CAREER ENDEAVOUR
Best Institute for IIT-JAM, NET & GATE

CSIR-UGC-NET/JRF LIFE SCIENCES
TEST : CELL BIOLOGY

Time : 60 Minutes **Date : 16-08-2019**
M.M. : 60

INSTRUCTION:

1. **Question paper contains 20 objective type questions, each question carry 3 marks.**
2. **There is negative marking, 1 mark will be deducted for each wrong answer.**
3. **Attempt all the questions, use of calculator is not allowed.**

2. The lipid and protein components of a membrane are held together by which force?
   a. Covalent bonds b. Non-covalent bonds
   c. Hydrophobic interactions d. Electrostatic interaction
3. The concentration of which phospholipid is more on the cytosolic side compared to the exoplasmic side?
   a. Sphingomyelin b. Phosphatidylcholine
   c. Phosphatidylethanolamine d. Cholesterol
4. Which of the following statements is/are NOT correct about hydropathy plots?
   P. The fragment of the protein needs to be of a fixed size.
   Q. Lipid solubility is one of the criteria to determine hydrophobicity.
   R. Methionine is assigned the most negative value.
   S. Â barrels are difficult to be identified.
   a. P and R b. Q and S c. Q and R d. R and S
5. Transport of water across aquaporins is regulated by the presence of which of the following highly conserved amino acid?
   a. Ala b. Asn c. Pro d. Thr
6. Polar bears maintain their body temperature because they have more of
   a. transducin protein b. uncoupling protein
   c. myoglobin protein d. F_0F_1 ATPase
7. Which of the following ligand gated channels are tetrameric?
   a. Acetyl choline b. Serotonin
   c. Glycine d. Glutamate
8. A failure of the _____ protein can result in cystic fibrosis.
   a. G-protein-coupled receptor b. KcsA
   c. Na^+ gated channel d. Transmembrane conductance regulator
9. Rank the following biological molecules in order of how readily they diffuse across the plasma membrane from the most diffusible to the least diffusible.
   P. CO_2 Q. Cl R. Sucrose S. Glycerol

a. P, R, S, Q b. Q, S, R, P c. R, Q, S, P d. P, S, R, Q

10. Which of the following best explains why the plasma membranes of all cells exhibit a negative resting potential?
    a. The membrane is mostly permeable to Cl^- and the Cl^- gradient favors its diffusion out of the cell.
    b. The membrane is mostly permeable to K^+ and the K^+ gradient favors its diffusion into the cell.
    c. The membrane is mostly permeable to K^+ and the K^+ gradient favors its diffusion out of the cell.
    d. The membrane is mostly permeable to Na^+ and the Na^+ gradient favors its diffusion into the cell.
11. Lipid rafts are rich in both sphingolipids and cholesterol. Cholesterol plays a central role in raft formation since lipid rafts apparently do not form in its absence. Why do you think cholesterol is essential for the formation of lipid rafts?
    a. Cholesterol decreases the mobility of sphingolipids in the lipid bilayer.
    b. Large head groups of sphingolipids repel each other in presence of cholesterol.
    c. Cholesterol interacts with fatty acid tails in the membrane.
    d. The planar cholesterol molecules are postulated to fill the voids that form underneath the large head groups of the sphingolipids.
12. In transcellular transport, the cells import solutes from one side and pass on to other side. In an experiment, the glucose uniporters present on the basal part of intestinal epithelial cells were blocked. The cells were provided ample glucose in the media. What is the most likely impact of blocked glucose uniporters on these cells?
    a. The cells will stop taking up the glucose.
    b. Glucose will keep accumulating in the cells.
    c. The cells will take up glucose only in the required quantity.
    d. The cells will die.
13. A cancer patient who was showing chemo-resistance to a drug suddenly started responding to the same drug. This could be due to:
    a. Amplification of ABC transporter genes for the drug due to mutation.
    b. Loss of function mutation in ABC transporter genes for the drug.
    c. Adaptation to the drug.
    d. Enzymatic modification of the drug into effective drug by the liver Cyt P450 enzymes.
14. Both sphingomyelin and phosphoglycerides are phospholipids. Which one of the following statements is not correct?
    a. While one has fatty acid tail attached via an ester bond, in another, the fatty acid tail is attached via an amide bond.
    b. The hydrophilicity of both is dependent on the phosphate group and other head groups attached to the phosphate group.
    c. Only one of them may contain a carbon-carbon double bond (C=C).
    d. Both may have choline as head group.
15. Which of the following applies to membrane lipids? Please select the correct statement.
    P. Membrane lipids are non-polar in nature.
    Q. Scramblases and flippases are able to catalyze the transfer of lipid molecules between the outer and

