Digestion of Starch by Salivary Amylase

Human Biology (ANE106)

Year 1/ Spring semester

Lab 5

Lecturer: Mr. Omer Sardar Taha

Assistant: Ms. Zahra Mohammad

E-mail: Omer.sardar@tiu.edu.iq

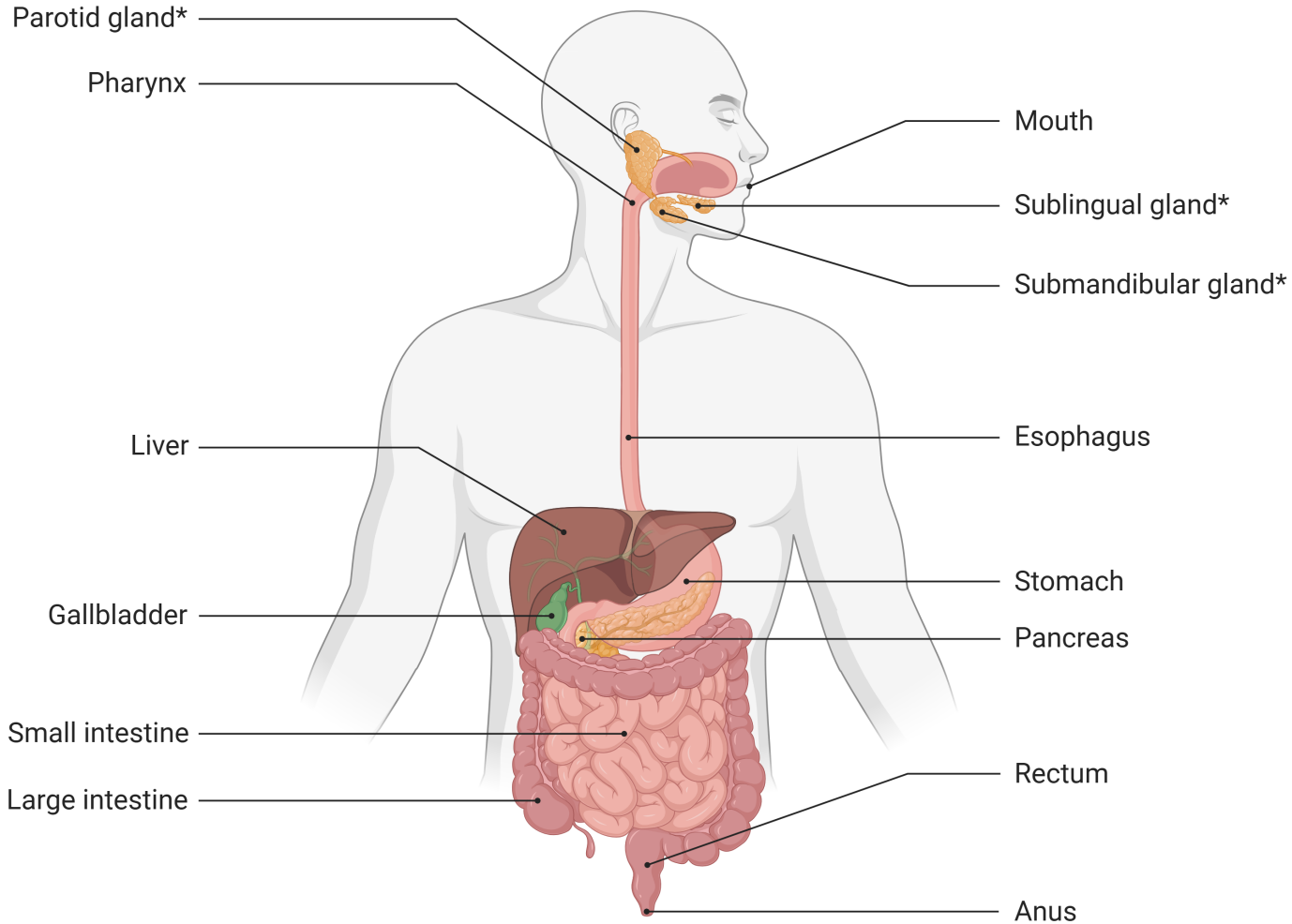
June 04, 2026

Anesthesia Department

Digestive System

The digestive system is a group of organs responsible for breaking down food into smaller molecules that can be absorbed and used by the body for energy, growth, and repair.

