

BIRLA INSTITUTE OF TECHNOLOGY AND SCIENCE, PILANI
FIRST SEMESTER 2023-24
BIO F313 ANIMAL PHYSIOLOGY
Mid-Semester EXAM (CLOSED BOOK)

Max. Marks: 50

Time: 90 mins

Date: 09/10/2023

Note: “NO” marks would be allotted if you don’t justify your answer. Answers should be to the point and should not be more than 3-4 sentences. Marks will be deducted for unnecessary long answers.

-----**GOOD LUCK!!**-----

“Believe in yourself and all that you are. Know that there is something inside you that is greater than any obstacle”, so with this motivational quote from Prof. C.D. Larson, let’s begin the journey of science of you (Physiology)

Section A (17.5M)

Q1. (a) “The muscle layers in the Muscularis Externa of the digestive tract is uniquely designed and placed to create the peristaltic movement.” What will you comment on the “unique” design of the muscle layers in the Muscularis Externa that enables them to generate peristaltic movement? Justify your answer. **2.5M**

(b) How do extrinsic autonomic nerves are the key to controlling digestive system activities? Briefly explain with a flow chart. **3M**

(c) Mention a real example when your cerebral cortex is actively involved in the release of saliva. Be very specific and explain in brief. **2M**

(d) Blood plasma CO₂ concentration is important in achieving the release of HCl by the parietal cells in the gastric lumen of the stomach. Is this statement correct? Justify. **2.5M**

Q2. (a) “All protein digestive enzymes released by the exocrine cells of the digestive system and associated organs are always in zymogen form”, why so? Justify. **2M**

(b) Although the strong peristaltic movement of the stomach does not take place in the fundus area of the stomach, however, fundus does play the most important role in achieving this function by the stomach wall. Justify how so. **2.5M**

(c) Organ A sends “signaling molecules” to control the secretion of Organ B. While the content of Organ B increases the release of the “signaling molecules” by Organ A. Interestingly, secretion by Organ C is modulated by the same “signaling molecules” released by Organ A while once Organ C secretes its content, it minimizes the release of the “signaling molecules” by organ A. Which are these organs A, B, and C? Can you briefly comment on these cross-talks between these organs? **3M**

Section B (17.5M)

Q3. “In the human body, cell-cell communication within a tissue or an organ or between two organs is essential to maintain homeostasis.” Name the type(s) of communication which are referred to in the above statement. Based on your knowledge from the Animal Physiology course, can you take some examples (signaling molecules or pathways) for each of such communication type(s) and mention how they achieve homeostasis? **3M**

Q4. (a) Why do you think a longer loop of Henle allows to better concentrate the filtrate? Justify your answer with appropriate reasoning. **2.5M**

(b) Tubuloglomerular feedback (TGF) is key to maintaining constant GFR. Can you briefly discuss the cross-talk between the cells of the TGF system to maintain the GFR constant in individuals whose systemic blood pressure is transiently increased or transiently decreased? Write about the TGF system in both the context. **3M**

(c) Let's take two contexts; Context 1: your body is completely hydrated, Context 2: your body is highly dehydrated. In both these contexts, what will be the concentration of the filtrate leaving the ascending part of the loop of Henle? Justify your answer. **2M**

(d) A new class of drugs has been shown to be effective in treating people with type-2 diabetes and the drug mainly target the PCT of the nephron. Explain how such an effect is achieved by the drug. Justify. **2M**

(e) "Absorption of sodium ions are highly controlled by the action of different hormones including aldosterone in the PCT and ascending part of loop of Henle", is this statement correct? Justify. **2M**

(f) What is the role of the basement membrane in the glomeruli during filtration? What do you understand by the term "countercurrent multiplication" in context of nephron? Is countercurrent multiplication an active process? Justify. **3M**

Section C (15M)

Q5. (a) We know that insulation of the axon by myelin cells is necessary for faster movement of electrical signals through the axon. Why then the entire axon is not completely insulated and has the presence of myelin-free "Nodes of Ranvier"? Justify. **2.5M**

(b) "The movement of a naturally occurring action potential is unidirectional", why is action potential unable to move in both directions as it moves through the axon to reach to axon terminal? Justify. **2.5M**

(c) "Loss in the strength of a graded potential is inevitable as it moves from the site of its origin towards the axon hillock", what is the main reason behind such loss in strength of the graded potential as it moves towards axon hillock? Justify. **2.5M**

Q6. (a) Why do the majority of the synapses in the human nervous system are chemical synapses but not electrical synapses even though electrical synapses are more efficient in the conduction of nerve impulses? Justify. **2.5M**

(b) A group of interneurons in CNS are GABAergic which indicates the release of GABA neurotransmitter by these interneurons when stimulated. This also means that this group of GABAergic interneurons can only be stimulated by GABA (at dendrite or cell body level) so that they can release GABA in return at the axon terminal. Is the underlined statement correct? Justify. **2.5M**

(c) "Astrocytes are the primary supporting cells of the CNS in stabilizing active synapses". Briefly explain the key chemical signaling pathway(s) that allows astrocytes to achieve such function. **2.5M**

-----**THE END**-----

"Success is not final; failure is not fatal: it is the courage to continue that counts"- Winston Churchill