Science Building Blocks
Food and Digestion

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Introduction

This program introduces junior secondary students to digestion and food testing. Many experiments - both with food testing and enzyme activity – are shown. Graphics showing how the digestive system functions are also featured. Topics include:

• Testing for nutrients
• Mouth and oesophagus
• The stomach
• The small intestines
• The large intestines and waste

Also available in this series: Separating Mixtures, Light and Sound, Changing States of Matter, Magnetic Force.

Program Timeline

00.30 Introduction
02.21 Testing for nutrients
07.04 Summary
07.43 Mouth and oesophagus
10.38 Summary
11.27 The stomach
15.08 Summary
15.59 The small intestine
20.44 Summary
21.38 The large intestine & wastes
24.04 Summary
24.48 Conclusion
25.11 Credits
26.40 Program end

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Science Building Blocks – Separating Mixtures
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VEA – Bringing Learning to Life
Science Building Blocks – Food and Digestion

**Before Viewing the Program**

1. Why do we eat?

2. What happens to the food that we eat?

3. What should a healthy diet include?

4. What are some of the things that can go wrong with the digestive system?

5. What humans eat depends a lot on culture. What are some different diets you know about? Are they healthy diets?
While Viewing the Program

1. What are the major nutrients in food? What does digestion do to food?

2. How do you test for starch? What is a positive test? Which foods tested positive?

3. How do you test for protein? Which foods tested positive? What indicated a positive test?

4. Which foods tested positive for glucose? Is all sugar glucose? Why is it important to use distilled water to liquefy the food?

5. What is the test for fats and oils? Which foods tested positive?

7. Which pH does salivary amylase work best at? How do you know this? Why do you think this is so?

8. What is the oesophagus? What 2 things help the food down the oesophagus?

9. Where is pepsin found? What is it for? What pH does it work best at? Why?

10. What is heartburn?

11. What happens to food in the stomach mechanically? Chemically?

12. How long is the small intestine in adults? What is its major function?
13. What is added to the food when it passes from the stomach to the small intestine?

14. How is the surface area of the small intestine increased? How are the products of digestion removed from the small intestine?

15. How does bile work? Where is it stored?

16. What are fats broken down to in the presence of bile and lipase?

17. Fill in the following table;

<table>
<thead>
<tr>
<th>Food type</th>
<th>Where it is digested</th>
<th>Name of enzymes that digest it</th>
<th>Products of digestion</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carbohydrate</td>
<td></td>
<td></td>
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<tr>
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</tr>
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18. Why is the large intestine so named and what are its 2 main parts called?
19. What does the colon absorb? Why are the bacteria found there important?

20. What is the role of fibre in the digestive system?
After Viewing the Program

1. Find out more about carbohydrates and sugars. Define the following: glucose, sucrose, fructose, maltose, disaccharide, polysaccharide and monosaccharide. What is the difference between reducing sugars and non-reducing sugars? What does Benedict’s reagent test for? Why can we digest starch but not cellulose? Termites can digest cellulose but not without help. Find out about how they do it. If you can find some of the large termites that live in rotting wood you may be able to see for yourself using a microscope.

2. The program has experiments that test enzymes at different pH. Design your own experiment to test what temperature is the most effective for the enzymes. What is your guess? Why? If you have time try the experiment you have designed.

3. Many laundry products say they contain enzymes to remove food and grass stains. Design an experiment to test their claims on some food stains. Make sure all your tests are fair and make sure you understand the use of controls and include them in your design.

4. Lots can go wrong with the digestive system. There are inherited diseases such as Cystic Fibrosis, deficiency diseases such as scurvy and other ones that develop over time such as ulcers, hernias and appendicitis. Have each class member research a different digestive or deficiency disease and report to the class.

5. Make a model of the digestive system. The materials that you can use are unlimited. Pasta and papier-mâché, balloons and polystyrene. Make sure you check on relative diameters and lengths so that you reflect the scale of the human system.
Science Building Blocks – Food and Digestion

Suggested Student Responses

1. What are the major nutrients in food? What does digestion do to food?
   Carbohydrate including sugars, protein, fibre, fats, minerals and vitamins. Digestion breaks food down to nutrients that can be absorbed by the body.

