BIRLA INSTITUTE OF TECHNOLOGY AND SCIENCE, PILANI
FIRST SEMESTER 2022-23
BIO F313 ANIMAL PHYSIOLOGY
Mid-Semester EXAM (CLOSED BOOK)

Max. Marks: 50 **Time: 90 mins** **Date: 05/11/2022**

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 2-3 sentences. Marks will be deducted for unnecessary long answers.

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

Section A

Q1. (a) What is pancreatitis? This disease is often said to be hereditary. A mutation in the PRSS1 gene is known to cause this disease. PRSS1 codes for trypsinogen. Speculate reasons for the mutation in the PRSS1 gene to lead to pancreatitis condition. 2+2=4M

(b) What will be the consequences with respect to digestive physiology, if D cells of the stomach are not been able to secrete somatostatin? 2M

(c) Researchers provided radioactively labeled food to an experimental mammal and traced the movement of absorbed molecules. Which of the energy-giving macromolecules do you think moved along a path different from all the others? Mention the reason and trace the path. 2.5M

(d) You have learned that Na+ plays a major role in neurotransmission. However, your friend suggests that this particular ion is necessary for the subsequent derivation of energy as well. Recall from your classes of digestive physiology. 2.5M

Q2. (a) You are a professor supervising first-year medical students. One student is examining the adrenal gland of the cadaver. "Wow!" he expresses surprise, "This person when alive must have had an endocrine problem. Their adrenal gland lacks any kind of duct connecting it to the bloodstream. The hormones could only have oozed out." How do you respond? 2.5M

(b) Adrenal and pituitary gland have similarities with respect to their functional regulation. Explain. 2.5M

(c) How can you ensure the availability of hormones for a particular target tissue without increasing/stimulating the hormone production itself? 2M

Section B

Q3. Cell A of Organ X secrets Factor E which allows the proliferation of Cell A as well as another group of the neighboring cells named Cell B in Organ X. Interestingly, upon the action of Factor E on Cell B, these cells secrete Factor F which acts on Cell C in Organ Y and causes inhibition of Cell C apoptosis. Based on this information, what kind of signaling do "Factor E" and "Factor F" induce? Justify with appropriate reasoning. 3M

Q4. (a) "Efferent arteriole plays the most important role in maintaining the GFR", is this statement correct? Justify. 2M

(b) You have learned about Blood Brain Barrier (BBB) while learning about CNS. We have also discussed about the filtration of blood in the capillaries of kidney glomeruli. How do these two concepts are similar/different in context to the function of endothelial cells of the blood vessels? Briefly explain. 2.5M

(c) How does "Plasma-colloid Osmotic Pressure" different than that of "Bowman's Capsule Hydrostatic Pressure"? Briefly define these forces and distinguish them. 2.5M

(d) In a hypothetical situation, if in a person, the loop of Henle of all the nephrons are unable to create the gradient of filtrate concentration from 300 mOsm (at the tip where PCT joins to descending part of loop of Henle) to 1200 mOsm (at the bottom near the "U", at the junction of descending and ascending part of the loop Henle), do you think in that person vasopressin mediated water conservation at collecting duct will be so effective as like a normal individual? Justify your answer with appropriate explanation and reasoning.

4M

(e) “Kidney senses low systemic blood pressure and acts accordingly to maintain the homeostasis by normalizing the blood pressure”, how does it sense the low blood pressure, and how does it act to normalize the reduction in systemic blood pressure? Mention all key points and justify. 3M

Section C

Q5. (a) If the voltage-gated K+ channels were fast in both opening and closing during action potential in neurons, what difference would you observe in the entire cycle of an action potential? Draw the entire cycle of action potential graph and indicate the difference in the diagram along with justifying in a few lines, the reason behind such observations. 3M

(b) “The Na+-K+ pump accounts for about 70% of the energy (ATP) requirement of the nervous system”, why do you think neuron has to spend so much energy to keep the Na+-K+ pump active? Justify. 2.5M

(c) “An interneuron’s axon terminal typically forms a synapse with dendrites and/or cell body of afferent neuron”, is this statement correct? Justify your choice with appropriate reasoning. 2.5M

Q6. (a) “Sleep is by the brain for the brain but not majorly for other parts of the body”, based on the knowledge gained in the course, how do you interpret this sentence in context to the necessity of sleep? Briefly explain with key points. 2.5M

(b) Emotionally arousing events are very effective in creating memory through the amygdala. How many different pathways do “emotionally arousing events” could cause memory storage? Briefly explain with key points. 2.5M

(c) “Astrocytes are known to take up excess K+ ions and glutamate from brain ECF”, how does this particular function of astrocytes help in the functioning of the neurons? Briefly explain. 2M

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