

BIO 3303 Animal Physiology I
Midterm #1 A

Student #: _____
Name: _____

Dr. E.M. Standen

February 4th, 2019

70min

TOPICS: Nervous System and Endocrinology

Cellular phones, unauthorized electronic devices or course notes (unless an open-book exam) are not allowed during this exam. Phones and devices must be turned off and put away in your bag. Do not keep them in your possession, such as in your pockets. If caught with such a device or document, the following may occur: academic fraud allegations will be filed which may result in you obtaining a 0 (zero) for the exam.

By signing below, you acknowledge that you have ensured that you are complying with the above statement.

Signature: _____

Answer on the question sheet in the space provided. This exam is out of **50** marks.

Read through the exam fully before starting as short answer and multiple choice questions are throughout.

1. (1 point) There are four unifying themes in physiology. One of them is that Physiology is integrative. What does this mean?

Animal physiologists study phenomenon at multiple levels of organization, from molecules to ecosystems.

And/or

Animal physiologists address both basic and applied questions.

And/or

Physiology crosses many disciplines.

2. (2 points) Physiological processes are usually regulated. Two strategies that animals use to deal with a changing environment are to be a regulator or a conformer. What is the difference between the two?

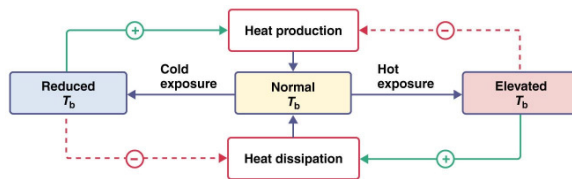
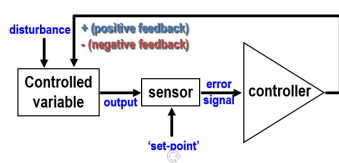
Conformers: allow internal conditions to change with variation in external conditions

Regulators: maintain constant internal conditions regardless of the external conditions. → Homeostasis

3. (2 marks) What is a negative feedback loop? Draw a diagram if you like and give one example of a negative feedback loop we have used in class.

A negative feedback loop is a control system where the stimulus is received by a receptor, that receptor signals via messenger to the system a change, an effector tissue is messaged that then does something to reduce the initial stimulus. Homeostatic body temperature is an example (not a fever).

Negative and Positive feedback loops



4. (1 mark) We have discussed two main types of ion channels in class based on how they are opened. There are ___ligand___ gated channels and ___voltage___ gated channels.

5. (2 marks) What is the difference between a graded potential and an action potential?

Ligand gated ion channels vs voltage gated channels
Spatially and temporally summated vs all or none
Takes place in cell body vs in axon

muscles will not as effectively create a fast contraction of the whole muscle as a strap muscle would because their angle of shortening is not perfectly in line with their angle of action **(1 mark)**.

6. (1 mark) Why does it take a greater change in membrane potential to cause a second action potential to initiate during the relative refractory period?

The membrane is hyperpolarized (.5 marks). The equilibrium potential of K^+ is -90 which is 20mV lower than the normal resting potential of the membrane. During the relative refractory period the membrane potential must increase from -90mV up to threshold of -55mV. This is a larger change and thus requires a larger signal to reach it (.5 marks).

7. (1 mark) What is habituation?

simple kind of learning
a decline in the tendency to respond to a stimulus due to repeated exposure

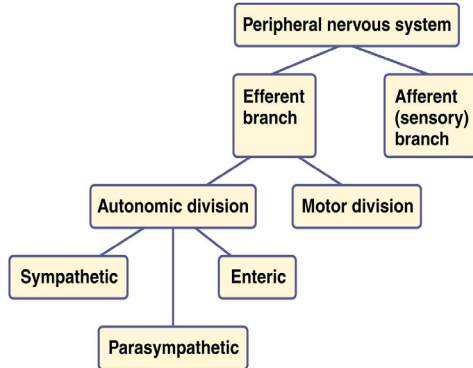
8. (1 mark) The brain and spinal cord make up the ___Central nervous_____ system which combines with the ___periferal nervous_____ system to include all nervous tissues in the body?

9. (3 marks) Patients that suffer from Split Brain Syndrome have altered brain function? Briefly, what causes this change in function and what single critical thing does it tell us about the brain?

A severing of the corpus collosum causes split brain.

This tells us that let and right sides of the brain communicate with each other and pass information and that particular parts of the brain are responsible for particular functions (language vs perception).

10. (3 marks) Draw a flow diagram that depicts the components of the Peripheral Nervous System? Use the simplified example from class as your guide, hint: there should be 8 components included in your diagram.



11. (4 marks) As should be included in your diagram above, define SNS and PSNS and the three ways they work together to maintain homeostasis in the body.

SNS – sympathetic nervous system (.5 mark)

PSNS – parasympathetic nervous system (.5 mark)

They work together using (1 mark each)

1. Antagonistic action
2. Dual enervation
3. Basal tone.

12. (3 marks) In a cholinergic synapse ___Acetylcholine_____ is the neurotransmitter. What are the two types of receptors this messenger can act on?

