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Sr. No. of Question Paper : 6381

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Your Roll No.....

Unique Paper Code : 249501

Name of the Course : **B.Sc. (Hons.) Biochemistry**

Name of the Paper : Membrane Biology (BCHT-508)

Semester : V

Duration : 3 Hours

Maximum Marks : 75

Instructions for Candidates

1. Write your Roll No. on the top immediately on receipt of this question paper.
2. Attempt **five** questions in all, including Question No. 1 is compulsory.

1. (a) Explain briefly :

- (i) Transport through Valinomycin but not Gramicidin is affected by alteration in membrane fluidity.
- (ii) At pH 7.0, Tryptophan crosses a lipid bilayer at about one-thousandth the rate of the closely related substance indole.
- (iii) Cyanide inhibits the uptake of lactose by the cells
- (iv) A 0.25M sucrose solution would not be isotonic for a mammalian cell if the cell had sucrose carrier protein in its plasma membrane,
- (v) Membrane unsaturation index of humans and thermophilic bacteria are considerably different

(b) Answer in one or two words :

- (i) Give a method to measure the phase transition in membranes.
- (ii) A disease caused by anionic transporter defect.
- (iii) Light dependent ion transporter in prokaryotes.

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- (iv) A GPI anchored protein.
 - (v) A membrane protein having β -barrel structure.
- (c) Give the full form of the following and briefly explain :
- (i) FRAP
 - (ii) PTS (10,5,4)
2. (a) Discuss the effect of the following on the lipid phase transition of pure dimyristoyl phosphatidylcholine vesicles
- (i) Cholesterol
 - (ii) Distearoyl phosphatidylserine
 - (iii) Dioleoyl phosphatidylcholine
- (b) Consider a phospholipid vesicle containing 10 mM Na^+ ions. The vesicle is bathed in a solution that contains 52 mM Na^+ ions. The electrical potential difference across the membrane is -30 mV, negative inside. Calculate the electrochemical potential for Na^+ ions at 25°C . ($R = 8.314$ J/mole.K, $F = 96,500$ J/V.mole)
- (c) Define the critical micelle concentration of a detergent. How do detergents solubilize membrane proteins ? (6,5,3)
3. (a) What is a hydropathy plot ? How does this method help to predict the structure of a membrane protein ?
- (b) Which of the following statements about the diffusion of lipids and proteins in the membrane is not true ? Justify your answer.
- (i) Many membrane proteins can diffuse rapidly in the plane of the membrane
 - (ii) Membrane lipids show a faster lateral diffusion than membrane proteins
 - (iii) Membrane proteins do not show flip flop movement
 - (iv) Membrane proteins show rotational motion
 - (v) Membrane lipids do not show flip flop movement

- (c) How do you determine the topology of a membrane protein ? Give two methods to determine the topology of a membrane protein. (5,5,4)
4. (a) Diagrammatically outline the mechanism of transport by Na^+K^+ ATPase. Why is it called an electrogenic pump ?
- (b) Red blood cells have a glucose permease that transports glucose into the cells through passive transport. Intestinal cells have a secondary active transport system that allows glucose to accumulate in these cells
- (i) Why is a permease or a transport system required for glucose uptake into the cell ?
- (ii) Why would red blood cells have a passive system and intestinal cells require a secondary active transport system ?
- (c) Explain :
- (i) Nerve transmission is an all or none phenomena.
- (ii) Action potential is not diminished with distance. (5,5,4)
5. (a) Explain :
- (i) What makes voltage gated Na^+ channels voltage sensitive.
- (ii) Give the difference between Nicotinic and Muscarinic acetylcholine receptor
- (b) What are liposomes ? How do they serve as model membrane systems ?
- (c) Which of the following statements about membrane asymmetry are true ? Correct the wrong statements and justify your answer.
- (i) It is absolute for glycolipids
- (ii) It is absolute for phospholipid
- (iii) It arises during biosynthesis
- (iv) It is structural but not functional (6,4,4)

6. (a) Membrane vesicles of *E. coli* that possess the lactose permease are preloaded with KCl and are suspended in equal concentration of NaCl. It is observed that these vesicles actively (though transiently) accumulate lactose, if Valinomycin is added to the vesicles suspension. No such active uptake is observed if KCl replaces NaCl in the suspending medium. Explain.
- (b) Frequently tumour cells become simultaneously resistant to several chemotherapeutic drugs. Explain.
- (c) Arrange the following in the order of decreasing permeability through a lipid bilayer. Justify your answer.
- (i) Isoleucine
 - (ii) Tyrosine
 - (iii) O₂
 - (iv) Na⁺
- (5,5,4)

7. Differentiate between :

- (a) Carriers and Channels
 - (b) Flippases and Floppases
 - (c) Active and passive transport
 - (d) Symport and antiport
- (4,4,4,2)

8. (a) Differentiate between the membrane fusion events triggered by Influenza virus and neurotransmitter release.
- (b) What are lipid rafts ? Why are they called detergent resistant domains ? What is the physiological function of these rafts ?
- (c) What makes aquaporins a water-specific channel ? Explain.
- (5,5,4)