

True or False (1 point each) – 10 points total for this section

1. ___ The proteasome degrades proteins into amino acids.
2. ___ Serine is incorporated into sphingolipids.
3. ___ The ER translocon transports protein in only one direction, into the ER.
4. ___ Type II transmembrane proteins have multiple membrane spans.
5. ___ The binding of substrates by the SCF-ligase is regulated by phosphorylation of the substrate.
6. ___ Enzymes alter reaction rates and not equilibria.
7. ___ The proteasome is involved in the production of certain transcription factors.
8. ___ ABC proteins are exclusively found in eukaryotic organisms.
9. ___ Bacterial porins typically have alpha helical transmembrane segments.
10. ___ The chemiosmotic model proposes that H⁺ flow drives ATP synthesis.

Multiple Choice (2 points each); circle the correct answer – 20 points total for this section

11. Which of the following is not a lipid class found in biological membranes?
 - A) sterols
 - B) sphingolipids
 - C) glycerophospholipids
 - D) triacylglycerols

12. What serves as the carboxyl carrier in acetyl-CoA carboxylase, the enzyme required for the first step in fatty acid synthesis?
 - A) biotin
 - B) ATP
 - C) NADPH
 - D) acetyl-CoA

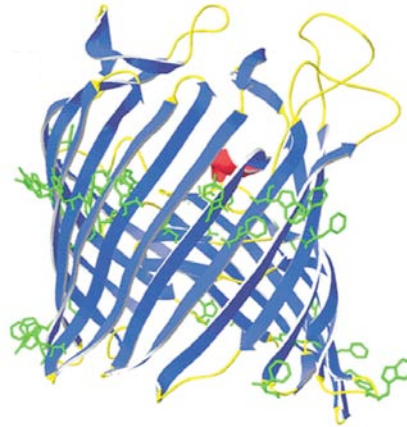
13. The Epsin molecule that aids in curving membranes (Hurley *et al*) has an ENTH domain that is known to:
 - A) bind clathrin
 - B) bind phosphoinositides
 - C) regulate Rab activity
 - D) regulate V-SNARE / T-SNARE interactions

14. Which of the following lipids can be found as a post-translational modification on extracellular proteins?
- A) myristate
 - B) cholesterol
 - C) palmitate
 - D) farnesyl
15. Which of the following is not a general feature of an ER-targeting signal sequence?
- A) hydrophilic domain
 - B) positively-charged amino acids
 - C) negatively-charged amino acids
 - D) hydrophobic domain
16. Which of the following is not a secondary messenger?
- A) calcium
 - B) inositol triphosphate
 - C) cAMP
 - D) pyrophosphate
17. Regulation of which of the following pathways mainly involves phosphorylation/dephosphorylation events?
- A) the NFAT-mediated immune response
 - B) the production of Notch
 - C) the ATF6-mediated unfolded protein response
 - D) the SREBP-mediated sterol response
18. Which of the following is true about P-type ATPases?
- A) they are phosphorylated on Ser residues
 - B) they are vanadate sensitive
 - C) they transport only protons
 - D) they have a single transmembrane span
19. Which of the following does not occur during the channel-mediated transport of ions across membranes?
- A) desolvation of the ion
 - B) structural rearrangements of the channel
 - C) increases in membrane potential
 - D) diffusion
20. Which of the following do not normally hydrolyze ATP?
- A) P-type ATPases
 - B) V-type ATPases
 - C) F_1F_0 ATPases
 - D) ABC-type ATPases

