

## 4. The digestive system

### 4.3 Historical representations of digestion

4.3.3

## From the 18<sup>th</sup> to the 20<sup>th</sup> century

### SPALLANZANI

In the 18<sup>th</sup> century, Spallanzani studied digestion in animals but wanted to do research on humans. He decided to make himself vomit on an empty stomach, then filled a tube with the liquid he had harvested. He then put cooked, chewed beef into the tube and placed it in an oven to imitate the temperature in his stomach. After some 35 hours, the meat had lost all its texture.

### BEAUMONT



In the 19<sup>th</sup> century, Beaumont, an American surgeon, took advantage of the opportunity of having a patient, who had been wounded by a bullet in the abdomen, to explore things further. The wound healed but left a direct entry point into the stomach. Beaumont was then able to remove digestive juices and watch digestion as it was happening in the patient's stomach.

### MECHANICAL AND CHEMICAL TRANSFORMATION

Digestive juices were identified at the start of the 20<sup>th</sup> century and it was established that digestion is a series of mechanical and chemical transformation.

## From the 18th to the 20th century

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Spallanzani studied digestion during the...

- 20th century
- 18th century
- 16th century

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What did Spallanzani do for the sake of his experiment?

- He put on weight.
- He found a sponsor.
- He vomited.

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By placing meat next to the fluid he had vomited, Spallanzani proved that chemical transformations exist.

- False
- True

---

Spallanzani demonstrated that a piece of meat placed in gastric juice would lose its consistency after 35 hours.

- False
- True

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When did Beaumont conduct an experiment on digestion on a wounded patient?

- In the 19th century
- In the 18th century
- In the 21st century

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What had happened to Beaumont's patient? He had been wounded...

- in a plane
- in the leg
- by a bullet

---

Beaumont carried out his experiment on the patient's...

- colon
- stomach
- small intestine

---

Beaumont's experiment proved that the stomach's mechanical action made chemical transformation easier.

- False
- True

---

When were gastric juices identified?

- In the early 20th century
- In the late 20th century
- In the 19th century

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During the 20th century, evidence showed that digestion was a series of...

- chemical transformations only
- mechanical transformations only
- both mechanical and chemical transformations

## Answers

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Spallanzani studied digestion during the...

- 20th century**  
*Wrong! It was much earlier than that.*
- 18th century**  
*Well done! You're right, it was in fact in the 18th century that Spallanzani carried out experiments on digestion.*
- 16th century**  
*Wrong! It was later than that.*

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What did Spallanzani do for the sake of his experiment?

- He put on weight.**  
*Wrong! That's not what he did.*
- He found a sponsor.**  
*Wrong! Try again!*
- He vomited.**  
*Well done! He wanted to carry out studies on humans, so he induced his own vomiting to extract his own gastric juice.*

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By placing meat next to the fluid he had vomited, Spallanzani proved that chemical transformations exist.

- False**  
*Wrong! His experiment set mechanical transformations aside to prove that chemical transformations are also part of digestion.*
- True**  
*Well done! That's right!*

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Spallanzani demonstrated that a piece of meat placed in gastric juice would lose its consistency after 35 hours.

- False**  
*Wrong! Try again!*
- True**  
*Well done! He proved that chemical transformations took place.*

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When did Beaumont conduct an experiment on digestion on a wounded patient?

- In the 19th century**  
*Well done! That's right!*
- In the 18th century**  
*Wrong! It was later than that.*
- In the 21st century**  
*Wrong! It was much earlier than that.*

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What had happened to Beaumont's patient? He had been wounded...

- in a plane**  
*Wrong! Planes, as we know them today, did not exist back then.*
- in the leg**  
*Wrong! This would not have increased his suitability for taking part in experiments on digestion.*
- by a bullet**  
*Well done! The patient had been injured in the abdomen and the wound had healed badly. This enabled Beaumont to extract gastric juice from the patient's stomach.*

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Beaumont carried out his experiment on the patient's...