Digestive system



*Salivary glands

Digestion

Digestion

Breaking food into smaller molecules.

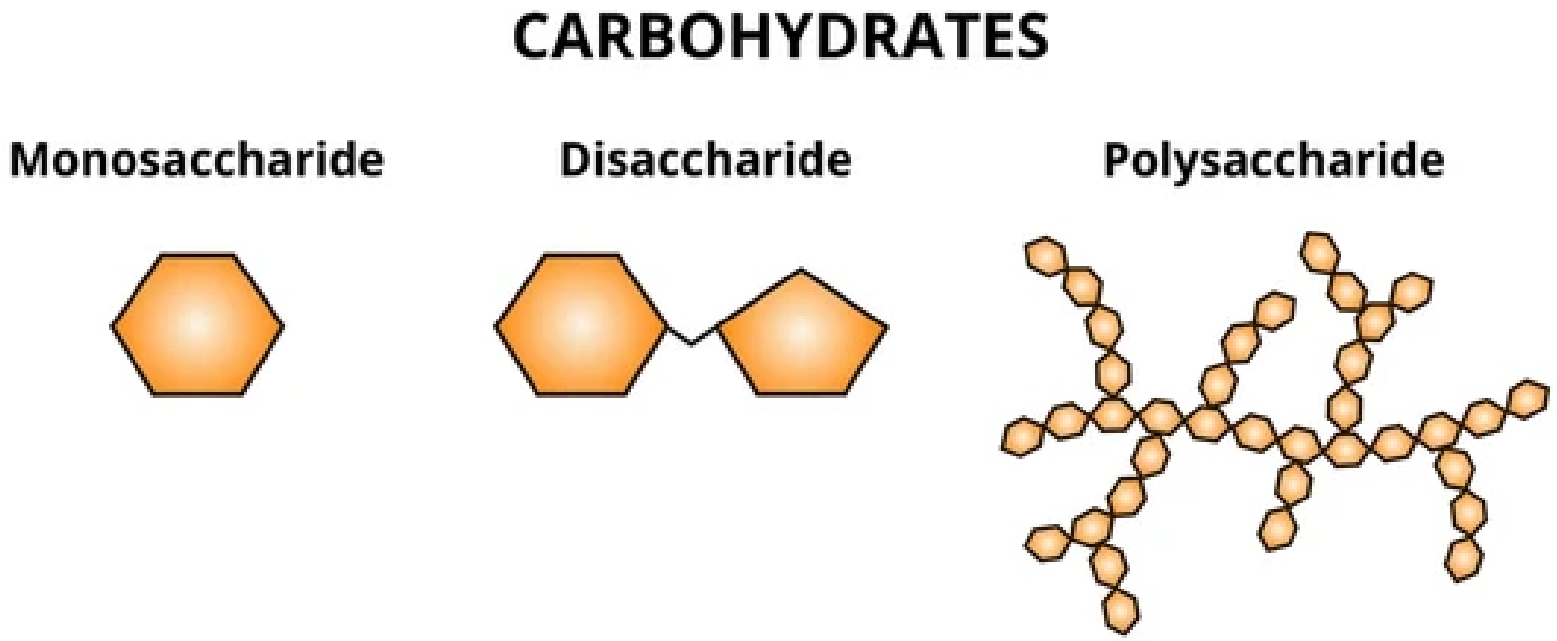
- Mechanical digestion: Physical breakdown of food.
- Chemical digestion: Enzymatic breakdown of food.

Introduction to Biological Macromolecules and Their Digestion

Food contains four major classes of biological macromolecules: carbohydrates, proteins, lipids, and nucleic acids. These large molecules must be digested into smaller units before they can be absorbed by the body.

