs after an intense workout?
    a. Thermoreceptors
    b. Nocioreceptors
    c. Mechanoreceptors
    d. Chemoreceptors
17. Which of the following diagrams correctly depicts the result of a loss of elasticity in the lens?

a. 

b. 

c. 

d. 

18. If the left image above is a normal cone system, what cone system would a person who sees the right image up have?
    a. Deuteranopia
    b. Tritanomaly
    c. Tetrachromat
    d. Tritanopia

19. Ash Ketchum was in optician school when the pandemic hit. So during online classes, rather than focusing and taking notes, he skipped class and tried to catch them all. That failed and tomorrow is his final on eye disorders. Luckily for him, you have a pair of eyes, so give him a hand in studying. (18)

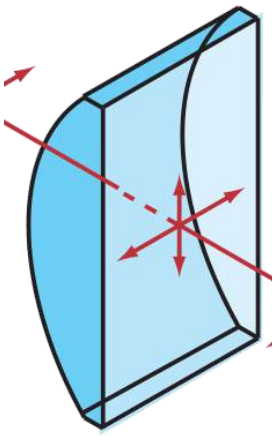
a. 

   i. Identify the eye disorder (1)
   Astigmatism

   ii. What problem in the structure of the eye produces this disorder? (2)
   Irregularly shaped cornea

   iii. Identify what kind of lens would be needed to correct it (1)
   Cylindrical lens

   iv. Draw the lens from iii (2)



b. 

i. identify the eye disorder (1)

Myopia

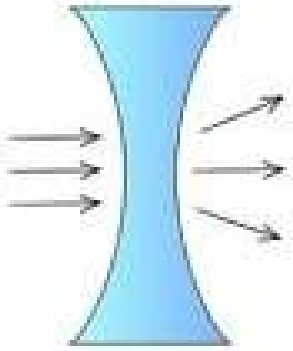
ii. What problem in the structure of the eye produces this disorder? (2)

Longer than usual eye

iii. Identify what kind of lens would be needed to correct it (1)

Concave lens

iv. Draw the lens from iii (2)



c. 

i. identify the eye disorder (1)

Hyperopia

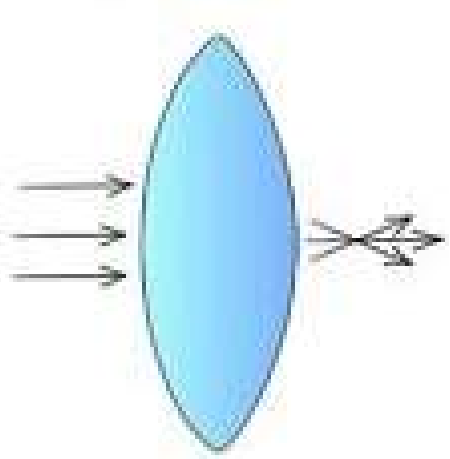
ii. What problem in the structure of the eye produces this disorder? (2)

Shorter than usual eye

iii. Identify what kind of lens would be needed to correct it (1)

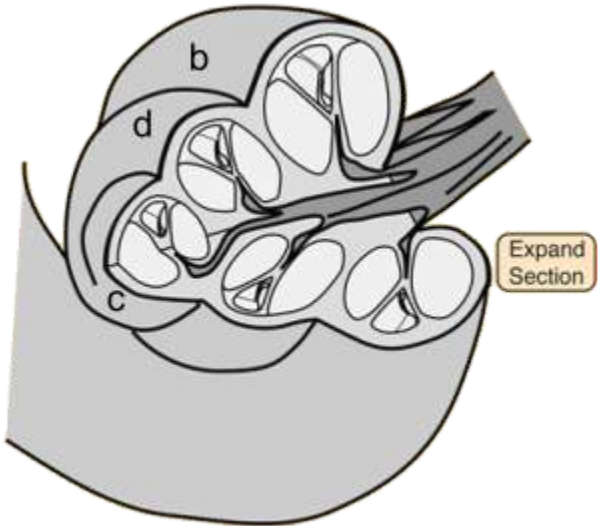
Concave lens

iv. Draw the lens from iii (2)