- colon**  
*Wrong! It was on an organ placed higher up in the digestive system.*
- stomach**  
*Well done! The badly healed wound enabled Beaumont to access his patient's stomach to carry out his experiments.*
- small intestine**  
*Wrong! You are not far off, though! It's the organ just before that.*

---

Beaumont's experiment proved that the stomach's mechanical action made chemical transformation easier.

- False**  
*Wrong! Try again!*
- True**  
*Well done! That's right!*

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When were gastric juices identified?

- In the early 20th century**  
*Well done! That's right!*
- In the late 20th century**  
*Wrong! It was earlier than that.*
- In the 19th century**  
*Wrong! It was later than that.*

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During the 20th century, evidence showed that digestion was a series of...

- chemical transformations only**  
*Wrong! The existence of mechanical transformations in digestion had been acknowledged before then.*
- mechanical transformations only**  
*Wrong! Those are 17th-century theories.*
- both mechanical and chemical transformations**  
*Well done! A digestion model with both mechanical and chemical transformations was first established in the early 20th century.*

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## Studying historical experiments

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[14-16 years old]

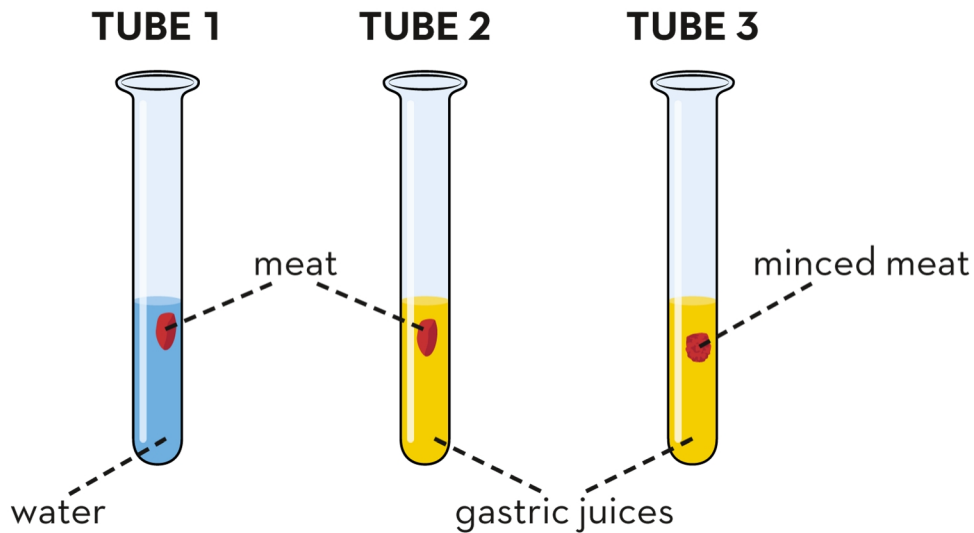
Objective: Illustrate that:

- The enzymes within digestive juices dissolve food (chemical action).
- Grinding up food beforehand (mechanical action) helps enzyme action.

Instructions:

Put the following in a bain-marie at 37°C:

- test tube 1 containing a piece of meat and water;
- test tube 2 containing a piece of meat and gastric juices;
- test tube 3 containing a piece of minced meat and gastric juices.



Leave for two hours and then observe what has happened.

- The meat in tube 1 remains intact.
- The meat in tube 2 has dissolved.
- The meat in tube 3 has dissolved more than the meat in tube 2. This is because it had been minced.

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## Digestion of food in vitro

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*[14-16 years old]*

Objective: Illustrate the action of amylase on starch.

What you need to know:

- Bread contains starch (a complex carbohydrate);
- Iodine solution is a chemical reagent which only changes colour when starch is present;
- Amylase is an enzyme (present in saliva) which transforms starch into glucose.

Instructions: Prepare two test tubes with the following mixtures:

- tube 1: bread + iodine solution + water
- tube 2: bread + iodine solution + amylase

Leave for 20 minutes and then observe what has happened:

- The iodine solution in tube 1 has turned blue, showing that it contains starch and that water alone does not transform starch.
- The iodine solution in tube 2 remains yellow, showing that it does not contain any starch and that the amylase has transformed the starch into glucose.