

## ***BERG/STRYER V STUDY GUIDE***

### **CHAPTER 23**

1. Homework 2, 4, 6, 9, 13. **Ubiquitin** is a small protein (76 aa) used as a marker for cellular protein turnover. Marked proteins are unfolded and broken down by the **proteasome**, a "garbage can" shaped structure which is related to **Gro-EL**, a folding chaperone (the opposite job!). Dietary protein is hydrolyzed by **pepsin** in the stomach, and then by trypsin, chymotrypsin, and other proteases in the small intestine. Essentially all protein consumed orally is broken down to amino acids, which is why money spent on most "enzyme pills" (like Superoxide Dismutase) is wasted.
2. Amino acid catabolism starts with **transamination**. Amino groups are transferred to alpha-ketoglutarate by specific **aminotransferase** enzymes (639). The resulting glutamate is then oxidatively deaminated by **glutamate DH** which can use either  $\text{NAD}^+$  or  $\text{NADP}^+$ . The ammonia produced is generally incorporated into **urea** for excretion. Ammonia is toxic if allowed to build up. You should understand how **PLP**, pyridoxal phosphate works. PLP is the cofactor for very many amino acid reactions. **Aspartate aminotransferase** is presented as an example in the text (642-3). Understand that the group that is perpendicular to the plane of PLP is the group that is removed. [The old name for Asp Amino Trans was Glutamate Oxaloacetate Transaminase or "GOT." Doctors still prescribe blood tests for **SGOT** – S for serum – as an indicator of heart or liver damage.] **Serine** breaks down two ways – serine dehydratase deaminates to form pyruvate, and serine hydroxymethyltransferase reversibly produces glycine. Know that **alanine** and **glutamine** can carry nitrogen through the blood from muscles to liver, where excess nitrogen enters the **urea cycle**.
3. Know the complete **Urea Cycle**, with synthesis of **carbamoyl phosphate** (644-646). Understand the connection to the **Citric Acid Cycle**. The discussion of the evolution of the urea cycle is interesting. In fact "**Aspartate donation**" as shown on 647 is one of the major modes of nitrogen transfer, along with "**Glutamine donation**," **Transamination** and formation/attachment of **Carbamoyl Phosphate**.
4. What are **glucogenic** and **ketogenic** amino acids? (649). Know the three, four, and five carbon families of amino acids (on 650-651) and be able to show the breakdown of **proline** or **arginine** to glutamate, as shown in class. Know the pathway from **phenylalanine** to **epinephrine** (on handout). This starts with **Phe Hydroxylase** (654) the lack of which causes **PKU** or **Phenylketonuria** (656).