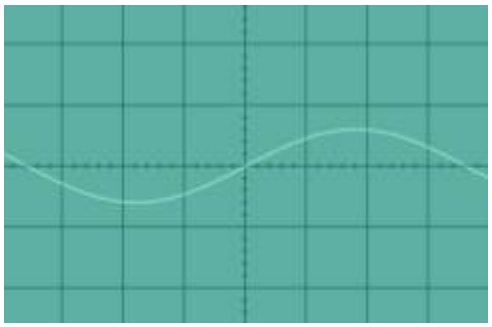
20. (8)

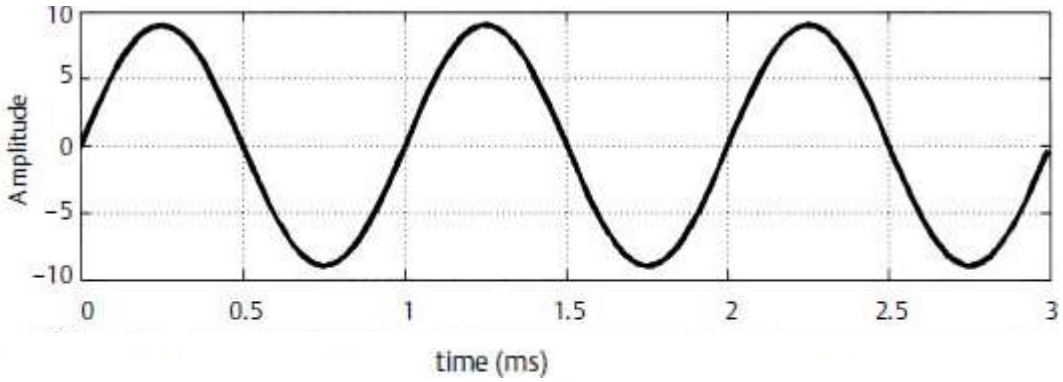
a. What is the structure below? (2)



For the following, given the soundwave or frequency, indicate on the diagram above relatively where the basilar membrane would be displaced (Don't overthink it! 2 pts each)

b. 10,000 hertz

c. 

d. 

21. I'm sure we have all heard that the saying "vitamin A improves your eyesight" was just a cover-up by pilots to hide radar technology. However this is not entirely true. Nyctalopia is a condition where it can be harder or impossible to see in lower light levels. While generally it can be caused by faulty rods in the eye, it can also be caused by Vitamin A deficiency. Using your extensive knowledge on the structure of the retina, explain why this is. (4)

Rods contain a receptor-protein called rhodopsin. When light falls on rhodopsin, it undergoes a series of conformational changes ultimately generating electrical signals which are carried to the brain via the optic nerve. In the absence of light, rhodopsin is regenerated. The body synthesizes rhodopsin from vitamin A, which is why a deficiency in vitamin A causes poor night vision.

22. It was a hot summer night in Saudi Arabia circa 2018 and I was helping my cousin out at his food truck. According to eugenics, middle easterns have larger noses to help them breath in the warmer air. It was that fateful night where I discovered that it was BS because the moment I entered the food truck, a solid 20 degrees hotter than it was outside, my nose started gushing. That was the first nosebleeds of many that summer. In retrospect, that got me wondering, what exactly is a nose bleed and how can I prevent them? (10)
    a. What structure of the nose do nosebleeds occur the most often? (2)

Kiesselbach's plexus

    b. What about this structure makes it especially vulnerable to nosebleeds? (2)

Very thin skin covering blood vessels + constant exposure to the drying effect of inspiratory currents

    c. In that summer of nosebleeds, I noticed that besides the mental pain of knowing my nose was bleeding, I never felt any pain from nose bleeds. Why could this be? (3)

Nocirecptor much deeper than kiesselbach's plexus in nose and not connected, so it doesn't pick up the damage

    d. Upon looking for remedies for this nuisance, I found a very common pattern for prevention. Predict what this pattern is and explain why this works. (3)

Keeping nose from getting too dry so skin doesn't flake off exposing blood vessels to damage