Carbohydrates

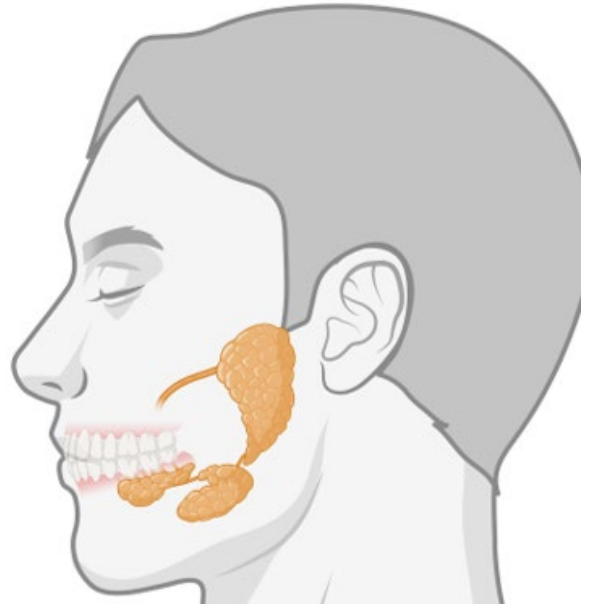
Carbohydrates are the primary source of energy for the body. Complex carbohydrates such as starch are broken down into simple sugars, mainly glucose.



Carbohydrates

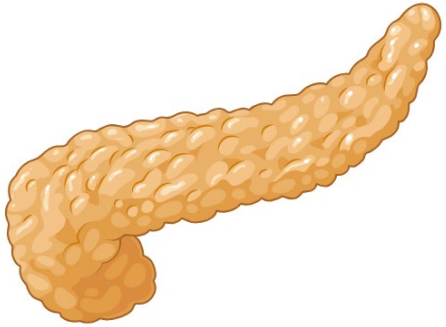
Digestive enzymes:

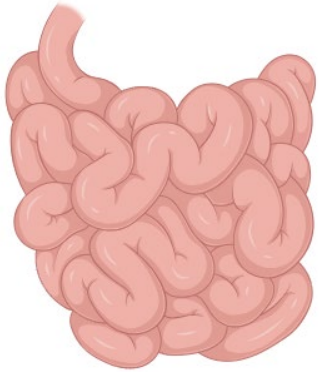
- Salivary amylase (mouth)
- Pancreatic amylase (small intestine)
- Maltase, sucrase, and lactase (small intestine)



Organs releasing these enzymes:

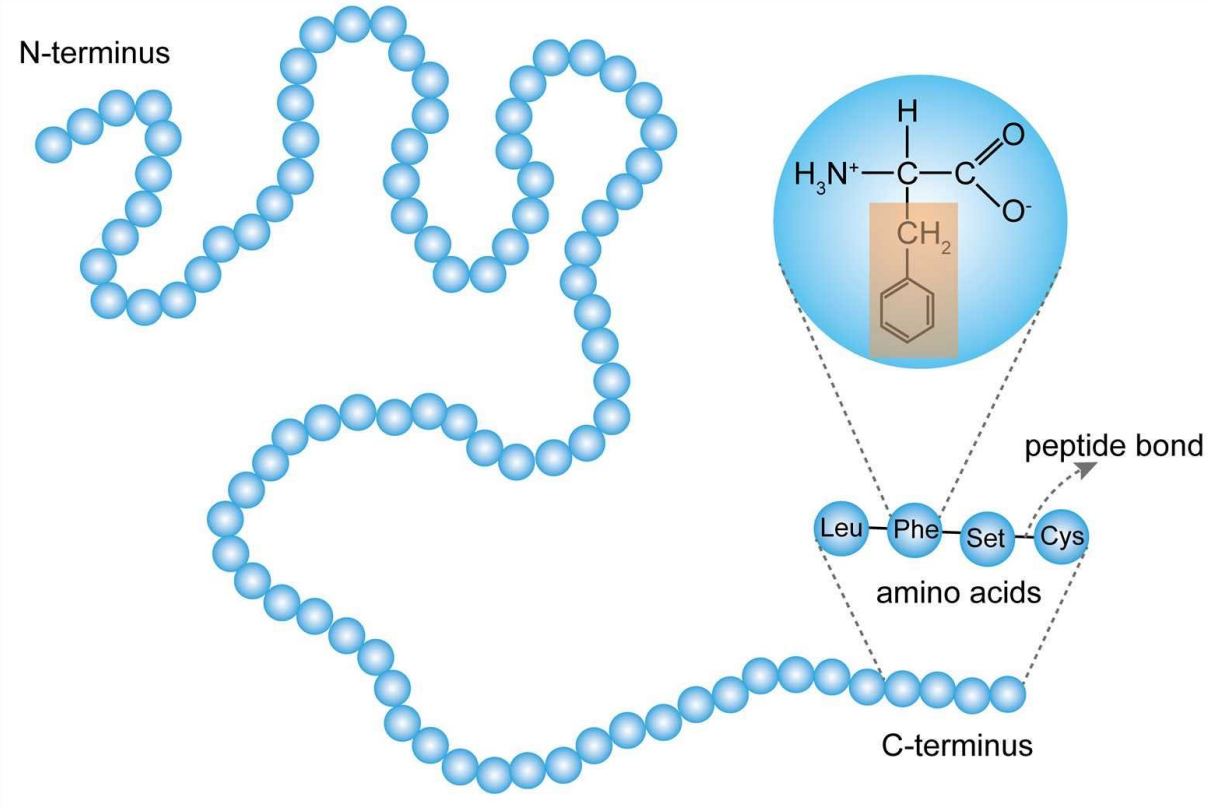
- Salivary glands
- Pancreas
- Small intestine