2. How do you test for starch? What is a positive test? Which foods tested positive?
   Using iodine. Starch turns iodine a purple black colour. Potato, bread, and fries gave positive tests.

3. How do you test for protein? Which foods tested positive? What indicated a positive test?
   Using sodium hydroxide solution then running copper sulphate solution down the side of the test tube (called Biuret’s test). A positive test shows a purple colour as the egg white did. Cheese and bread also gave positive results.

4. Which foods tested positive for glucose? Is all sugar glucose? Why is it important to use distilled water to liquefy the food?
   Bread, orange, and soft drink all tested positive for glucose. There are many different sugars. Glucose is a simple sugar but it is one of many sugars. Distilled water is used with the food to make a pulp that can be tested. If water with impurities were used it could effect the result.

5. What is the test for fats and oils? Which foods tested positive?
   If the food is rubbed on filter water and leaves a translucent mark when the paper is dried then the food contains fats or oils. Cheese, fries, and bread tested positive.

   Food is digested mechanically (physically) by the teeth and tongue and chemically by the salivary amylase, which breaks down starch (carbohydrate) to sugars.

7. Which pH does salivary amylase work best at? How do you know this? Why do you think this is so?
   PH=7 We know this because the iodine is its original brown colour in this tube indicating that the starch that was in the tube has been changed to sugars that don’t change the colour of the iodine. In all the other tubes starch is still present. The mouth would have a pH close to neutral (pH=7).

8. What is the oesophagus? What 2 things help the food down the oesophagus?
   It is the tube that runs from the mouth to the stomach. Waves of muscular contractions called peristalsis help move the food along it to the stomach. The food is mixed with mucus in the mouth, which makes it slippery, and this also helps food along the oesophagus.

9. Where is pepsin found? What is it for? What pH does it work best at? Why?
   Pepsin is found in the stomach. It begins the digestion of protein. It works best at pH=3. The acid in the stomach is necessary to start up protein digestion. (The stomach is the only place with this low pH and pepsin and is lined with mucus to prevent the muscle of the stomach from being digested)

10. What is heartburn?
    If the sphincter between the stomach and the oesophagus doesn’t close, stomach acid can seep into the oesophagus giving the burning sensation, which is heartburn.

11. What happens to food in the stomach mechanically? Chemically?
    Every 20 seconds stomach muscles contract to mix the food with gastric juices. The food stays in the stomach for 3-4 hours. Pepsin and Hydrochloric acid begin the chemical digestion of protein. The presence of Hydrochloric acid stops the amylase digestion of carbohydrate. Simple substances such as sugars and alcohol are absorbed into the blood stream from the stomach.
12. How long is the small intestine in adults? What is its major function?
7 metres long. It is where most of the absorption of nutrients into the bloodstream occurs.

13. What is added to the food when it passes from the stomach to the small intestine?
Pancreatic juice is added which contains bicarbonate to neutralize the stomach acid and amylases to digest carbohydrate, proteases to digest protein and lipases to digest fats and oils. Bile is also added to aid lipase in the digestion of fats.

14. How is the surface area of the small intestine increased? How are the products of digestion removed from the small intestine?
By 1000’s of villi with microvilli attached. Inside the microvilli are capillaries, which absorb the nutrients and take them to the liver for processing and after that to the rest of the body for use.

15. How does bile work? Where is it stored?
It helps to break down fats. It acts like a detergent to increase the surface area of the fats by breaking them into smaller droplets so that the lipases can act on them more effectively. Bile is stored in the gall bladder.

16. What are fats broken down to in the presence of bile and lipase?
Fatty acids and glycerol.

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18. Why is the large intestine so named and what are its 2 main parts called?
Its diameter is 3-4 times larger than the small intestine. The first part is the colon with the appendix and the other part is the rectum.

19. What does the colon absorb? Why are the bacteria found there important?
Water and salts. The bacteria are important because they break down the food further to produce vitamins and amino acids that are absorbed through the colon wall.

20. What is the role of fibre in the digestive system?
It is not digested but it cleans out the digestive system and adds bulk to the nutrients.