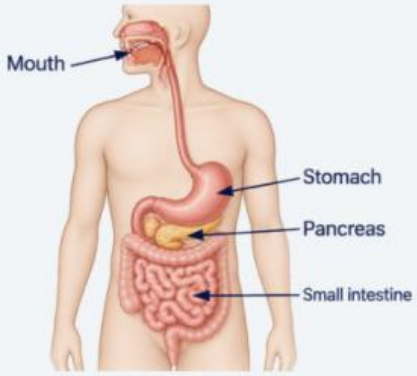
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A Chemical Gauntlet: How pH Shapes Human Digestion



Every meal you swallow embarks on an intense chemical journey. Rather than maintaining a uniform chemical environment, the human digestive tract operates as a segmented assembly line where each compartment maintains a strictly controlled pH level. These drastic shifts in acidity and basicity are not accidental. They dictate precisely where specific digestive enzymes can work and where they are immediately shut down.

Digestion begins in the mouth, where chewing mixes food with saliva. Salivary glands create a nearly neutral environment with a pH between 6.5 and 7.5. Here, an enzyme called salivary amylase initiates the breakdown of complex carbohydrates into simpler sugars. Because amylase requires a near-neutral setting, the mouth provides ideal working conditions.

Once swallowed, food passes down the esophagus and drops into the stomach, plunging into a brutally acidic bath with a pH between 1.5 and 2.5. Hydrochloric acid creates an environment unlike anywhere else in the human body. This extreme acidity serves two vital functions: it destroys ingested microbes and activates pepsin, a specialized enzyme that hydrolyzes (breaks down) proteins into shorter peptide chains. However, this acidic plunge is catastrophic for salivary amylase. When amylase reaches the stomach, the excess hydrogen ions disrupt its delicate molecular bonds. The enzyme denatures, meaning its three-dimensional shape permanently unfolds, causing it to lose its function entirely.

After mechanical churning, the liquefied mixture, known as chyme, exits the stomach into the duodenum of the small intestine. Because stomach acid would corrode intestinal tissue and destroy upcoming enzymes, the pancreas secretes pancreatic juice into the intestine. Rich in alkaline bicarbonate, this fluid neutralizes the acidic chyme, shifting the pH upward to between 7.0 and 8.0.

This neutral to slightly basic environment triggers another complete enzymatic turnover. The sharp rise in pH denatures pepsin, extinguishing its protein-digesting activity. Simultaneously, the small intestine activates trypsin (produced in the pancreas), another protein-digesting enzyme. This brings the pH to approximately 8.0. Through this tightly orchestrated sequence of chemical transitions, the digestive system ensures that potent enzymes remain active only where they are needed, safeguarding the body from digesting itself.

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Section 1: Chemical Gradient Analysis

Use the diagram and the reading passage to analyze the pH conditions across the digestive tract.

1. Complete the table below by recording the typical pH range and ranking each organ from **1 (most acidic)** to **4 (least acidic / most basic)**.

Organ / Compartment	**Typical pH Range**	**Acidity Rank (1 = Most Acidic)**
Stomach		
Mouth		
Small Intestine		
Pancreas (pancreatic secretions)		

Section 2: Retrieval Questions

2. Which digestive enzyme begins breaking down carbohydrates in the mouth?

☐ A. Pepsin

☐ C. Trypsin

☐ B. Salivary amylase

☐ D. Bicarbonate

3. What substance does the pancreas release to neutralize the acidic chyme leaving the stomach?

☐ A. Hydrochloric acid

☐ C. Pancreatic juice

☐ B. Saliva

☐ D. Pepsin

5. What happens when salivary amylase denatures in the stomach?

☐ A. Acid changes its shape, causing it to lose its function.

☐ C. Protein changes it into pepsin.

☐ B. Acid increases its ability to digest carbohydrates.

☐ D. Bicarbonate makes it digest proteins.

6. Which phrase from paragraph 3 shows how unusual the stomach's pH is compared with the rest of the body?

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☐ A. "passes down the esophagus"

☐ B. "hydrolyzes proteins into shorter peptide chains"

☐ C. "an environment unlike anywhere else in the human body"

☐ D. "salivary amylase enters the stomach"

7. According to the passage, which enzyme breaks down proteins in the stomach?

☐ A. Salivary amylase

☐ B. Pepsin

☐ C. Trypsin

☐ D. Bicarbonate

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