Proteins

Proteins are essential for growth, repair, and maintenance of body tissues. They are digested into amino acids.



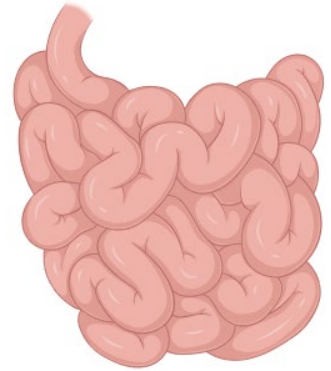
Proteins

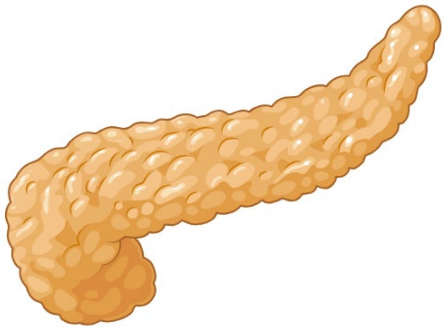
Digestive enzymes:

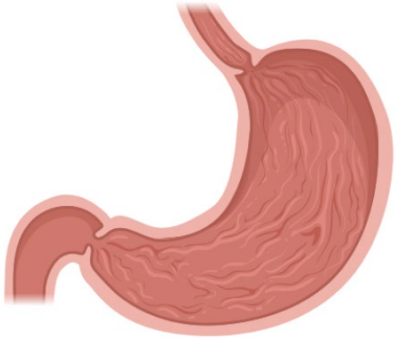
- Pepsin
- Trypsin
- Chymotrypsin
- Peptidases

Organs releasing these enzymes:

- Stomach (pepsin)
- Pancreas (trypsin and chymotrypsin)
- Small intestine (peptidases)

