

**True / False (1/2 point each; 12 points total)**

1. Fatty acid biosynthesis requires:

- biotin
- NADPH
- ATP
- GTP

2. Gram positive prokaryotes:

- include organisms such as *E. coli*
- have an extensive peptidoglycan layer
- make extensive use of Type III secretion systems for infection
- often use porins for small molecule transport

3. The Bromo domain:

- contains 5 alpha helical bundles
- makes extensive use of electrostatic intermolecular interactions
- is the only interaction domain that interacts with acetylated lysines
- is found on histones

4. Regarding proteolysis:

- serine proteases have the same molecular mechanism regardless of substrate
- cysteine proteases release the C-terminal portion of a polypeptide prior to the N-terminal portion
- aspartic proteases rely on phosphorylation of aspartic amino acids as part of their mechanism
- the four established protease classes each form acyl intermediates with their substrates

5. Regarding lipid-linked proteins:

- GPI is a type of sphingolipid
- GPI utilizes its amino group as a nucleophile in GPI protein formation
- isoprenylation can be mediated by three distinct isoprenoid transferases
- phospholipases can release the isoprenoid moiety of isoprenylated proteins

6. Regarding ABC-type transporters:

- they have a modular design
- their nucleotide binding domains (NBD) are structurally similar regardless of transport substrate
- each ABC transporter is designed to transport a unique substrate
- their transport mechanism was substantially elucidated by the first X-ray crystal structure of an ABC transporter (MsbA)

**Multiple Choice (2 points each; 24 points total; one correct answer per question)**

7. The Fatty Acid Synthase primarily produces fatty acids of what length?

- A) C12
- B) C14
- C) C16
- D) C18

8. Fatty acids are released from the Fatty Acid Synthase through the action of:
- A) ATP hydrolysis
  - B) carboxylation
  - C) reduction
  - D) a thioesterase
9. The most recent hypothesis that attempts to explain the nature of the signal sequence associated with type III bacterial secretion systems suggests that the signal is:
- A) dependent on a lipid modification
  - B) dependent on mRNA
  - C) dependent on N and C-terminal polypeptide sequences
  - D) tripartite in nature
10. The typical width of the lipid portion of a biological membrane is:
- A) 1.5 nm
  - B) 5 nm
  - C) 8 nm
  - D) 15 nm
11. Which of the following amino acid is least likely to be found within a TM segment according to guidelines outlined in the article titled "Border Crossing" by Bowie.
- A) glutamine
  - B) leucine
  - C) methionine
  - D) phenylalanine
12. Sphingomyelin synthesis depends on:
- A) glycerophosphatidylcholine
  - B) glycerophosphatidylethanolamine
  - C) glycerophosphatidylinositol
  - D) glycerophosphatidylserine
13. Which of the following agents should you add to get the broadest target specificity against serine proteases that might be present in a crude cellular lysate?
- A) EDTA
  - B) PMSF
  - C) TPCK
  - D) TLCK
14. As discussed in class, which of the following have not been co-opted into secondary messenger systems:
- A) amino acids
  - B) fatty acid conjugates
  - C) inorganic ions
  - D) nucleotide derivatives

15. Which of the following is not a selectivity filter utilized by aquaporins?
- A) dipole filter
  - B) osmotic filter
  - C) proton filter
  - D) size filter
16. Which of the following is the largest gene family of transport ATPases?
- A) ABC-type
  - B) F-type
  - C) P-type
  - D) V-type
17. What does the P stand for in P-type ATPases?
- A) peripheral
  - B) phosphate
  - C) PKA activated
  - D) proline
18. Which of the following is likely to be found at the interfacial region of porins?
- A) phenylalanine
  - B) tryptophan
  - C) tyrosine
  - D) all of the above

**Short Answer - These can be answered using keywords, lists, diagrams, and/or 1-2 sentences (1-5 points each; 28 points total)**

19. Two specific examples were provided in class in which methionine residues were described as being good for maintaining protein-peptide interactions with diverse substrates. List the two examples AND their interactors. (3 points)
20. Using the stick figure method, draw the chemical structure of a naturally occurring  $16:2(\Delta^{8,12})$  fatty acid. (4 points)
21. Docosahexaenoic acid is commonly found in what over-the-counter nutritional supplement? (1 point)