108C Discussion Problems: Week 7 – Nitrogen Waste and Salvage

Answer each question descriptively with complete sentences where appropriate.

1a. Amino acids can be catabolized for energy. What must occur before an amino acid can be shunted into one of the carbon metabolism pathways? What are two ways that this process can occur?

1b. When peripheral tissues catabolize amino acids for energy, excess nitrogen is transported in the blood to the liver. What molecules transport this nitrogen?

2a. In mammals, the bulk of excess nitrogen is excreted as what compound? The production of this compound overlaps significantly with the biosynthesis of which amino acid?

2b. The urea cycle requires 1 aspartate and 1 ammonia to operate. How is aspartate formed for the urea cycle? How is free ammonia generated? In what organelle/compartment does this chemistry occur?

2c. Fish excrete their bulk nitrogen waste as what compound? Birds and reptiles excrete their bulk nitrogen waste as what compound? What biosynthetic pathway is co-opted to synthesize this waste product?

3. Purine nucleotides taken up in the diet can be salvaged. Which purine rings can be taken up through salvage pathways? How are these purine rings converted to intermediates of purine biosynthesis?

4. Excess purines are excreted via a pathway distinct from bulk nitrogen waste. What is the waste product of purine catabolism in birds, reptiles, and higher primates? What is the waste product of purine catabolism in most mammals? What is the hypothesis put forth by evolutionary biologists to explain the discrepancy in purine waste products between mammals and higher primates?

5. Which pyrimidine rings can be taken up through salvage pathways? How are these rings converted into intermediates of pyrimidine biosynthesis?

6. Thymine can be metabolized in the citric acid cycle. What metabolite of thymine can be shunted into the citric acid cycle? What are the ultimate fate(s) of metabolized cytosine and uracil?