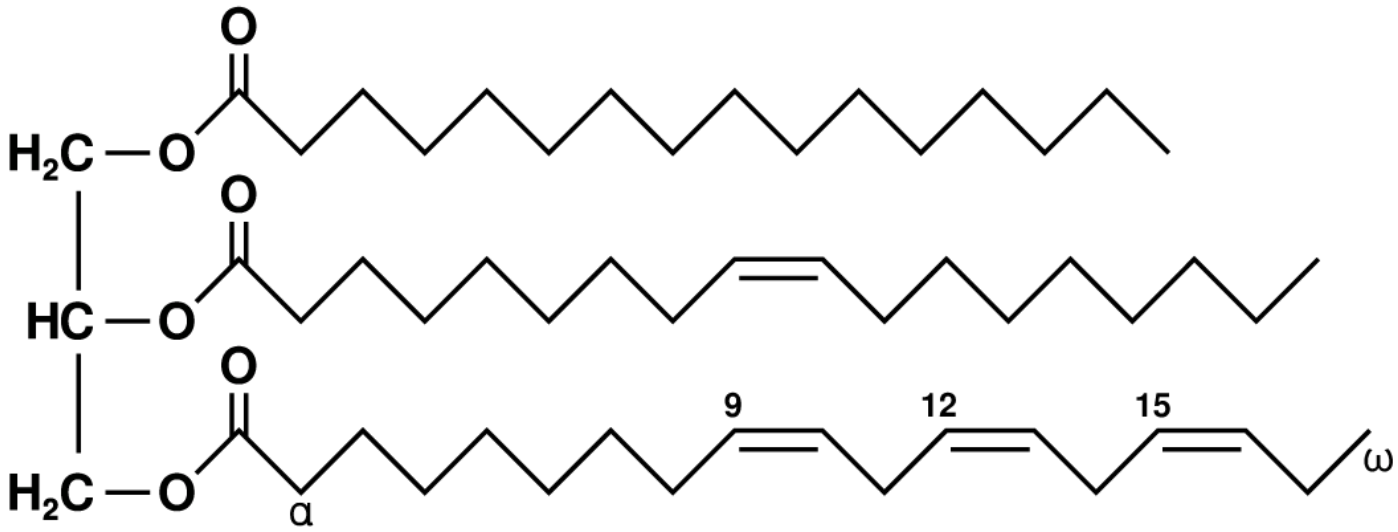






Lipids (Fats)

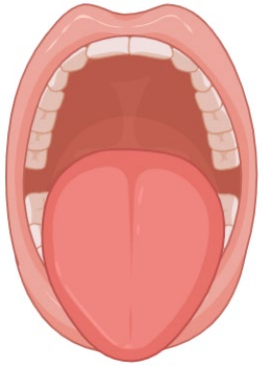
Lipids serve as a concentrated source of energy and are important components of cell membranes. They are digested into fatty acids and monoglycerides.

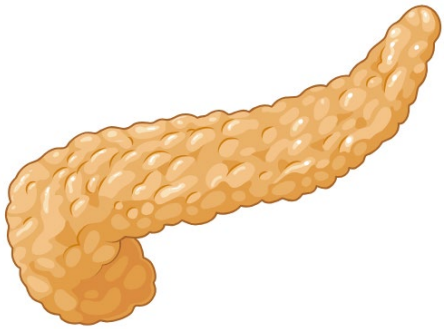


Lipids (Fats)

Digestive enzymes:

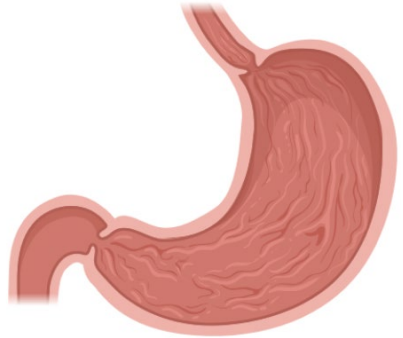
- Lingual lipase
- Gastric lipase
- Pancreatic lipase





Organs releasing these enzymes:

- Tongue (lingual glands)
- Stomach
- Pancreas



Note: Bile produced by the liver and stored in the gallbladder is not an enzyme but helps emulsify fats, increasing the efficiency of lipid digestion.

Nucleic Acids

Nucleic acids (DNA and RNA) contain genetic information and are digested into nucleotides.

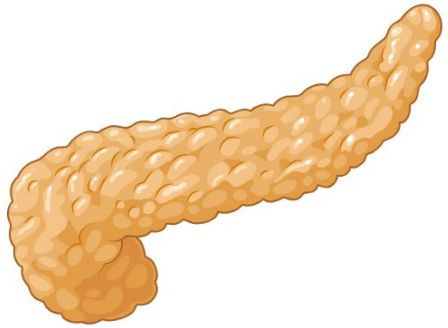
Nucleic Acids

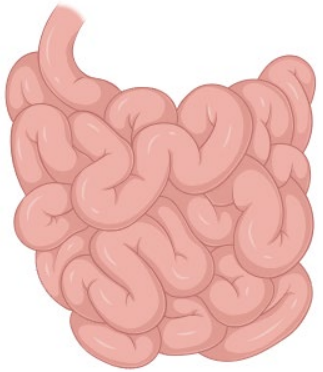
Digestive enzymes:

- Deoxyribonuclease (DNase)
- Ribonuclease (RNase)

Organs releasing these enzymes:

- Pancreas
- Small intestine





Practical Session:

Digestion of Starch by Salivary Amylase

Objectives

1. Explain the role of amylase in carbohydrate digestion.
2. Describe the principle of the iodine test for starch.
3. Demonstrate the digestion of starch by salivary amylase.

