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Short Communication

# Pepsin Gastric Enzyme Facilitating Protein Hydrolysis and Digestion

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## DESCRIPTION

Pepsin is one of the most important digestive enzymes in the human body, primarily responsible for breaking down proteins in the stomach. It is a member of the protease family and plays an essential role in the digestive process, ensuring that proteins consumed in food are adequately degraded into smaller peptides for absorption. This shows the structure, function, activation, mechanisms of action and clinical significance of pepsin, emphasizing its vital role in digestion and health.

### Structure and activation

Pepsin is produced in the stomach as an inactive pioneer known as pepsinogen. Pepsinogen is secreted by the chief cells in the gastric mucosa [1]. Upon exposure to the acidic environment of the stomach, pepsinogen undergoes a conformational change that reveals the active site, converting it into active pepsin. This activation can occur auto catalytically, meaning that pepsin can also activate more pepsinogen molecules once it is formed.

### Mechanism of action

**Substrate binding:** Pepsin binds to its protein substrate, aligning it within the active site to facilitate the cleavage of peptide bonds [2].

**Formation of the enzyme-substrate complex:** The enzyme forms a temporary complex with the substrate, stabilizing the transition state for the reaction.

**Peptide bond cleavage**: Pepsin preferentially cleaves peptide bonds adjacent to aromatic amino acids, such as phenylalanine, tryptophan, and tyrosine [3]. The aspartate residues in the active site play a important role in the catalytic mechanism by donating protons, facilitating the hydrolysis of the peptide bond.

**Product release:** After cleavage, smaller peptide fragments are released, and the enzyme is regenerated to its original state, allowing it to catalyze further reactions [4].

### Biological functions

**Digestion:** The primary role of pepsin is to initiate the digestion of proteins in the stomach. By breaking down complex proteins into smaller peptides, pepsin prepares them for further digestion by pancreatic enzymes in the small intestine [5]. This step is essential for nutrient absorption, as smaller peptides and amino acids are more easily absorbed by the intestinal lining.

**Regulation of gastric function:** Pepsin is involved in regulating gastric function. The presence of food in the stomach stimulates the secretion of gastric juices, including pepsinogen [6]. As protein digestion progresses, the products of digestion further stimulate gastric secretion, creating a response loop that ensures efficient digestion.

**Immune function:** Pepsin may also play a role in the immune system. By breaking down dietary proteins and potential allergens, it helps to prevent the entry of harmful substances into the bloodstream [7]. This function is particularly important in maintaining gut health and preventing food allergies.

### Clinical significance

**Digestive disorders:** Pepsin levels and activity can be altered in various gastrointestinal disorders. Conditions such as gastritis, peptic ulcers and Gastroesophageal Reflux Disease (GERD) can affect pepsinogen secretion and function [8]. Monitoring pepsin levels in gastric juice can provide insights into the underlying causes of these conditions.

**Enzyme replacement therapy:** In cases of insufficient gastric acid production or pepsinogen secretion, enzyme replacement therapy may be considered [9]. This approach involves the use of pepsin supplements to aid digestion, particularly in individuals with conditions like achlorhydria or certain gastric surgeries.

**Diagnostic marker:** Pepsin can serve as a diagnostic marker for certain gastrointestinal disorders. Elevated levels of pepsin in the esophagus, for instance, may indicate Gastroesophageal Reflux Disease (GERD) or esophagitis [10]. Testing for pepsin in saliva

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or bronchial secretions has also been explored as a potential biomarker for aspiration pneumonia.

## CONCLUSION

Pepsin is a vital enzyme that plays a significant role in protein digestion, regulating gastric function and contributing to immune health. Its activation, mechanism of action, and clinical implications make it a vital focus in both medical and biotechnological study. Accepting pepsin's functions enhances our knowledge of digestive physiology and opens ways for therapeutic applications in treating digestive disorders. As study advances, the potential uses of pepsin in food processing, pharmaceuticals, and biotechnology will likely continue to grow, underscoring its importance in health and industry.

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