Proteolytic degradation, or proteolysis, is a key factor that controls protein concentration and function.

LEARNING OBJECTIVES

Describe protein degradation

KEY TAKEAWAYS

Key Points

- The major mechanism of proteolytic degradation utilized by the cell, is via the proteasomal pathway. Proteins that are degraded via the proteasomal complex are tagged via the addition of a ubiquitin signal.
- An additional mechanism utilized for proteolytic degradation is via the lysosomal pathway. The lysosome contains proteases which target proteins for degradation.
- Proteolysis is necessary to control protein concentration and prevent abnormal accumulation.
- Upon protein degradation, the amino acids are typically reused and recycled for the synthesis of new proteins.

Key Terms

- **ubiquitin**: A small regulatory protein sequence that directs proteins to specific compartments within the cell. Specifically, a ubiquitin tag directs the protein to a proteasome, which destroys and recycles the components.
**proteases**: A class of enzymes that can cleave proteins.

![Figure: The Process of Protein Degradation in a Proteosome](https://bio.libretexts.org/Bookshelves/Microbiology/Book%3A_Microbiology_(Boundless)/7%3A_Microbial_Genetics/7.19%3A...)

Proteolytic degradation is necessary in the regulation of cellular processes and function. The breakdown of proteins into smaller polypeptides, or its respective amino acids, are necessary for metabolic and cellular homeostasis. Polypeptides are commonly broken down via hydrolysis of the peptide bonds by utilizing a class of enzymes called **proteases**. However, proteolytic degradation can also occur utilizing various mechanisms, including intramolecular digestion and non-enzymatic methods. The mechanisms of proteolytic degradation are necessary for obtaining amino acids via degradation of digested proteins, preventing accumulation or abnormal concentrations of proteins, and by regulating cellular processes by removing proteins no longer needed.

Proteasomes are protein complexes that function in the degradation of unneeded or damaged proteins via proteolysis. The proteasomes are a major component of a complex and highly regulated mechanism. The proteasome is able to degrade proteins based on the presence of a **ubiquitin** protein. This ubiquitin sequence is a modification to proteins that are targeted for degradation. The recognition of this ubiquitin signal by the proteasome results in degradation of the protein into its amino acids, which are then recycled and reused for the synthesis of new proteins. The proteasomal degradation pathway is the major pathway utilized to ensure proteolytic degradation. It is necessary for homeostasis functioning in controlling cell cycle and gene expression, for example.

In addition to proteasomal complexes, the organelle, the lysosomes are also used to ensure protein degradation. The intracellular process that utilizes lysosomes involves autophagy. The lysosomal pathway, in comparison to the proteasomal pathway, is typically non-selective. The lysosome contains proteases that are able to target and degrade proteins.