Introduction

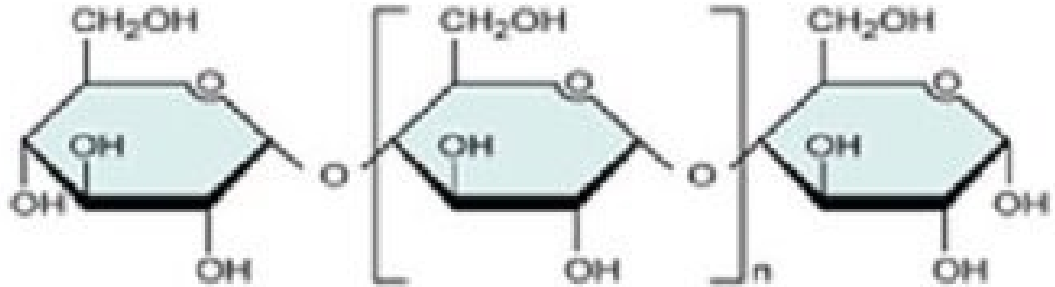
Starch is a plant storage polysaccharide composed of amylose and amylopectin. Its digestion begins in the mouth, where salivary amylase hydrolyzes starch into smaller carbohydrates such as maltose and dextrins.

Amylase is a hydrolase enzyme that uses water, not ATP, to break glycosidic bonds. Starch can be detected using iodine, which produces a blue-black color in its presence. As starch is digested by amylase, the blue-black color gradually disappears.

