

Questions 1-4: 15% each; 5-8: 10% each.

1. Please identify the major membrane components which account for the selective permeability of plasma membrane or its modulation and explain how this is accomplished.
2. Compare and contrast signaling mechanisms, both extracellularly and intracellularly, applied by neurons to those conducted by endocrine cells which secrete hormones.
3. Conformation is a major determinant for the functional status of proteins. Please give two examples to explain how protein conformation can be altered and the functional consequences.
4. (a) Taxol and colchicine are both used as anticancer drugs. These two drugs, however, exert opposite effects on microtubules. Taxol binds tightly to microtubules, stabilize them and promotes the assembly of free tubulin into microtubules. In contrast, colchicine prevents microtubule formation. Give your rationale why both drugs are toxic to dividing tumor cells.
(b) Compare this behavior characteristics of microtubules with those of actin filaments.
5. Liver cells proliferate both in alcoholic patients and in patients with liver tumors. Discuss the differences in mechanisms by which cell proliferation is regulated in these two diseases.
6. Please define the similarities and differences in structure and function between two types of membrane proteins of your choice (e.g. ATPases, receptors, ion channels, G proteins etc.).
7. Give your rationale why cells use Ca^{2+} (which is kept at an intracellular concentration at 10^{-7} M) instead of another ion such as Na^{+} (which has an intracellular concentration at 10^{-3} M levels) for intracellular signaling.
8. It is generally thought that genetic variation is beneficial for a species because it enhances its ability to adapt to changing environment. Explain why cells go to great lengths to assure the fidelity of DNA replication.