

Guide Questions for Topic: Protein Function & Regulation

Terms

Enzyme	Conformational change
Substrate vs. product	Phosphorylation
Activation energy	Kinase
Transition state	Phosphatase
Catalysis	Serine, threonine, and tyrosine
Active site	Protein-protein interactions
Structural protein	The ubiquitin-proteasome system
Scaffolding protein	Ubiquitin vs. ubiquitination
Transmembrane channel and transporter	Proteasome
Transmembrane receptor	Lysine
Allosteric regulation	E3 ubiquitin ligase
Allosteric site	

Protein Functions

1. How do enzymes accelerate rates of chemical reactions?
2. What dictates the specificity of an enzyme for its substrate(s)?
3. The protein PSD-95 is referred to as a “scaffolding protein”. What does this indicate about the role that PSD-95 plays in cells?

Allosteric Regulation

4. What does the term “allosteric site” refer to?
5. What is the difference between an active site and an allosteric site on a protein?
6. How/Why does binding of a small molecule to an allosteric site on a protein alter the protein’s activity?
7. TRUE or FALSE: Binding of a small molecule to an allosteric site on a protein always causes inhibition of the protein’s activity.
8. Troponin and calmodulin are two proteins that subject to allosteric regulation in cells. Based on this information, what can you conclude these proteins have in common?

Phosphorylation

9. Phosphorylation refers to _____.
10. What amino acids can be phosphorylated?
11. Proteins that catalyze phosphorylation are called _____.
12. Proteins that catalyze dephosphorylation are called _____.
13. Phosphorylation of a protein can alter its activity by _____.
14. Phosphorylation of a protein can have which of the following effects on the protein?

Protein-protein interactions

15. The term “protein-protein interaction” refers to _____.
16. The proteins FOXO and 14-3-3 provides an example of how protein-protein interactions can regulate the activity of protein. What is the consequence of protein-protein interactions between FOXO and 14-3-3?
17. Protein Kinase A (PKA) provides an example of how protein-protein interactions can regulate the activity of a protein. How do protein-protein interactions affect PKA activity?

The Ubiquitin-Proteasome System

18. What role does the proteasome play in cells?
19. How does the proteasome distinguish between its substrates and non-substrates?
20. What role do E3 ubiquitin ligases play in cells?
21. What amino acid(s) can be ubiquitinated on proteins?
22. Why are p53 levels low in cells when they do NOT have an abundance of DNA damage?
23. Why do p53 levels rise when cells accumulate DNA damage?

24. Below is a sequence of amino acids located in the middle of the protein p53.

N-.... - Thr - Leu - Cys - Met - Glu - Ala - Val - Asn - Lys - Gly - Ser - Pro - ...-C
62 63 64 65 66 67 68 69 70 71 72 73

Based on this information, which of the following p53 mutations (i.e., changes in the above amino acid sequence) would most likely interfere with its degradation by the proteasome?