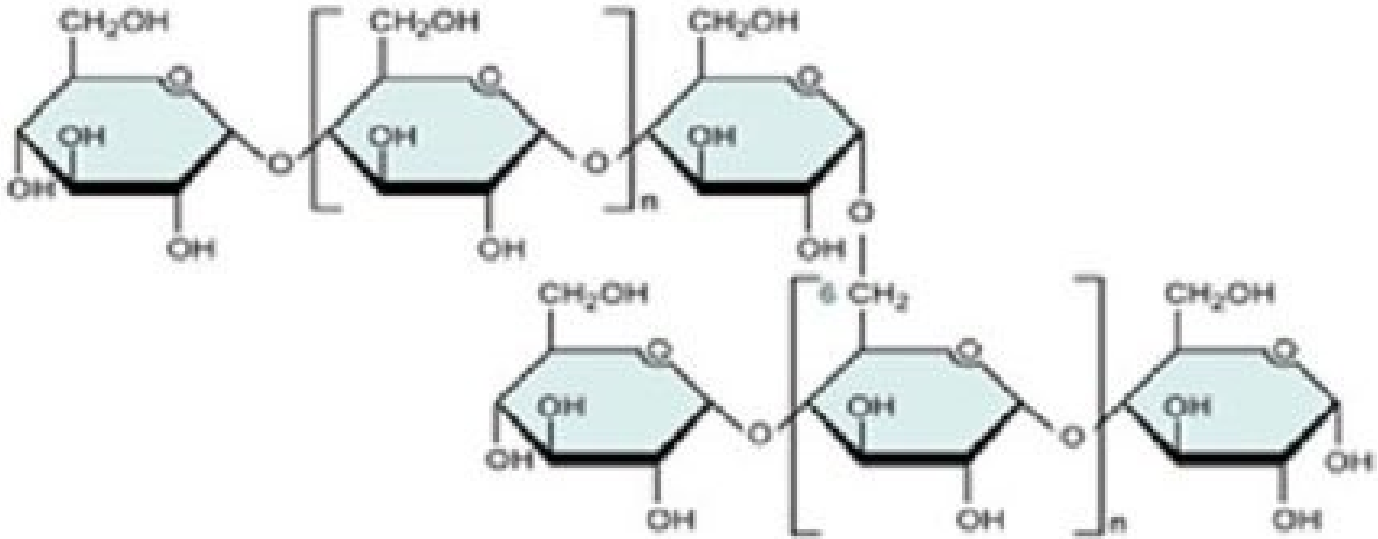
Principle

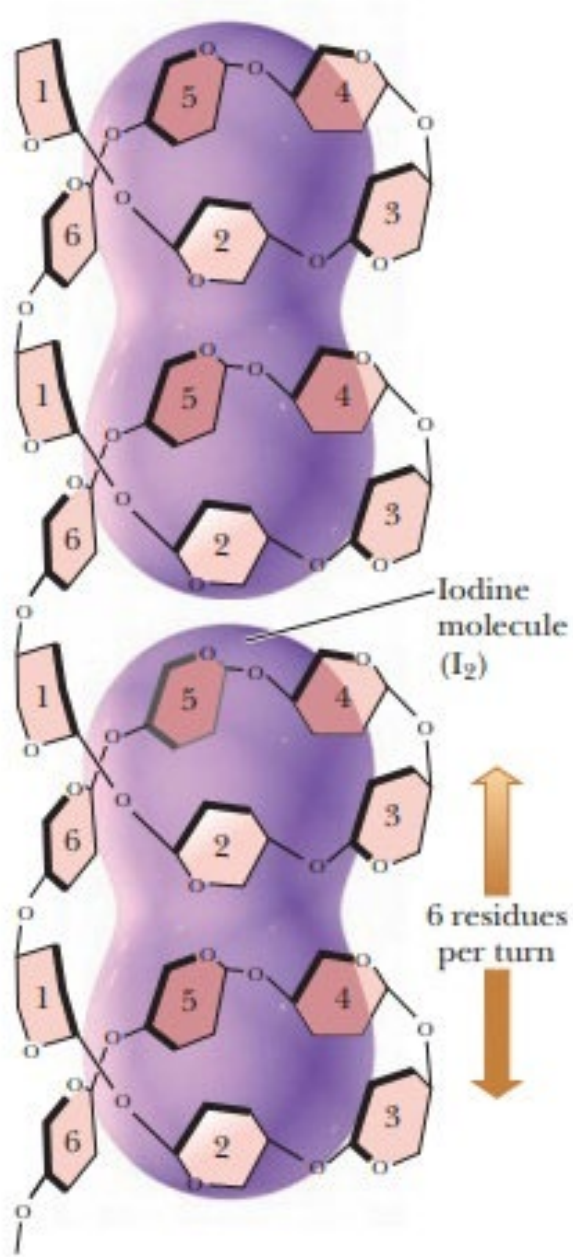
Iodine reacts with starch to produce a blue-black color. During incubation with salivary amylase, starch is hydrolyzed into smaller carbohydrates that do not react with iodine. Therefore, the intensity of the blue-black color decreases with time and eventually changes to the yellow-brown color of iodine.