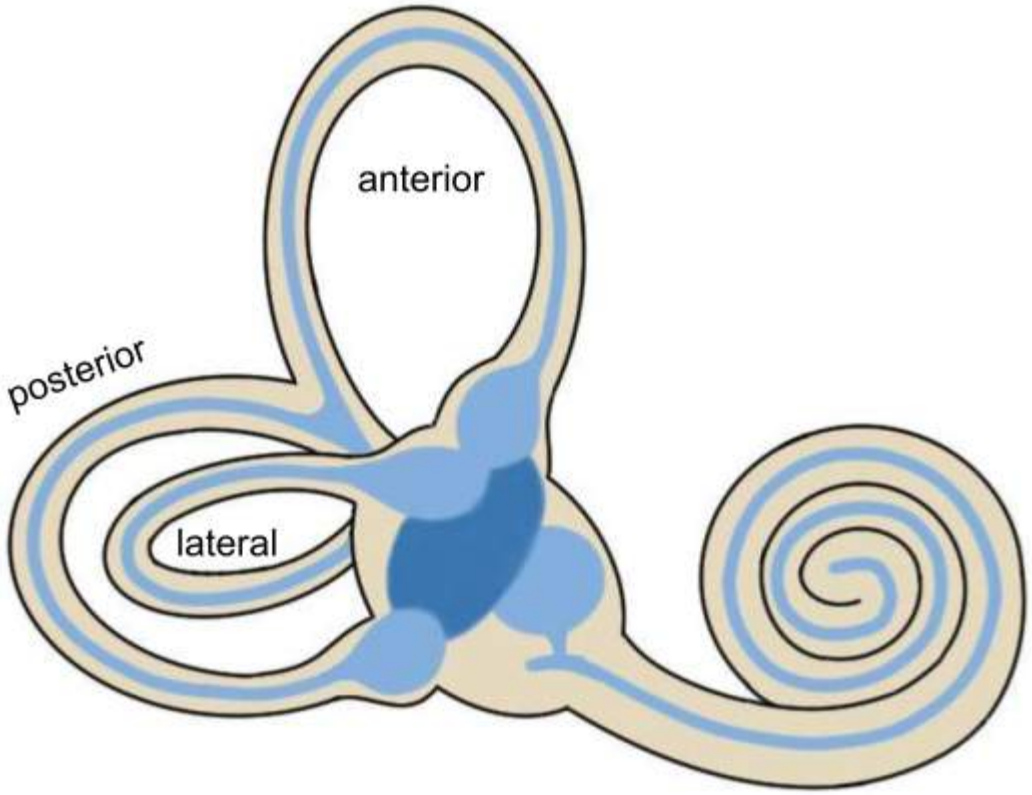
23. I went on a fishing trip back in 2019, and it was a rather windy day. Usually, I have no problem with boats, but this one time with all the rocking and what not, I got really nauseous and dizzy and could not enjoy the trip. (12)
    a. What system was out of order which caused my motion sickness? (1)

Vestibular

b. What exactly causes motion sickness? (2)

Eyes and nerves tells your brain that you are standing still but the endolymph in the liberty says otherwise

c. What are the two structures below? (2)



d. In the image above, correctly label the semicircular structure with the following: lateral, anterior, posterior (1.5)

e. If you were to look out the window to your right, which labelled structure would detect the movement? (2)

lateral

f. If you were to nod your head, which labelled structure would detect the movement? (2)

anterior

24.

a. What's your favorite color :D (1)

Accept anything except "i don't have a favorite color"

b. What receptors would be responsible for receiving the color above. (1)

Cones and to a lesser extent rods

c. What would someone with monochromia see the color above as? (.75)

Some shade of gray

d. What would someone with glaucoma see the color above as? (.75)

Glaucoma does not affect color vision

Multiple Choice: (2 points each)

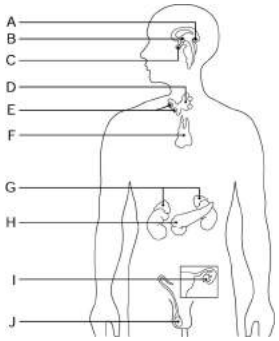
1. Which of the following is not a function of the endocrine system?
    a. Maintenance of hydration
    b. Mobilization of body defenses
    c. **Facilitating signal movement through ducts**
    d. Regulation of homeostasis
2. Which is an example of a peptide hormone
    a. Glucagon
    b. Estrogen
    c. Thyroxine
    d. Adrenaline
3. Which of the following correctly describes a difference between peptide and steroid hormones?
    a. Steroids are lipophilic, peptides are lipophobic
    b. Steroids are strictly paracrine, peptides are endocrine
    c. Steroids are always nonpolar, peptides can be either
    d. Steroids are never neurotransmitters, peptides can be neurotransmitters
4. Why can steroids not travel freely in the blood?
    a. They never exist freely
    b. Due to their unstable nature, they will oxidize with iron in hemoglobin
    c. They are nonpolar
    d. The statement is false. Peptides can not travel freely in blood, not steroids.

