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S. No. of Question Paper : 8681

Unique Paper Code : 249501 C

Name of the Paper : BCHT—508 : Membrane Biology

Name of the Course : B.Sc. (Hons.) Bio-Chemistry Part III

Semester : V

Duration : 3 Hours

Maximum Marks : 75

*(Write your Roll No. on the top immediately on receipt of this question paper.)*

Attempt Five questions in all.

Question No. 1 is compulsory.

Use of scientific calculator/log tabs may be allowed.

I. Give explanation for the following :

- (i) Cholesterol functions as a membrane plasticizer.
- (ii) Glycosphingolipids cannot form bilayers by themselves.
- (iii) Peripheral proteins do not require the use of detergents for their solubilization.
- (iv)  $\alpha$  helices are more common than  $\beta$  barrels in transmembrane proteins.
- (v) Patients suffering with hereditary spherocytosis have spheroidal and relatively fragile erythrocyte.

P.T.O.

- (vi) Tumor cells develop resistance to chemotherapeutic drugs.
- (vii) Osteoclasts cause resorption of bone matrix.
- (viii) Action potential is not attenuated as a function of distance travelled. (2×8)
- (ix) As compared to Valinomycin, Gramicidin possesses considerably less ionic specificity but much higher transport rates. (3)
2. (i) What is Fluid Mosaic model as proposed by Singer and Nicolson in 1972. Give an experiment each to prove and explain the two aspects of the model.
- (ii) Explain why the rate of Flip-Flop movement of membrane lipids is much higher in endoplasmic reticulum and prokaryotic plasma membrane in comparison to other membranes. Design an experiment to study the rate of Flip-Flop movement of PE in bacterial membrane.
- (iii) What is the basis of permeability of molecules in membranes? Compare the ease with which the following molecules cross the bilayer and place them in increasing order :
- Phenylalanine, NO, glycerol, glycine, toouline, urea (6,5,3)
3. (i) What is the criteria of selecting a detergent for membrane protein purification?
- (ii) How is lateral asymmetry in membranes maintained? Support your answer with examples.

(iii) Give short notes on the composition and function of the following :

(a) Caveolae

(b) Gap junctions

(c) SNARE Complex.

(2,6,6)

4. (i) What are the different techniques used to determine the topography of integral membrane protein?

(ii) Name the lipid which is the major component of the following :

(a) Outer leaflet of plasma membrane

(b) Inner leaflet of plasma membrane

(c) Myelin sheath

(d) Mitochondrial inner membrane

(e) *E.coli* cytoplasmic membrane

(f) Thylakoid membrane.

(iii) What is an enzyme marker ? Give an enzyme marker for the following membranes :

(a) Plasma membranes

(b) Endoplasmic reticulum

(c) Inner membrane of mitochondria

(d) Trans Golgi apparatus

P.T.O.

- (iv) What changes take place in the membrane composition in the following :
- A bacteria surviving in hot springs
  - An aging human being (5,3,3,3)
5. (i) What are the different types of lipids that anchor proteins to membranes ? How does lipid anchoring modulate the function of these proteins? Explain with example:
- (ii) Explain how Liposomes serve as :
- model membrane system
  - drug delivery system.
- (iii) What is the basis of purification of membranes by density gradient centrifugation ? What is the criteria of selecting the medium for separation ? Name any *two* such medium. (6,4,4)
6. (i) Compare the transport of Glucose by GLUT-I to a reaction catalyzed by an enzyme.
- (ii) Give the detailed mechanism of how P type  $\text{Na}^+ \text{K}^+$  ATPase transports  $3\text{Na}^+$  out and  $2\text{K}^+$  inside the cell. How does Ouabain inhibit this transporter ?
- (iii) E-1 and E-2, the two conformational forms of Lactose Permease can interconvert only when their  $\text{H}^+$  and lactose binding sites are either both filled or both empty. What is the significance of this ? Also show the mechanism of transport:
- (iv) Calculate the electrochemical potential, if the intracellular  $[\text{Na}^+] = 10\text{mM}$  and extracellular  $[\text{Na}^+] = 140\text{mM}$  at  $37^\circ\text{C}$ . The membrane potential is  $-60\text{mV}$  (-ve inside).

$$[R = 8.315 \text{ J/mol.K}]$$

$$[F = 96,500\text{J/V.mol}]$$

$$(4,4,3,3)$$

7. (i) Explain the mechanism of the following :
- (a) Cytosolic pH is maintained by numerous transporters.
  - (b) *Halobacterium halobrium* can survive in high salt media.
  - (c) Porins act as molecular sieve.
  - (d) Glucose is transported in *E.coli*. via group translocation.
- (ii) Give the basis of the following diseases :
- (a) Cystic fibrosis
  - (b) Diabetes insipidus. (12,2)
8. (i) Give the structure of voltage gated  $\text{Na}^+$  channel. What is the voltage sensing mechanism of the channel?
- (ii) Compare the conduction of action potential in myelinated and non-myelinated neurons. What advantage do myelinated neurons have over non-myelinated neurons ?
- (iii) Describe how colicins form pore-forming toxins. (5,6,3)

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