

Tutorial 30: Amino Acid Metabolism

Goals:

- ✓ Be able to describe the fate of the amino group in metabolism.
- ✓ To understand the processes of transamination to remove the amino group from an amino acid.
- ✓ To know the terms ketogenic and glucogenic with respect to amino acids.
- ✓ To understand the difference between essential and nonessential amino acids.

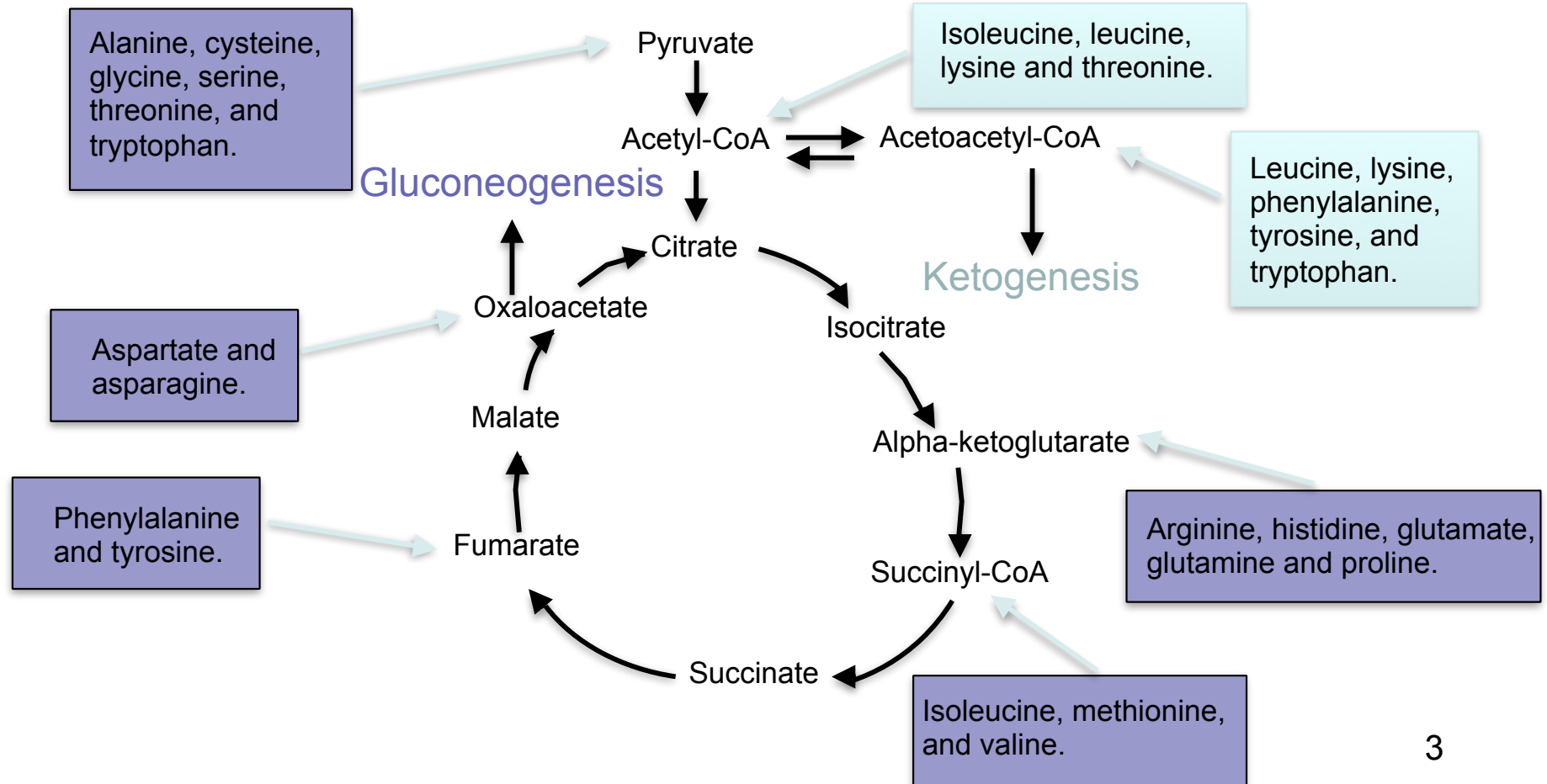
Amino Acid Metabolism

- **Overview of Amino Acid Metabolism:**

- Amino acids from digestion and body tissue degradation first undergo transamination to remove the amino group. The carbon skeleton that remains can be used for anabolic or catabolic purposes. The amino group is either excreted in the urine as urea, or used as a source of nitrogen for biosynthesis of nitrogen containing molecules.
- The remaining carbon skeletons are different for the 20 different amino acids. They each undergo their own unique pathway and are converted into pyruvate, acetyl-CoA, acetoacetyl-CoA, and Krebs cycle intermediates.
- All carbon skeletons can be completely catabolized in the Krebs cycle, but they can also be used for energy storage as fats (via lipogenesis), glucose (via gluconeogenesis) or ketone bodies (via ketogenesis).

Glucogenic and Ketogenic Amino Acids

- Ketogenic amino acids are those whose carbon skeletons can be converted directly into acetyl-CoA or acetoacetyl-CoA. Thus, they can either enter the Krebs cycle for energy production, or they can be used for fatty acid synthesis via lipogenesis and synthesis of ketone bodies via ketogenesis for energy storage.
- Glucogenic amino acids are those whose carbon skeletons can be converted into pyruvate or a Krebs cycle intermediate. Thus, they can enter the Krebs cycle for energy production, or they can form glucose via gluconeogenesis for energy storage.



Essential Vs. Nonessential Amino Acids

- Nonessential amino acids are those that can be synthesized by our bodies.
- Essential amino acids are those that must be obtained from foods because they cannot be efficiently synthesized by our bodies.
- Our diets must contain a reasonable ratio of the essential amino acids in order to maintain health.
 - Meat, eggs and milk contain the essential amino acids in a similar ratio to that needed by humans.
 - Fruits, vegetables, nuts, seeds, beans and grains tend to be high in some and low in others. They do not contain similar ratios to that needed by humans. Thus, they should be consumed such that the amino acids they contain will ‘complement’ each other.
 - Current nutritional research suggests that quinoa and soybeans are a complete protein source. Remember that this means they contain a similar ratio to that needed by humans.

Essential Amino Acids

Histidine

Isoleucine

Leucine

Lysine

Methionine

Phenylalanine

Threonine

Tryptophan

Valine