<u>For 5-7, indicate what kind of stimulus is involved in stimulating the endocrine gland.</u>

5. The suckling of infant at breast stimulates the release of oxytocin which activates the mammary glands
    a. Humoral
    b. Neural
    c. Hormonal
    d. None of the above
6. The thyroid is stimulated by TRH released by the thalamus
    a. Humoral
    b. Neural
    c. Hormonal
    d. None of the above
7. Elevated levels of sugar in the body signal for an increased production of insulin
    a. Humoral
    b. Neural
    c. Hormonal
    d. None of the above
8. Some hormones act by:
    a. increasing the synthesis of enzymes
    b. converting an inactive enzyme into an active enzyme
    c. affecting only specific target organs
    d. all of the above

9. Which of the following correctly describes the relationship between T3 and T4?
    a. T3 is responsible for metabolism while T4 regulates homeostasis
    b. T3 is a prohormone while T4 is a steroid hormone
    c. T3 is synthesized out of T4 while T4 is synthesized in the thyroid
    d. T3 is involved in sympathetic response while T4 is invade in parasympathetic response
10. Testosterone is to the male as which hormone is to the female?
    a. luteinizing hormone,
    b. progesterone,
    c. Estrogen
    d. prolactin

<u>Questions 11-13 refer to the diagram below</u>



11. Controls the levels of calcium in the body
    a. A
    b. D
    c. E
    d. G
12. Is involved in a blood sugar feedback loops
    a. F
    b. G
    c. H
    d. I
13. Mood swings are often, al biet falsey, blamed on fluctuations of activities of this gland
    a. A
    b. B
    c. C
    d. I
14. The thymus produces an important lymphocyte called:
    a. Macrophage
    b. T Cell
    c. NK cells
    d. B cells
15. Patients treated by lithium for bipolar disorder are at greater risk for a disorder caused by the overproduction of hormones released from this gland.
    a. Parathyroids
    b. Thyroid
    c. Thymus
    d. Thalamus

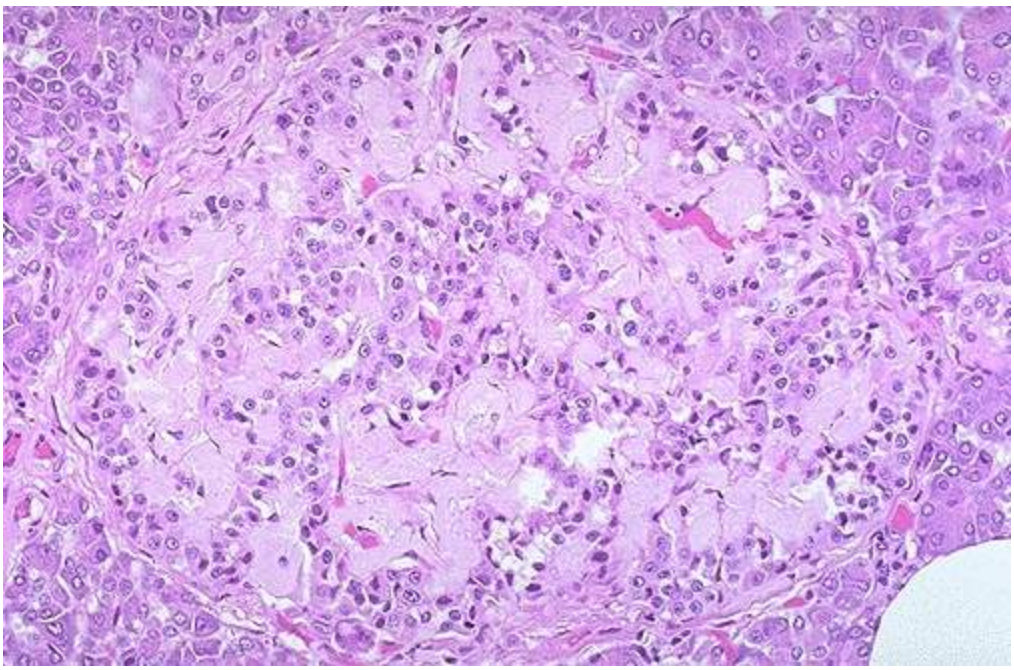
16. Which of the following correctly describes the effect of hyposecretion and hypersecretion of follicle stimulating hormone?
    a. **Hyposecretion: failure to reach sexual maturation; hypersecretion:no important effects**
    b. Hyposecretion: no important effects; hypersecretion: failure to reach sexual maturation
    c. Hyposecretion Pituitary dwarfism in children; hypersecretion: Gigantism in children, acromegaly in adults
    d. Hyposecretion: Gigantism in children, acromegaly in adults; hypersecretion: Pituitary dwarfism in children
17. Baba G presents to the emergency room with symptoms of coughing, sore throat, and shortness of breath. After a blood test, it was found that his iodine levels were dangerously low. What might these symptoms be an indicator of?
    a. Diabetes mellitus
    b. Addsion's disease
    c. Hypothyroidism
    d. Goiter
18. Abigail Adams presents to the emergency room with anxiety, an enlarged thyroid, and puffy eyes. What might these symptoms be an indicator of?
    a. Diabetes mellitus
    b. Addsion's disease
    c. Hyperthyroidism
    d. Goiter

