



Which is common to both prokaryotes and eukaryotes?

A. Endoplasmic reticulum.

B. Plasma membrane.

C. Nucleus.

D. Mitochondrion.

E. Trafficking vesicles.



Which is unique to eukaryotes?

A. DNA as genetic materials.

B. Ribosomes as protein synthesis machines.

C. Involvement of mRNAs.

D. Nuclear envelope.

E. Cell membrane.



Which is true for both embryonic stem cells and induced pluripotent stem cells?

A. Derived from blastocysts.

B. Derived from adult cells.

C. Ability to differentiate into various cell types.

D. Requiring Yamanaka factors.



Diabetic patients suffer losses of pancreatic beta cells. If you'd like to treat the patients with stem cell-derived beta cells, which type of stem cell will likely be more successful?

- A. Induced pluripotent stem cells derived from the patient's own skin cells.
- B. Embryonic stem cells from a government-approved cell line.
- C. Either of them.
- D. Neither of them, use beta cells from donors.



Which carbohydrate does **NOT** contain glucose?

A. Sucrose.

B. Fructose.

C. Glycogen.

D. Cellulose.

E. Starch.



Which carbohydrate is found mainly in animal cells?

A. Sucrose.

B. Fructose.

C. Glycogen.

D. Cellulose.

E. Starch.



In humans, _____ is responsible for the long-term energy storage.

A. Glucose.

B. Phospholipid.

C. Cholesterol.

D. Triglyceride/fat.

E. Starch.



Which is likely found in the plasma membrane of a cell from the plant *Arabidopsis*?

A. Triglycerides with saturated fatty acid chains.

B. Triglycerides with unsaturated fatty acid chains.

C. Triglycerides with both unsaturated and saturated fatty acid chains.

D. Phospholipids.



Which amino acid is usually **NOT** associated with post-translational modifications?

A. Alanine.

B. Serine.

C. Threonine.

D. Tyrosine.

E. Cysteine.



An aspartic acid residue mediates a protein-protein interaction. Which residue is most likely found opposite the aspartic acid residue at the protein-protein interface?

A. Alanine.

B. Serine.

C. Lysine.

D. Proline.

E. Glutamic acid.

Which residue is most likely buried inside a protein?

A. Leucine.

B. Serine.

C. Lysine.

D. Proline.

E. Glutamic acid.

Which noncovalent bond is most important for stabilizing alpha helices in a polypeptide?

A. Van Der Waals.

B. Hydrophobic effect.

C. Ionic bond.

D. Hydrogen bond.

E. Disulfide bond.

Which sequences do Hsp70 chaperones usually bind to?

A. Hydrophobic motifs.

B. Positively charged motifs.

C. Negatively charged motifs.

D. Polar but uncharged residues.

E. Hydrophilic but uncharged residues.

Which feature is found only in chaperonins but not in Hsp70 chaperones?

A. Requirement of ATP.

B. Assisting protein folding.

C. An internal chamber that accommodates polypeptides.

D. Requirement of a nucleotide-exchange factor.

Which statement is correct?

A. Proteins begin to fold only after they are fully synthesized.

B. Chaperonins are the first chaperones that bind to folding polypeptides.

C. Hsp70 chaperones can bind to ribosome-associated polypeptides.

D. Chaperones are only required for proteins that contain multiple subunits.

Which is **INCORRECT** regarding protein folding?

A. Exposure of hydrophobic stretches may lead to protein aggregation.

B. Misfolding of proteins may cause diseases.

C. Chaperones act as HSF1 activators in the heat shock response.

D. Chaperones are usually not associated with fully folded proteins.

Which statement is correct?

A. HSF1 undergoes dimerization upon activation.

B. HSF1 moves between organelles in the heat shock response.

C. Deletion of HSF1 will result in an increased expression of chaperones.

D. DNA-bound HSF1 is monomeric.

Synaptotagmin has two C2 domains that bind to membrane lipids. The lipid-binding regions of C2 domains contain multiple lysines and arginines. Which lipid most likely binds to C2 domains?

A. PC.

B. PS.

C. PE.

D. Cholesterol.

E. Triglyceride

Which treatment will most likely disrupt the integrity of a lipid bilayer?

A. Decrease PC concentration and increase PS concentration.

B. Lower cholesterol contents.

C. Dialysis of the membrane solution to introduce ethanol.

D. Phosphorylations of the inositol group of PI.

E. Use an enzyme to remove the head group of PE.

Doc2b is a peripheral membrane protein binding to phosphatidylserine. Which side of the membrane does Doc2b preferentially bind to in proliferating T cells?

A. Extracellular side.

B. Cytoplasmic side.

C. Both extracellular and cytoplasmic sides.

D. Lumenal side of organelles.

SREBP is a glycosylated transcription factor that controls cholesterol synthesis in the cell. It has two hydrophobic transmembrane domains. To activate its target genes, SREBP will most likely require:

A. A glycan-modifying enzyme.

B. A glycan-removing enzyme.

C. A protease.

D. A phospholipase.

E. A kinase.

Which statement is **INCORRECT** regarding lipid dynamics?

