

---

# Unit B

## Understanding

# Animal Body Systems

---

### Lesson 5

## Protein Digestion by Enzyme Action

---

# Terms

- Antibodies
- Catalysts
- Digestion
- Epithelium
- Gastric pits
- Hemoglobin
- Insulin
- Pepsin

---

## What is the environment of the stomach and how does this environment relate to protein digestion?

- The **epithelium**, or stomach lining, is the source of “digestive juices.”
- A. The upper epithelial surface of the stomach is dotted with deep depressions called **gastric pits**. These pits contain glands with two types of excreting cells which excrete both hydrochloric acid and pepsinogen. The hydrochloric acid transforms pepsinogen into the enzyme pepsin in the stomach.
- B. Due to the large amounts of HCl secreted by the stomach, the pH level of the stomach is very acidic (1.5 to 2.5).

# THE STOMACH ENVIRONMENT

---

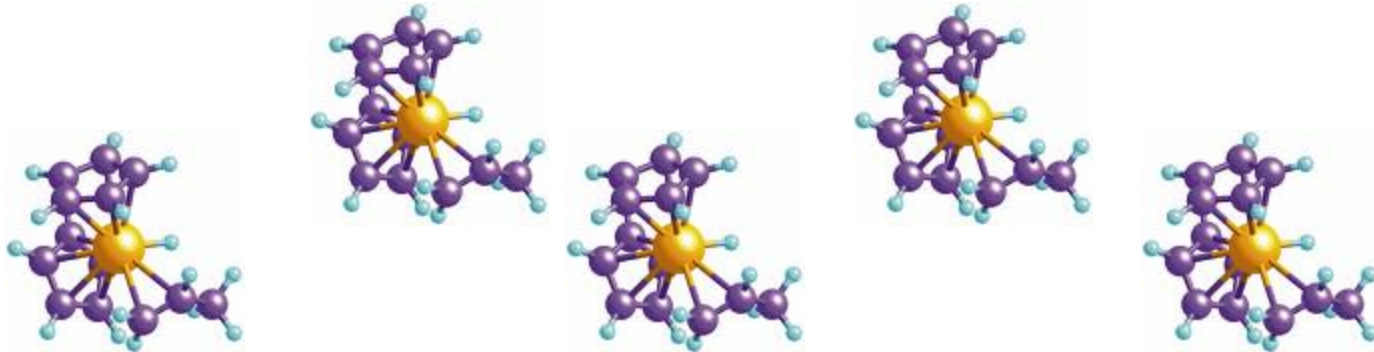
- ◆ Epithelium—stomach lining; the source of “digestive juices.”
  - Upper epithelial surface of the stomach is dotted with deep depressions called gastric pits.
  - These pits contain glands with two types of excreting cells which excrete both hydrochloric acid and pepsinogen.
  - The hydrochloric acid transforms pepsinogen into the enzyme pepsin in the stomach.
- ◆ Due to the large amounts of HCl secreted by the stomach, the pH level of the stomach is very acidic (1.5 to 2.5).

---

## How does an enzyme breakdown proteins in the stomach?

- The majority of **digestion**, or break down of food, occurs in the stomach.
- A. The stomach contains high concentrations of hydrochloric acid and the protein digestion enzyme called **pepsin**. Pepsin will only become active at low pH levels (around 2.0). Pepsin breaks down long globular proteins into shorter polypeptide chains.

- B. After the stomach, the proteins are further digested in the small intestine by enzymes secreted by the pancreas.
  - The pancreas releases the enzyme Trypsin that continues to break down proteins into amino acids, which are absorbed into the blood stream.



- 
- C. Enzymes are **catalysts**, substances that speed up chemical reactions. Water itself can break down proteins, but at such a slow rate that the body would not be able to absorb enough energy to carry out basic functions.
    - Enzymes break long chains of proteins into smaller chains, which are in turn broken down into individual amino acids. These amino acids can then be rearranged into proteins that are found and used in our bodies.

# PROTEIN DIGESTION BY ENZYMES

---

The majority of digestion occurs in the stomach.

- ◆ The stomach contains high concentrations of hydrochloric acid and the protein digestion enzyme called pepsin.
  - Pepsin will only become active at low pH levels (around 2.0).
  - Pepsin breaks down long globular proteins into shorter polypeptide chains.
- ◆ After the stomach, the proteins are further digested in the small intestine by enzymes secreted by the pancreas.
  - The pancreas releases the enzyme Trypsin that continues to break down proteins into amino acids, which are absorbed into the blood stream.
- ◆ Enzymes are catalysts, substances that speed up chemical reactions.
  - Enzymes break long chains of proteins into smaller chains, which are in turn broken down into individual amino acids.
  - These amino acids can then be rearranged into proteins that are found and used in our bodies.



---

## Why is it necessary for animals to break down proteins to be utilized by the body?

- Proteins make up more than 50% of the dry weight of animals.
- A. Proteins perform many important functions in living organisms.
  - 1. Hair and fingernails are composed of fibrous structural proteins.
  - 2. Animal body fluids contain soluble proteins, known as **antibodies**, that help combat disease.

- 
- 3. **Hemoglobin**, is an oxygen carrying protein found in red blood cells.
  - 4. Some proteins, actin and myosin, help muscles contract.
  - 5. **Insulin**, which helps the body absorb sugar, is a number of protein hormones.
  - 6. Proteins are found in biological membranes that regulate the passage of substances through these membranes.
  - 7. The most numerous class of proteins is the enzymes.

- 
- B. Proteins are complex organic compounds made up of amino acids.
    - 1. Amino acids contain carbon, hydrogen, and oxygen. In plants, proteins are largely concentrated in the growing portions, especially leaves and seeds.
    - 2. Essential amino acids cannot be produced fast enough by animals, and therefore must be supplied in the livestock feed. Maize and cotton seed cakes together as feed, usually provide a good source of the essential amino acids.

# **BENEFITS OF PROTEINS**

---

- ◆ **Hair and Fingernail Composition**
- ◆ **Antibodies to Help Fight Disease**
- ◆ **Hemoglobin to Carry Oxygen to Cells**
- ◆ **Muscle Contraction**
- ◆ **Insulin to Help Body Absorb Sugar**
- ◆ **Regulation of Substance Passage Through Membranes**

---

# Review/Summary

- What is the environment of the stomach and how does this environment relate to protein digestion?
- How does an enzyme breakdown proteins in the stomach?
- Why is it necessary for animals to break down proteins to be utilized by the body?