19. There is a very interesting chemical within the body called norepinephrine. Despite being one unchanging chemical, a wide variety of responses can be produced from it. Moreover, it is somehow considered to be both a neurotransmitter and a hormone. Explain how this can be (hint consider the definition of each term). (4)

If released from a neuron and traveling across a synapse it is a neurotransmitter (1). Secreted by a gland into blood steam for widespread distribution, it's a hormone (1). Different receptors can produce different responses (2).

20. A patient presents to the emergency room with a stroke. Luckily, you are world class surgeon Dr. Mario and you are able to save her. According to a patient's family member, he was a relatively normal adult until a couple years ago when he became addicted to mountain dew, doritos, and Burger King's 10 piece chicken nuggets after which became his main diet. Prior to his stroke, the patient often complained about foot ulcers, decreased visual clarity, and increased thirst. Upon hearing this, you request a biopsy, which is depicted below. (23)
    a. Besides the obvious state of the subjects, what is the difference between a biopsy and an autopsy? (1)

Biopsy is tissue sample for a diagnosis while an autopsy is whole body and for cause of death



    b. What is the structure depicted above? (2)

Islet of langerhans

c. What cells compose this structure? (1)

Beta cells

d. What are the light-pink patches? (2)

Amyloid deposits

e. What is the protein that composes the light-pink patches? (1)

Amylin

f. What caused the light-pink patches? (3)

Oversecretion of insulin (1) led to accumulation of amylin leading to amyloid deposits (2)

g. You have a suspicion as to what this patient may have, but you need more evidence. You request a blood sugar sample which comes back to be 140 mg/dL. Is this normal? If not, what is a normal level? (1)

No, <99 mg/dL

h. You have gathered enough evidence to come to a conclusion. Diagnose the disease by its full name. (2)

Diabetes mellsinus

i. Provide two pieces of evidence from the passage and one piece evidence from one of the subsections to support your diagnosis. (3)

Passage: obesity, stroke, foot ulcers, thirst, decreased vision
Subsection: amyloid deposits, high blood sugar

j. Explain why two of your pieces of evidence support your conclusion. Use one from the passage and one from the subsection. (3)

Obesity: cause of type 2; stroke caused by damaged blood vessels from sugar; foot ulcers indicator of diabetes + artery disease form sugar; diabetics get extra thirsty because kidney go into overdrive tying to filter out sugar wasting liquids; high blood sugar can cause lens to swell leading to poor visual clarity

Amyloid deposits: over secretion of insulin + amylin=diabetes; high blood sugar >129 ml/dL= diabetic

k. This disease has many classifications. Classify the disease the patient has and explain your reasoning. (4)

Diabetes type 2 (1). Obesity is the common cause of diabetes type 2 (1). Amyloid deposits indicate once functioning beta cells inp,ying that this is acquired and not genetic. (2)

21. Identify the hormone's source organ, one target tissue, and one effect.
    a. Parathormone

Parathyroid, bone intestines and kidneys, calcium regulation

    b. Melatonin

Pineal gland, CNS and peripheral tissue, circadian rhythm and antioxidant

22. There's no way he'd ask that

That's right, he asked it! For those of you who are new here, I like to include a station in every test that is tailored to test your understanding of a topic all while annoying you in the process. In a nutshell, it's that one thing you decided not to study because you thought "there's no way he'd ask that."