inner leaflets.

R. Membrane lipids are able to spontaneously move between the outer and inner leaflets.

S. Different lipid compositions are found in the two leaflets of a membrane.

a. P and Q
b. Q and R
c. Q and S
d. P, Q and S

16. What is the difference between carriers and channels?

a. Carriers discriminate between solutes mainly on the basis of size and electric charge; channels bind their solutes with great specificity in the same way an enzyme binds its substrate.
b. Channels discriminate between solutes mainly on the basis of size and electric charge; carriers bind their solutes with great specificity in the same way an enzyme binds its substrate.
c. Channels will allow the passage of any solute as long as it has an electric charge; carriers bind their solutes with great specificity in the same way an enzyme binds its substrate.
d. None of the above.

17. Which statement best describes how cholesterol affects cell membrane fluidity?

a. Cholesterol increases fluidity at high temperatures and increases fluidity at low temperatures.
b. Cholesterol increases fluidity at high temperatures and decreases fluidity at low temperatures.
c. Cholesterol decreases fluidity at high temperatures and increases fluidity at low temperatures.
d. Cholesterol decreases fluidity at high temperatures and decreases fluidity at low temperatures.

18. Lipid rafts are involved in signal transduction in cells. Rafts have composition different from rest of the membrane. Rafts were isolated and found to have cholesterol to sphingolipid ratio of 2:1. The estimated size of the raft is 35 nm^2. If the surface area of cholesterol is 40$Å^2$ and sphingolipid is 60$Å^2$, how many cholesterol and sphingolipid are present in one raft?

a. 50 cholesterol : 25 sphingolipid
b. 200 cholesterol : 100 sphingolipid
c. 40 cholesterol : 20 sphingolipid
d. 20 cholesterol : 10 sphingolipid

19. ATP-driven pumps hydrolyze ATP to ADP and phosphate and use the energy released to pump ions or solutes across a membrane. There are many classes of these pumps and representatives of each are found in all prokaryotic and eukaryotic cells. Which of the following statements about these pumps is not correct?

a. P-type pumps are multipass transmembrane proteins which phosphorylate themselves during pumping and involve in ion transport.
b. F-type pumps normally use the H^+ gradient across the membrane to drive the synthesis of ATP.
c. V-type pumps normally use voltage gradient for transport of small molecules.
d. ABC transporters primarily pump small molecules across cell membrane.

20. In an experiment, a plant cell was placed into a medium containing a 1.0 mM concentration of Ca^{++}. The electrochemical potential across the plasma membrane was measured at -110 mV. The Nernst equation predicted that the intracellular concentration of Ca^{++} would be 5,400 mM. The actual concentration of Ca^{++} in the cell was 1.5 mM. This value suggests that calcium

a. is actively transported into the cell
b. is not transported across the plasma membrane
c. is passively transported out of the cell
d. is actively transported out of the cell

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ANSWER KEY

2. (b)	**3.** (c)	**4.** (b)	**5.** (b)	
6. (b)	**7.** (a)	**8.** (d)	**9.** (d)	**10.** (c)
11. (d)	**12.** (b)	**13.** (b)	**14.** (b)	**15.** (c)
16. (b)	**17.** (c)	**18.** (a)	**19.** (c)	**20.** (d)