Amylose



Amylopectin




Iodine molecule (I_2)
6 residues per turn

Materials

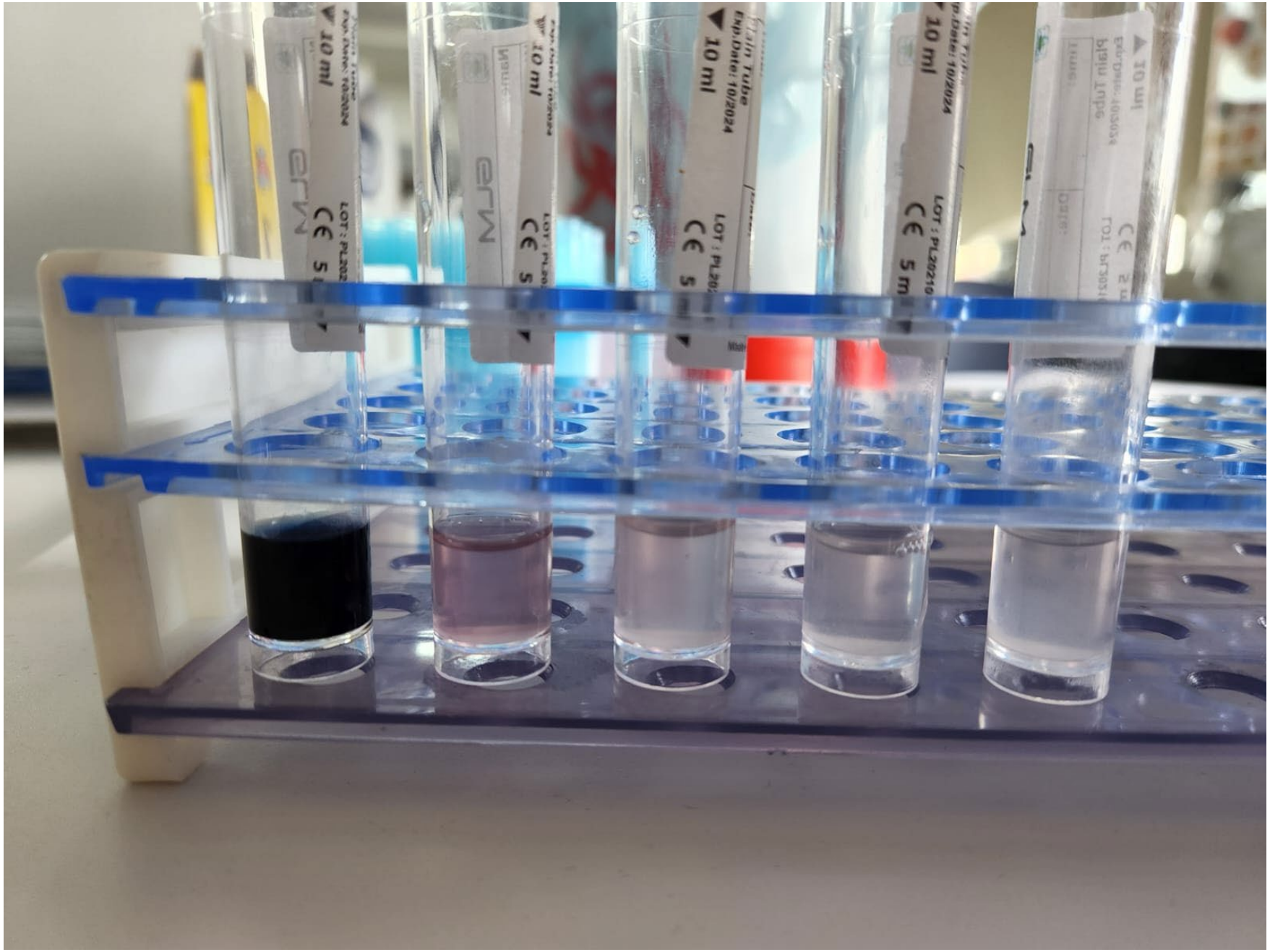
1. Starch
2. Saliva (source of amylase)
3. Iodine solution
4. Test tubes
5. Pipettes
6. Water bath (37°C)
7. Stopwatch
8. Distilled water
9. Sensitive balance
10. Spatula
11. Filter paper

Procedure

1. Dissolve 1 g of starch powder in a small amount of cold distilled water to form a paste, then add it to 100 mL of boiling distilled water while stirring. Boil for 1–2 minutes, allow to cool, and use as the starch solution.
2. Prepare a reaction tube containing 5 mL of starch solution and 1 mL of saliva.
3. Mix thoroughly and incubate the tube in a 37°C water bath.
4. Label five test tubes as 0, 5, 10, 15, and 20 minutes.
5. Add 1 mL of iodine solution to each test tube.
6. Immediately after mixing the starch and saliva (0 min), transfer 0.5 mL of the reaction mixture into the tube labeled "0 min" and record the color.
7. Repeat the procedure at 2-minute intervals using the corresponding iodine tubes.
8. Observe and record the color change in each tube.
9. Continue until the blue-black color disappears and only the yellow-brown color of iodine remains.

Expected results

Observation	Interpretation
Blue-black color	Starch present
Purple or brown color	Partial starch digestion
Yellow-brown color	Starch absent or completely digested


10 ml
10 ml
10 ml
10 ml