We often say that hormones are made in glands, but we never question how. Let's say I am a student who was curious about this and ended up reading some pretty complicated stuff that I am having trouble understanding. So be a good tutor and help me out, because for this week's episode, simplify the biosynthesis of the hormones below by answering the questions below. Good luck ;). (25)

a. Oxytocin
    i. Is oxytocin an amine, peptide, or steroid hormone? (1)
        1. **peptide**
    ii. What is the gene that encodes for the precursor protein? (2)
        1. **OXT**
    iii. What is the name of the processes that produce the precursor proteins? (1)
        1. **Transcription and translation**
    iv. During the synthesis of this hormone, the precursor protein is broken down into several smaller parts through a process called: (1)
        1. **Hydrolysis**
    v. How does the precursor protein being broken down into smaller parts contribute to its classification? (2)
        1. **Oxytocin is a peptide hormone so it's only a couple parts rather than a big hormone.**
    vi. What enzyme is involved in the final step in releasing the active oxytocin (2)
        1. **PAM**
    vii. What vitamin is the enzyme's cofactor? (2)
        1. **Vitamin C**
    viii. Name one enzyme known to metabolize oxytocin (2)
        1. **Oxytocinase, leucyl/cystinyl aminopeptidase**

ix. What kind of cells is oxytocin made in? (1)
    1. **Mangocelluar neurosecretory cells**
    2. **Leydig cells/corpora lutea is also acceptable**

b. Adrenaline
    i. Is oxytocin an amine, peptide, or steroid hormone? (1)
        1. **Amine**
    ii. Which molecule serves as the precursor for adrenaline? (2)
        1. **Tyrosine or phenylalanine**
    iii. How do enzymes contribute to a reaction (catalysis will not be accepted) (1)
        1. **Lower activation energy to speed it up**
    iv. Next in the process, an enzyme called AAAH leads to the synthesis of: (2)
        1. **L-DOPA**
    v. AADC is then used to catalyze the reaction of the chemical from iii to what molecule? (hint: smile :]) (2)
        1. **Dopamine**
    vi. The molecule from iv is then used by the enzyme DBH to synthesis what molecule (hint: this molecule was mentioned in a previous question in this station) (2)
        1. **Norepinephrine**
    vii. What cell is adrenaline synthesized in? (2)
        1. **Chromaffin cells**
    viii. What part of the adrenal gland is adrenaline sythzed in? (2)
        1. **Adrenal medulla**

Applied knowledge

This year especially, the tested systems are so interconnected that it would not be a proper test of knowledge unless an actual scenario is presented. Fill in the blanks to the passage below with the most appropriate answer. (1.5 points each)

It's a lazy summer morning. Light shines in your room through the curtains and you grudgingly get out of bed and walk towards the door. However, you forgot that you left your vintage tack collection on the ground, and a tack enters your foot. The foot cells have been damaged, releasing the hormone **histamine**, a hormone involved in activating an inflammatory response. In the pain receptors, or **nocireceptors**, an action potential occurs due to flooding of ions from **mechanically gated** and **chemically gated** channels. From neuron to neuron, the signal is passed until it reaches an integration center, in this case the **spinal cord**, which it enters through the **posterior horn**. Then from the gray matter to the **anterior horn** to **efferent** nerve fibers, a motor neuron relays a signal to **effector** muscles to create a response. You jerk your foot up and look down. You take a moment to process what you're seeing, a copper tack. The **hippocampus**, where long term memories are stored, kicks in and you suddenly remember that you are deathly allergic to copper and if you do not remove the tack and use your allergy pen, otherwise known as an **epinephrine** pen, you will die of anaphylactic shock. Your response starts in the **amygdala**, where the danger is recognized, which then sends a signal to the **hypothalamus**, which does two things. You feel yourself turning pale, heart rate rising, and **another symptom**. In other words, your **sympathetic** nervous system is kicking in. In addition to that, the **hypothalamus** releases CTR, or **corticotropin-releasing factor**, into the **pituitary gland** to signal it to secrete the hormone ACTH. As a result, the adrenal gland is activated. The adrenal cortex releases the hormone **cortisol**, which increases blood pressure, blood sugar, and suppresses the immune system. Additionally production for adrenaline in the **adrenal medulla**, is signaled which will aid in immediate reactions. You quickly hop over to your bed, take out the tack, and use your epi-pen. Perhaps it's time to ditch the vintage tacks and stick to fossil collecting.