8.5.2

Protein Metabolism

So far this reading has focused on the metabolism of sugars and fats. Indeed, sugars and fats make up the large majority of organic molecules processed as fuel in our cells. However, proteins can be metabolized to make ATP as well. Proteins are responsible for most of the structure and function in our body tissues, so we probably don't want to metabolize them too extensively. In fact, the body employs several regulatory mechanisms to spare body proteins from metabolism. But, in cases of prolonged fasting, or diets high in protein (like our average American diet), we see amino acid metabolism become an important part of ATP synthesis. In fact, the average American diet has much more protein than we need and so we can even see the products of protein metabolism being used to synthesize fatty acids and triglycerides which are stored in our fat cells. When proteins undergo catabolism, they are broken down into individual amino acids. Amino acids differ with respect to the "R group. The "R" group will determine where in the metabolic cycles that the amino acid products will enter. Notice in figure 13 that there are several metabolic entry points for amino acids in the biochemical pathways we have discussed.

Gluconeogenesis

The conversion of pyruvate to acetyl CoA is an irreversible reaction. This means that when fatty acids are metabolized to form acetyl CoA, it is not possible to turn the acetyl CoA back to pyruvate or any earlier glycolytic product. Also, acetyl CoA is 2 carbons long and 2 carbons are lost in the early reactions of the Citric Acid Cycle. For both of these reasons, it is not possible to use fatty acids to make glucose. In order to make glucose from scratch (**Gluconeogenesis**), our cells have to use a substrate that is not acetyl CoA and will not go through CO_2 expelling steps. In the figure below, we see that some amino acids can enter the metabolic pathways in places that meet these requirements. Therefore, amino acids are the best choice for a raw material to make glucose. When amino acids enter the metabolic pathways for the purpose of making glucose, the reactions of glycolysis more or less runs in reverse to synthesize a new glucose molecule. The liver is particularly good at doing this. Gluconeogenesis is stimulated by hormones in the body that are released when blood sugars become low.

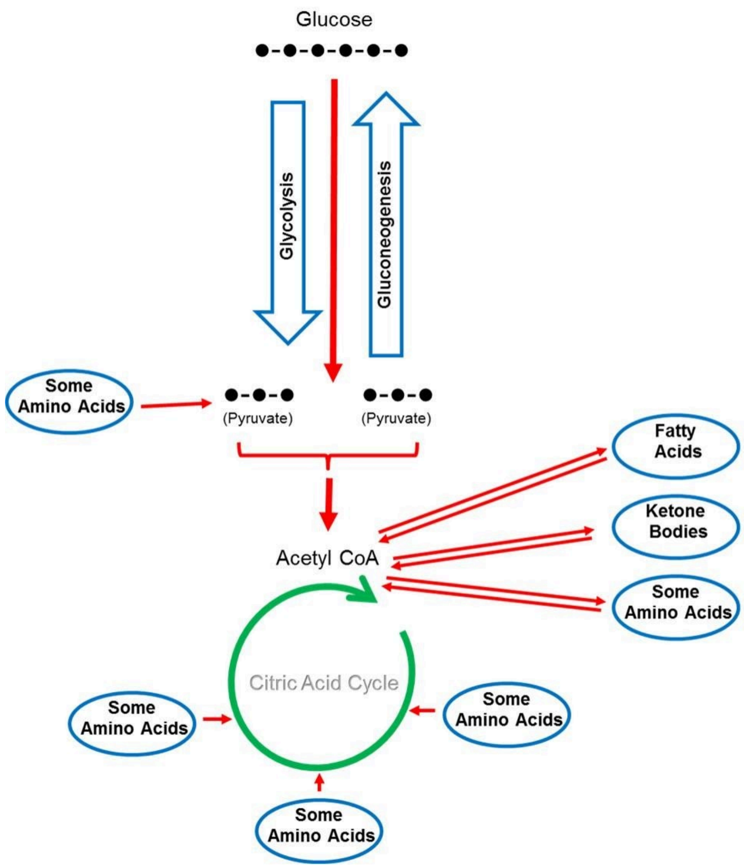

Image created by JS at BYU-Idaho Fall 2013. **This illustration shows the metabolic entry point of carbohydrates, fatty acids, and amino acids (from proteins). Notice that many of the reactions are reversible.**