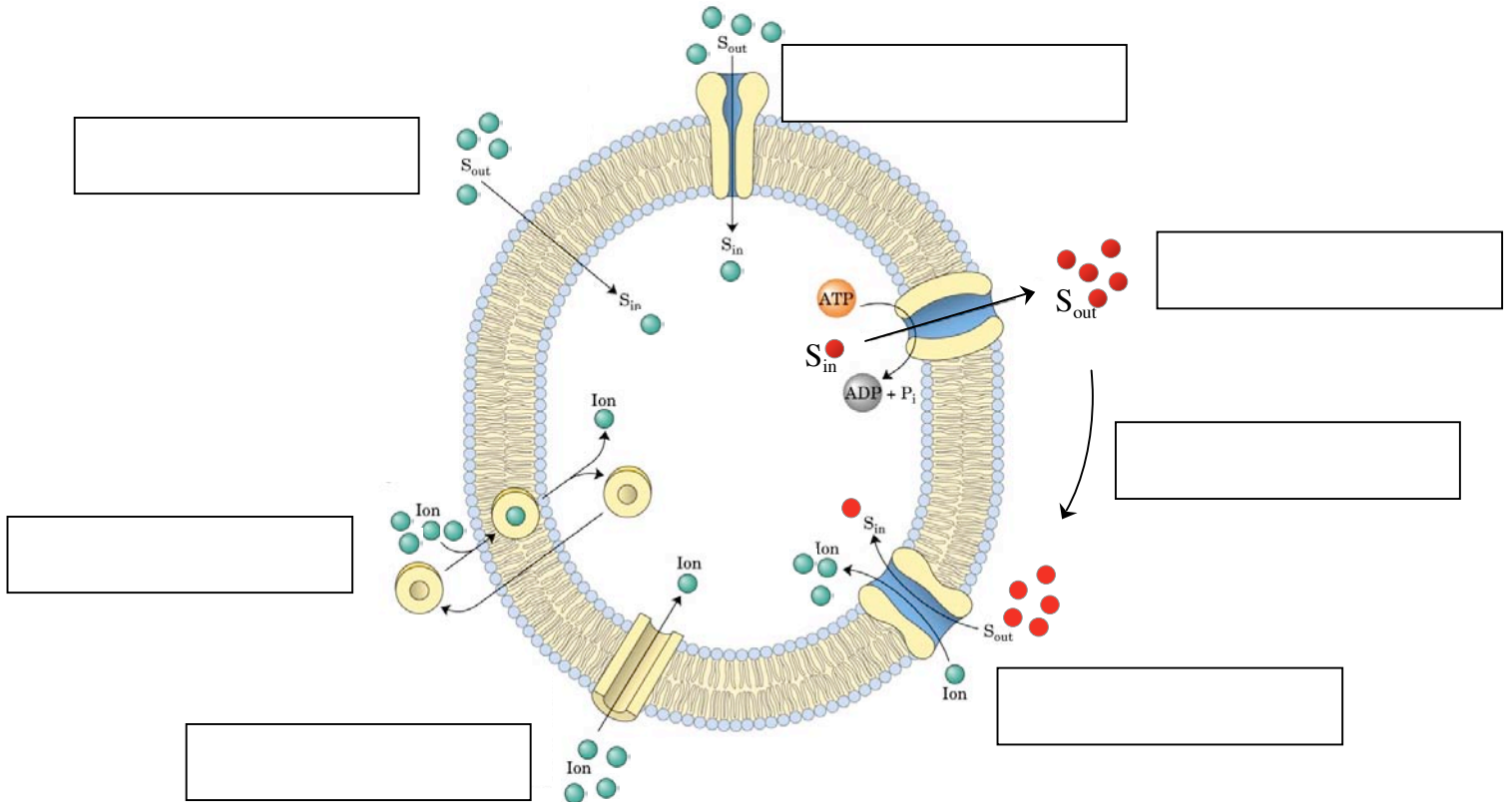
Short Answer (list answers or provide 1-2 sentence responses) – 25 points total for this section

21. What common intermediate is required for the production of triacylglycerols and glycerophospholipids?
(2 points).
22. Draw the chemical structure of a triacylglycerol (use R for acyl groups).
(3 points)
23. CTP is an important molecule in the synthesis of which type of general class of lipid?
(1 point)
24. What is the fate of mammalian signal peptides once they have been cleaved from translocated proteins?
(3 points)
25. List the four events typically associated with signal transduction mechanisms in multi-cellular organisms.
(4 points)
26. List three gating mechanisms, other than ligand gating, that modulate channel activity.
(3 points)

27. In what type of organism AND in which type of membrane do you expect this protein to be found?
 (2 points)



27. Fill-in the empty boxes with the type of transport event being schematized.
 (7 points)



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Long Answer / Descriptive Answer / Diagrams – 45 points total for this section

28. What is the molecular target of diphtheria toxin and how does this toxin affect translation?
(6 points)

29. Describe or draw the general pathway/steps associated with activation of the PKR-mediated anti-viral response AND indicate one step that can be interrupted by viruses.
(7 points)

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30. Based on your reading of Reguenga *et al* (the article on the import of peroxisomal matrix proteins), describe one method that can be used by to determine whether proteins associate as a complex.
(6 points)

31. Draw a cartoon diagram that describes the general pathway for ubiquitination of a substrate AND identify the generic names for the key enzymes and molecules involved in this process.
(6 points)

32. What are PDZ domains AND how are they used by enzymes?
(6 points)

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33. Describe or draw the key events associated with the activation of NF κ B. Formal identification/naming of all the individual enzymes/proteins associated with the pathway is not required for full credit.
(5 points)

34. Diagram the mechanism for how iodoacetamide (I-CH₂-CO-NH₂) can inactivate proteases?
(6 points)

35. You have identified a novel gene. Sequence analysis of the encoded protein indicates that it lacks an identifiable transmembrane domain. However, you have determined that your protein associates with the particulate / sedimentable fraction in a total lysate. Describe one simple experiment, other than further sequence analysis, that would help you to determine whether your protein is an integral or peripheral membrane protein. Assume that you already have a membrane preparation for your use and the reagents needed for detection of your protein.

(3 points)

Bonus Section – 5 points total for this section

1. List the post-translational modification(s) that occur to PKA?

(2 points)

2. List the two key features of aquaporins that provide selectivity against the transport of protons.

(2 points)

3. What feature of biological membranes is typically misrepresented in artistic renditions?

(1 point)