STUDY GUIDE: AMINO ACID METABOLISM 2015

1. The largest groups of enzymes that metabolize amino acids are the aminotranferases (transaminases). The common feature to all of these enzymes, no matter which amino acid it is specific for, is the enzymatic mechanism. Discuss the mechanism of the amine transfer and the role of pyridoxal 5’ phosphate.

2. Discuss the Glucose-Alanine Cycle and the Cori Cycle in relationship to the activity of striated muscle, and liver.

3. Glutamate dh, Glutamate synthase, Glutaminase and Glutamine synthetase. Sort them out, who does what? Why is the regulation of glutamine synthetase an important regulatory point in nitrogen metabolism?

4. Explain the Glutamate synthase a and b subunits relationship to the enzymatic activity of this protein. (remember to include the mechanism of amine transfer).

5. Discuss the structure and metabolic control of bacterial glutamine synthetase. How does convalent modification affect the activity of glutamine synthetase. (Describe the entire process of covalent modification).

6. Why is the formation of NH₃ from N₂ so unique? Discuss the structure and enzymatic activity of Nitrogenase.

7. Atmospheric nitrogen is the most important source of nitrogen. How does atmospheric nitrogen enter biological systems? What are the major points of entry of NH₄⁺ into metabolism?

8. What is the role of ATP in nitrogen fixation?


10. Why should this pathway be sensitive to O₂?

11. How is the NH₄⁺ assimilated into amino acids?

12. Define ketogenic and glucogenic amino acids, and discuss examples of each. Explain. Which amino acids are considered BOTH? Discuss the breakdown strategy of amino acids to TCA cycle intermediates.
13. In amino acid metabolism, how is the nitrogen disposed of?
14. What happens to the carbon skeletons after the deamination (there are many possibilities!)?
15. Explain the Urea Cycle and how that interacts with the TCA Cycle. Describe how glutamate and aspartate both deliver the NH$_2$ groups differently in the Urea cycle for the formation of urea. This is repeated in numerous pathways such as in purine biosynthesis. How is the activity of the urea cycle regulated? When is it most active?
16. Explain the different roles of carbamyl phosphate synthase I & II in eukaryotic cells.
17. Describe the importance of serine and threonine dehydratase.
18. The serine, glycine, alanine, threonine, cysteine pathway is a model of amino acid breakdown. Discuss this as a model. How is this pathway linked to methionine metabolism?
19. Discuss the methionine, isoleucine-leucine-valine pathways use of enzymes common to odd chain fatty acid utilization.
20. Lysine, tryptophan, leucine and phenylalanine produce acetoacetate. What pathway and unwanted end-product is the outcome of this?
21. Bacteria are amazing in their ability to produce amino acids, how do they uniquely utilize OAA & pyruvate in amino acid synthesis?
22. How is cysteine produced from methionine?
23. How is methionine recycled after methyl donation?
24. How does the methionine cycle interact in polyamine synthesis?
25. Where in the digestive tract are proteins broken down to their amino acid monomers? How does this happen? What enzymes are responsible?
26. Which organ is responsible for breaking down amino acids from ingested proteins to units that can be utilized to produce energy?
27. What types of reactions are taking place in this process?
28. Why is tetrahydrofolate a significant cofactor in one-carbon transfer reactions?
29. Why is S-adenosylmethionine a preferred cofactor for biological methyl group transfers? How is it produced?
30. Describe the process of cellular protein turnover. Compare the process of protein turnover in prokaryotes and eukaryotes.

Protein Degradation & Polyamine Metabolism

*Please remember that the polyamine readings are to be found on Wordpress.*

31. Amino acid sequence of proteins plays numerous roles in the life of a protein. Explain the N-end Rule. What is the PEST sequence and its role in the life of a protein?
32. Describe the protein structure of Ubiquitin? Describe the function of the three proteins involved in the ubiquitination of proteins.
33. Describe the interaction of E1 and E2 and the charging of ubiquitin with ATP.
34. Describe the role of E3.
35. Describe the interaction of E2 and E3 in the ubiquination process.
36. Describe the structure and function of the proteasome.
37. Ornithine decarboxylase plays a central role in polyamine metabolism. Describe its enzymology and role in the polyamine synthesis pathway.
38. Explain how S’adenosylmethionine pathway interacts with the polyamine pathway.
39. Describe the fate of MTA.
40. Explain the trans-sulfuration pathway.
41. Why is adenine and adenosine cleaved from both MTA and SAH?
42. Explain the function of sermidine-spermine acetyltransferase/Polyamine oxidase (SSAT/PAO) in the polyamine pathway.
43. Why does the pathway continue to interest the cancer chemotherapy community?
44. What is ODC’s role on loss of control of cell proliferation?