INTRODUCTION

Your body breaks down food into molecules small enough to be absorbed into the bloodstream and delivered to your cells. Your cells then further break down these molecules to release the energy that your body needs to function. How does this all work?

To find out, open the **Biomolecules on the Menu** Click & Learn and answer the following questions.

**PART 1: Digestion**

Go to the “**How is food digested?**” section. Read each page in this section and pay attention to the animations. Note that:

- You can select any of the bold, underlined terms to view their definitions.
- You can use the “Next” button to advance or the “Previous” button to review earlier pages.

1. Label Figure 1 as follows:
   a. Identify the names of the major body structures of the digestive system as indicated on the figure.
   b. Note the letter “F” next to the names of the structures that receive food (i.e., food goes directly through them) and “A” next to the names of accessory structures (structures that help with digestion but do not receive food).
   c. Note the letter “C” next to the names of the structures that play a role in chemical digestion and the letter “M” next to the ones that play a role in mechanical digestion. Add both letters to any structure that helps with both chemical and mechanical digestion and no letter to a structure that helps with neither.

**Figure 1.** A diagram showing the major body structures in the human digestive system.
2. Read the following statements labeled A–H. Then fill in the table below by writing the letter of the statement that answers the question.

A. This organ transports swallowed food to the stomach.
B. This organ produces bile.
C. This liquid in the mouth is involved in chemical digestion.
D. This organ contains lots of beneficial (commensal) bacteria.
E. These structures in the mouth perform mechanical digestion.
F. This organ produces enzymes and buffers that are delivered to the small intestine.
G. Most nutrient absorption happens in this organ.
H. This organ produces acid, which breaks down food into smaller pieces.

<table>
<thead>
<tr>
<th>Question</th>
<th>Statement</th>
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<tbody>
<tr>
<td>What is saliva?</td>
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<tr>
<td>What are teeth?</td>
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<tr>
<td>What is the esophagus?</td>
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<tr>
<td>What is the stomach?</td>
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<tr>
<td>What is the small intestine?</td>
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<td>What is the liver?</td>
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<tr>
<td>What is the pancreas?</td>
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<tr>
<td>What is the large intestine?</td>
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3. Digestion breaks down the biomolecules in food into smaller molecules called nutrients. Fill in the last column of the table with the names of the nutrient that each biomolecule is broken down into.

<table>
<thead>
<tr>
<th>Biomolecules</th>
<th>Nutrients</th>
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<tbody>
<tr>
<td>Carbohydrates</td>
<td></td>
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<tr>
<td>Fats</td>
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<td>Proteins</td>
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4. After passing through the digestive organs, where do the nutrients go before they can be delivered to the cells of the body?

PART 2: Metabolism
Go through each page of the “How do nutrients get into cells?” section and answer the following questions.

5. What do cells need to take in from the bloodstream to get usable energy?

6. What byproducts do cells get rid of?

7. This diagram represents the equation for a general chemical reaction.

Write a similar equation that represents cellular respiration. Include the following components as either reactants, byproducts, or products. Some components may be included in multiple places:

- amino acids
- adenosine triphosphate (ATP)
- carbon dioxide (CO₂)
- fatty acids
- heat
- monosaccharides
- oxygen (O₂)
- water (H₂O)

PART 3: Metabolism in Detail
Go to the “How are nutrients used for energy?” section. Read through the information on the “Overview” page.

8. Where do the four processes of cellular respiration — glycolysis, pyruvate oxidation, citric acid cycle, and electron transport chain — occur? Select the most accurate answer below.
   a. In cells throughout the body
   b. In the bloodstream only
   c. In the small intestine only

9. Select the “Cellular Respiration” button on the “Overview” page and observe how the diagram changes.
   a. What changes in the diagram, and what do you think these changes mean?
   b. What happens when you select the “Storage” button?
10. Scroll down to the “Metabolism” section. Select the “Catabolism” button and then the “Anabolism” button. Are most cellular respiration reactions anabolic or catabolic?

11. Scroll down to the “Presence of Oxygen” section and select the “O2 not required” button. Which process in cellular respiration does not require the presence of oxygen?

12. Now select the “O2 required” button.
   a. What changes in the diagram, and what do you think these changes mean?
   b. Compare the amount of energy (as indicated by the size of the ATP icons) released from nutrients in the presence and in the absence of oxygen. What do you observe?

13. Select the “Next” arrow to continue to the “Nutrients to ATP” section. Explore the diagram and read the following statements labeled A–D. Then fill in the table below by writing the letter of the statement that answers the question.
   A. This process uses acetyl-CoA to release ATP, loaded electron carriers, and carbon dioxide.
   B. This process produces acetyl-CoA, carbon dioxide, and loaded electron carriers.
   C. This process breaks down glucose to release some ATP, pyruvate, and loaded electron carriers.
   D. This process uses oxygen and electrons from loaded electron carriers to drive production of a lot of ATP, plus water and heat.

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<tr>
<td>What is the electron transport chain?</td>
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14. Which biomolecules do our bodies:
   a. Mainly use for energy?
   b. Mainly use to build and repair tissues?

Select the “Next” arrow to continue to the “Storage to ATP” section.

15. Complete the following sentence by filling in the blanks:
    When the cells’ energy needs are met, cells convert excess acetyl-CoA to __________, which can be stored as __________.

16. Marathon runners will often “carb-load” in the days leading up to a long-distance run. This involves eating more carbohydrates than usual and decreasing physical activity several days before the event.
a. Which storage molecules are made by carb-loading, and where are these molecules stored?

b. Which specific nutrient can this storage molecule supply when runners need energy?

PART 4: Putting It All Together
17. Explain how digestion and metabolism are distinct but related processes.

18. When you are active, your metabolism increases to satisfy your body’s ATP needs. You may start to breathe more rapidly and feel hotter. Explain why each response happens:
   a. Rapid breathing
   b. An increase in body temperature

19. If a person loses five pounds of fat, where does that weight go? (Note that triglycerides are made up of carbon, hydrogen, and oxygen. Be sure to consider each in your response.)

Examine the graph in Figure 2. The blood glucose level is a measure of how much glucose (a monosaccharide) is found in a person’s bloodstream.

![Graph of blood glucose levels](image)

**Figure 2.** A graph of one person’s blood glucose levels and how they change after eating.
20. Answer the following questions based on Figure 2.
   a. What do you observe in the graph for the first 45 minutes? How do you interpret this observation based on your knowledge of what’s happening in the body?

   b. What do you observe in the graph after 45 minutes? How do you interpret this observation based on your knowledge of what’s happening in the body?

   c. Between meals, blood glucose levels stay at a fairly constant range above zero. Why would it be important for the body to keep blood glucose levels above zero?

   d. Where does the blood glucose between meals come from?

21. In individuals with diabetes mellitus, blood glucose levels remain high for a longer period after a meal. This leads to hyperglycemia (hyper- = too much, glyc/o- = glucose, -emia = in the blood) and can be dangerous if it’s not treated. What might be causing the hyperglycemia?