- a. ___nicotinic_____
- b. ___muscarinic_____

Or they can say ionotropic and metabotropic

13. (1 mark) Imagine a scenario where you have one type of messenger molecule and one effector organ that messenger acts on. How do you make that effector tissue respond in multiple ways with a single messenger?

- Use different metabotropic receptor types on the effector organ.

14. (1 marks) An agonist is a substance that acts on a receptor and increases/decreases (pick one) its response signal, and antagonist is a substance that does the opposite.
15. (2 marks) We know that nicotine acts on nicotinic receptors as an agonist, and bungarotoxin acts on the same receptors as an antagonist. If two people are walking through the forest together and one was a smoker and the other wasn't, who has a better chance of surviving a bungaro snake bite?

smoker

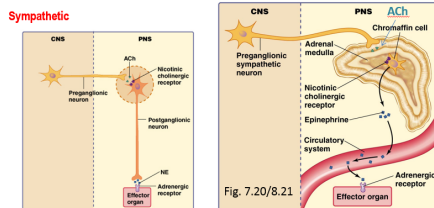
If exactly the same amount of nicotine and bungaro toxin are administered to the hiker, what is the key factor that will determine if the person survives?

Receptor affinity

16. (3 marks) What makes the adrenal medulla an exception of the SNS?

Exception in SNS – Adrenal medulla

- Preganglionic neuron synapses onto chromaffin cells (modified postganglionic neurons) of the adrenal medulla (highly modified sympathetic ganglion).
- Chromaffin cells (neurosecretory cells) secrete epinephrine and norepinephrine into circulation → widespread effects



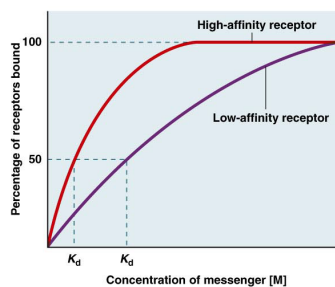
17. (2 marks) Both the endocrine system and the nervous system use chemical messengers to pass signals to effector tissues, but they do it in very different ways. How do their delivery systems differ and how does that difference affect overall function?

Endocrine system dumps messenger into blood that is pumped around the body. Nerves dump messenger into synapse directly by adjacent cells.

Endocrine system takes longer to reach effector organ and is a longer lasting signal.

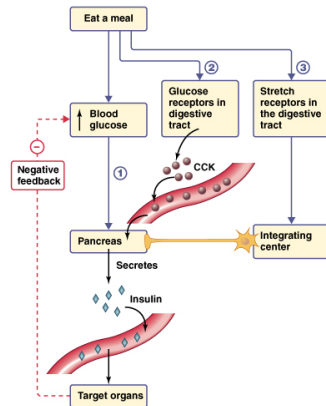
18. (3 marks) Below draw a figure with messenger concentration on the x-axis and receptor affinity on the y-axis. Draw two lines, one that denotes a receptor with high affinity for the messenger and one that denotes a receptor with low affinity. Make sure to label all axes and lines clearly.

Be forgiving on this question as I screwed up the y-axis, telling them to label it as receptor affinity rather than %bound receptors. I did correct it in class but still, we should be gentle here.



(b) Effect of receptor affinity

19. (4 marks) Describe the cascade of events that takes place to balance blood glucose levels after eating. Is there an example of a tropic hormone in this system and if yes which part?



glucose receptors in stomach release CCK which acts to release insulin.

20. (2 marks) What is the major difference between the anterior and posterior pituitary with respect to how it integrates with the hypothalamus?

The hypothalamus secretes releasing hormone at the median eminence that acts on the tissues of the anterior pituitary causing them to secrete other hormones while it has direct neural projections to the posterior pituitary and releases hormone directly into the blood.

21. (2 marks) There are both acute and chronic stress responses. Why is one adaptive and the other damaging for the organism?

22. One lets the animal prepare its body quickly to escape danger. The other is longer term and begins to shift resources away from critical body functions.

23. (1 mark) When considering the stress response why is it HPA in some animals and HPI in others?

Because in mammals the stress axis is the hypothalamus-Pituitary-Adrenal gland while in fishes it is the hypothalamus-pituitary-interrenal axis. This is because fishes do not have a developed adrenal gland and make cortisol in the interrenal cells.

They could also say something about the sympathetic nervous system releases cortisol from the interrenal cells rather than the adrenal gland in fishes (HPI vs HPA).

24. (2 marks) Illustrate what is meant by the permissive role of hormones using the stress axis as an example.

Permissive role: presence of one hormone is required for the other to exert an effect. For example cortisol causes a catecholamine receptor up-regulation making the tissue sensitive to catecholamines.

Another example is the Fat mobilization in response to catecholamines is inhibited if you remove the pituitary but this function can be recovered by treatment with ACTH or cortisol.