12.1 Identifying the Substance of Genes

Lesson Objectives

- Summarize the process of bacterial transformation.
- Describe the role of bacteriophages in identifying genetic material.
- Identify the role of DNA in heredity.

BUILD Vocabulary

A. The chart below shows key terms from the lesson with their definitions. Complete the chart by writing a strategy to help you remember the meaning of each term. One has been done for you.

<table>
<thead>
<tr>
<th>Term</th>
<th>Definition</th>
<th>How I'm Going to Remember the Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bacteriophage</td>
<td>Type of virus that infects bacteria</td>
<td></td>
</tr>
<tr>
<td>Transformation</td>
<td>When one type of bacteria is changed permanently into another type</td>
<td><strong>To transform something means to change it into something else.</strong></td>
</tr>
</tbody>
</table>

B. As you work through this lesson, you may find these terms in the activities. When you need to write a key term or a definition, highlight the term or the definition.

CHAPTER MYSTERY

UV Light The most dangerous wavelengths of sunlight are ultraviolet rays, or UV rays. They can damage skin and cause skin cancer. It is important to protect yourself from UV rays.

*Make a poster showing how people can protect themselves from UV rays. Include reasons why it is important to protect against the sun’s rays.*
**BUILD Understanding**

**Flowchart** A flowchart is a way to show the steps in a process. As you read Lesson 1, think about all the experiments that scientists performed to understand the job of DNA in cells. Reflect on what scientists learned from each experiment. The three flowcharts below summarize these experiments.

*Complete each flowchart with a sentence that describes either the experiment or its results.*

<table>
<thead>
<tr>
<th>Researcher</th>
<th>Experiment</th>
<th>Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>Griffith</td>
<td></td>
<td><em>Some chemical factor changed bacteria.</em></td>
</tr>
<tr>
<td>Avery</td>
<td></td>
<td><em>DNA is the molecule that changed bacteria.</em></td>
</tr>
<tr>
<td>Hershey and Chase</td>
<td><em>Labeled nucleic acids in viruses with radioactive isotopes of phosphorous-32.</em></td>
<td></td>
</tr>
</tbody>
</table>

**Bacterial Transformation**

*Answer the questions about Griffith’s experiment.*

1. Griffith killed some disease-causing bacteria. He then mixed these dead bacteria with harmless bacteria that were alive. When he injected this mixture of bacteria into laboratory mice, what happened?

   ________________________________________________________________

2. After the experiment described above, what did Griffith conclude?

   ________________________________________________________________

   ________________________________________________________________

   ________________________________________________________________
Bacterial Transformation

The Hershey-Chase Experiment  Hershey and Chase hoped to find out whether DNA or protein carried the genetic information of a virus. The scientists used radioactive substances to label the DNA in some viruses. They used the protein coat in other viruses. Then they let the viruses inject their genetic material into bacteria.

Follow the directions.

1. Label the illustration that shows the bacterium that contains DNA with the radioactive label.
2. Label the illustration that shows the bacterium that contains DNA without the radioactive label.

Answer the questions.

3. What did Hershey and Chase conclude was the genetic material of the virus? Circle the correct answer.
   DNA  protein  carbohydrate

4. What result did Hershey and Chase’s experiment have in the scientific community?

___________________________________________________________________________
___________________________________________________________________________
___________________________________________________________________________
___________________________________________________________________________
BUILD Connections

Passing Information An analogy takes two things that seem to be different and shows how they are similar. The analogy below compares DNA with a book.

![Diagram of books representing DNA with different topics]

1. What do the book in the diagram and DNA have in common?  

2. Find a partner. Using the analogy, make a list of three things that DNA and a book have in common.

The Role of DNA

Storing Information The main job of DNA is to store genetic information. Genes must have the information needed to produce traits such as eye color or blood type.

Make a list of six things about this dog that are controlled by its DNA.

1.  
2.  
3.  
4.  
5.  
6.  

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12.2 The Structure of DNA

Lesson Objectives

- Identify the chemical components of DNA.
- Discuss the experiments leading to the identification of DNA as the molecule that carries the genetic code.
- Describe the steps leading to the development of the double-helix model of DNA.

BUILD Vocabulary

A. The chart below shows key terms from the lesson with their definitions. Complete the chart by writing a strategy to help you remember the meaning of the term.

<table>
<thead>
<tr>
<th>Term</th>
<th>Definition</th>
<th>How I'm Going to Remember the Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>Base pairing</td>
<td>In DNA, cytosine pairs with guanine, and adenine pairs with thymine.</td>
<td></td>
</tr>
</tbody>
</table>

B. As you work through this lesson, you may find these terms in the activities. When you write a key term or its definition, highlight the term or the definition.

