BIRLA INSTITUTE OF TECHNOLOGY AND SCIENCE, PILANI-HYDERABAD CAMPUS

FIRST SEMESTER MID-SEM EXAMINATION-2022-2023

ANIMAL PHYSIOLOGY (BIO F313)

Date: 03.11.22 **Marks: 60** **Duration: 90 min**

Q1. JUSTIFY your answer in a **WORD** or **IN A MAXIMUM OF 1-2 SENTENCES**. No long explanations are required.

i. If there is a larger receptor potential, what effect it will have on the amplitude of action potential and why? 3M

ii. The figure 1 depicts two types of receptors that differs in the speed of adaptation. Name the two types of receptors based on the stimulus strength and receptor potential depicted in figure 1 below (ignore the arrows given in Fig 1). 3M

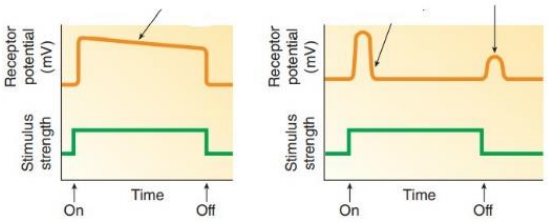

Figure 1

iii. Accidently you sat on a wet towel and wetted your clothes which is perceived by "wet receptors" located in your skin. Is this statement correct or incorrect? Justify your answer. 3M

iv. There are two structures in one of your sensory organs that lack blood vessels. Name the sense organ and the two structures that lack blood vessels. Justify in a maximum of 1-2 sentences how the absence of vessels potentiates the sensory organ function. (3 *2 = 6M)

v. The advantage of a given reflex action brought by 3 structures located in the ear was utilized in World War II to make anti-aircraft guns in order to protect the gunner's ears from the much louder boom of the actual gun firing. Name it and briefly explain how the protection mechanism was facilitated by these structures. (3+3 = 6M)

vi. The majority of sound energy in the air is reflected at the air: water boundary. How does the ear compensate for this loss of sound energy as it propagates from the air to the fluid that fills the inner ear? (2*3 = 6M)

vii. If all the sensory information from your skin is sent to your brain in form of impulses then how does your CNS distinguish between different types of stimuli? Justify your answer. 4M

viii. Consider a hypothetical cell that expresses only voltage-gated K+ channels. The outside concentration of K+ = 20mM and inside the cell = 200 mM. Calculate the Nernst potential of K+ ion (take the value of 2.303 RT/ZF as **61 only**). If the given cell is voltage clamped at -90mV, calculate the driving force for K+ ion. 4M

Q2. A neurobiologist, Dr. Haakon was conducting an experiment that involved a simple reflex action and identified 4 types of cells, **A, B, C, and D** in a neural pathway of a vertebrate nervous system. He noted the following points during his experiment:

i. Voltage-gated sodium and potassium channels was only expressed in **A**, **B**, and **C**, **while D lacked it**.
ii. Cell **D** was a star-like shape in appearance and possessed gap junctions.
iii. **C** lied in the CNS entirely, while **B** lied in the PNS.
iv. The cell bodies of **B** and **C** were located in the central nervous system (CNS) but soma for **A** was located in the peripheral nervous system (PNS).
v. In **B** and **C**, he found that impulses or action potentials were initiated at the trigger zone while in **A**, impulses were initiated at the peripheral end of a nerve fiber.
vi. Cell **A** lacked dendrites and presynaptic input and was located adjacent to the spinal cord in a ganglion.

Q2a. From your knowledge of the nervous system, name the type of cells, **A**, and **D** solely based on the expression of channel description given above in **(i)** and **(ii)**. (4M)

Q2b. Considering **ONLY THE POINT OF INITIATION OF IMPULSES AS THE CRITICAL FACTOR**, name the SPECIFIC functional cellular subtypes A, B, and C in this reflex pathway from your understanding of neuronal physiology. (2*3 = 6M)

Q3. The below flow chart represents the events occurring in the retina and visual pathway in response to the dark. **Label the diagram in chronological order. Only write the answer and do not draw the diagram.** (3* 5 = 15M)