- A. Both proteins and glycans can be covalently linked to lipids.
- B. Lipids can form microdomains on the plasma membrane.
- C. Phospholipids readily move between leaflets.**
- D. Certain proteins are immobile on membranes.
- E. Detergents are amphipathic molecules that disrupt membrane bilayers.

SNAP-25 is a lipid-anchored protein in which the cysteines are covalently linked to fatty acids. If you plan to purify lipid-anchored SNAP-25, which is the best approach?

A. Use detergents to dissolve the membrane bilayer.

B. Use phospholipases to release SNAP-25 from the lipid anchor.

C. Use high salt to remove SNAP-25 from membrane.

D. Deplete PS from the cytoplasmic side of membranes.

PrP is a GPI-anchored glycoprotein on the plasma membrane with S-S (disulfide) bonds. Which manipulation will LEAST likely affect PrP function?

A. Double the PS concentration in the membrane.

B. Use phospholipases to cleave GPI anchors.

C. Remove the glycans of PrP.

D. Use a protease to digest an unstructured region of PrP.

E. Use beta-mercaptoethanol to reduce S-S bonds.

You express aquaporins on the surfaces of frog oocytes. Then you add the oocytes to a hypertonic solution. What will likely happen to the oocytes?

A. Intact.

B. Swelling and exploding.

C. Shrinking.

D. None of the above.

The rate of nitric oxide diffusion across the plasma membrane is found to be always proportional to its concentration with no saturation observed. How does nitric oxide likely enter the cell?

A. Simple unassisted diffusion.

B. Facilitated diffusion.

C. Neither unassisted diffusion nor facilitated diffusion.

D. Either unassisted diffusion or facilitated diffusion.

Estrogen is a hydrophobic hormone, whereas **epinephrine** is a hormone with a positive charge. Where do you likely find the receptors of estrogen and epinephrine, respectively?

- A. Intracellular; Intracellular.
- B. Cell surface; Cell surface.
- C. Intracellular; Cell surface.**
- D. Cell surface; Intracellular.

A patient orally takes radiolabeled glucose. Which statement best describes the journey of the radiolabeled glucose in the body?

A. Intestine lumen, apical membrane of epithelial cells, basolateral membrane of epithelial cells, blood.

B. Intestine lumen, basolateral membrane of epithelial cells, apical membrane of epithelial cells, blood.

C. Blood, intestine lumen, basolateral membrane of epithelial cells, apical membrane of epithelial cells.

D. Intestine lumen, apical membrane of epithelial cells, blood, basolateral membrane of epithelial cells.

If you use a small molecule drug to selectively block facilitative glucose transporters in intestine epithelial cells, which would most likely happen?

A. Increased glucose transport across apical membranes.

B. Glucose builds up inside epithelial cells.

C. Increased glucose transport across basolateral membranes.

D. Glucose is depleted from epithelial cells.

E. Blood glucose levels increase.

Which statement is **INCORRECT** regarding voltage-gated potassium channels?

A. The transport of K^+ ions requires ATP.

B. The K^+ ion transport is electrogenic.

C. The channel is impermeable to Na^+ ions .

D. The gating of the channel involves movements of transmembrane helices.

Which channels/transporters are all NON electrogenic?

A. Voltage-gated K^+ channel, aquaporin.

B. Facilitative glucose transporter, Na^+ /glucose cotransporter.

C. Facilitative glucose transporter, aquaporins

D. Voltage-gated K^+ channel, Na^+ /glucose cotransporter.

What will most likely happen if you mutate the ATP binding site on the Na^+/K^+ ATPase (pump)?

A. Intracellular Na^+ concentration decreases.

B. Extracellular K^+ concentration decreases.

C. Intracellular Na^+ concentration increases.

D. Na^+ and K^+ concentrations remain constant.

E. None of the above.

In the process of an action potential, what drives the repolarization of the membrane?

A. Opening of voltage-gated Na^+ channels.

B. Opening of voltage-gated K^+ channels.

C. Closing of voltage-gated K^+ channels.

D. Opening of K^+ leak channels.

E. Increased speed of Na^+/K^+ pumps.

Tetrodotoxin (TTX) is a neurotoxin that inhibits action potentials. Membrane depolarization is lost in TTX-treated neurons. How does TTX likely block action potentials?

A. Prevent the opening of Na⁺ channels.

B. Lock Na⁺ channels in the “open” state.

C. Prevent the inactivation of Na⁺ channels.

D. Prevent the opening of K⁺ channels.

After the fusion of synaptic vesicles with the plasma membrane, neurotransmitters are released into _____.

A. presynaptic cytosol.

B. postsynaptic cytosol.

C. synaptic cleft.

D. other synaptic vesicles.

If you inject enzymes into synaptic clefts to rapidly degrade released neurotransmitters, which will likely happen?

A. Neurotransmitters fail to be released.

B. Ca^{2+} influx into presynaptic membranes is blocked.

C. Synaptic vesicles do not fuse with presynaptic membranes.

D. Postsynaptic depolarization is inhibited.

Which correctly describes the plasma membrane and cytoplasmic organelles?

A. Surrounded by single lipid bilayers.

B. Similar protein compositions.

C. Similar lipid compositions.

D. Containing phospholipids.

E. Similar luminal contents.