BUILD Understanding

T-Chart A T-chart is a way to organize information. One type of T-chart organizes main ideas and details. List the main ideas on the left side of the chart. On the right side, write details and examples that support those ideas.

As you read Lesson 2, complete the T-chart. Write the green headings from your text in the left column. These are the main ideas. List details and examples that support each main idea in the right column. One has been done for you.

<table>
<thead>
<tr>
<th>Main Ideas</th>
<th>Details and Examples</th>
</tr>
</thead>
<tbody>
<tr>
<td>The Components of DNA</td>
<td>DNA is an example of a nucleic acid and is made up of smaller units called nucleotides.</td>
</tr>
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</tr>
</tbody>
</table>
Solving the Structure of DNA

Three scientists who worked to solve the structure of DNA were Rosalind Franklin, James Watson, and Francis Crick. Franklin found clues. These clues helped Watson and Crick explain the structure and properties of DNA.

A Venn diagram is made up of overlapping circles. It is a useful tool for comparing two or even three topics. In the space where the circles overlap, write the features that the topics share. In the space where the circles do not overlap, write the features that are unique to each topic.

Complete the Venn diagram using phrases from the word box.

- built a three-dimensional model of DNA
- helped determine the shape of a DNA molecule
- photographed DNA using X-ray diffraction
- showed that DNA is a double helix
- studied DNA’s structure and properties

Answer the questions. Circle the correct answer.

1. Who first photographed DNA using X-ray diffraction?
   - Franklin  
   - Watson and Crick

2. Who first built a three-dimensional model of DNA?
   - Franklin  
   - Watson and Crick
Solving the Structure of DNA

Nucleic Acid and Nucleotides DNA is made of long chains of nucleotides. Each nucleotide contains three basic parts: a base, a deoxyribose molecule, and a phosphate group. There are four different bases: adenine, cytosine, guanine, and thymine. Only one base is found in each nucleotide.

Follow the directions.

1. In the diagram below, the sequence of nucleotides has the code AGCT. Color the diagram using this key:
   - deoxyribose: red
   - phosphate group: blue
   - adenine: yellow
   - cytosine: green
   - guanine: orange
   - thymine: black

2. Circle one complete nucleotide.

![Diagram of nucleotides]

Answer the questions.

3. Circle the correct answers. What two parts do all nucleotides have in common?
   - guanine
   - deoxyribose
   - phosphate group

4. Each nucleotide is connected to the next nucleotide. The connection is found between
   - A. sugar of one nucleotide and phosphate of another
   - B. base of one nucleotide and sugar of another
   - C. phosphate groups of two nucleotides

5. What are the parts of a DNA nucleotide?
The Double-Helix Model

Base Pairings Four nucleotides make up DNA: adenine, cytosine, guanine, and thymine. These nucleotides always occur in pairs called base pairs. The diagram below is a model of DNA.

Follow the directions.

1. Write the missing letter to complete each base pair. The first two have been done for you.

| C | G |
| A | T |
| G |   |
| G |   |
|   | C |
| C |   |
|   | T |
|   | A |
|   | C |

Key
A = Adenine
C = Cytosine
G = Guanine
T = Thymine

Answer the questions.

2. What nucleotide is always paired with thymine?__________

3. What nucleotide is always paired with guanine?__________

4. Whose rule does base pairing prove?__________

5. Suppose a strand of DNA has the following code on one side.

   A G T C C A G T A

   What would be the matching other side of a DNA strand?__________________________
12.3 DNA Replication

Lesson Objectives

- Summarize the events of DNA replication.
- Compare DNA replication in prokaryotes with that of eukaryotes.

BUILD Vocabulary

A. The chart below shows key terms from the lesson with their definitions. Complete the chart by writing a strategy to help you remember the meaning of each term. One has been done for you.

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</tr>
</thead>
<tbody>
<tr>
<td>DNA polymerase</td>
<td>Enzyme that joins individual nucleotides to make a strand of DNA</td>
<td></td>
</tr>
<tr>
<td>Replication</td>
<td>The process of duplicating DNA</td>
<td>DNA makes a replica during replication.</td>
</tr>
<tr>
<td>Telomere</td>
<td>The tip of a chromosome</td>
<td></td>
</tr>
</tbody>
</table>

B. As you work through this lesson, you may find these terms in the activities. When you need to write a key term or a definition, highlight the term or the definition.

BUILD Understanding

Preview Visuals Previewing visuals and taking notes about them can help you remember what you read and review for tests. Look at the diagram of DNA Replication in your textbook. Write down any questions you may have about it. Then, as you read Lesson 3, find the answers to your questions. Organize your questions and answers in the two-column table below.

<table>
<thead>
<tr>
<th>Questions</th>
<th>Answers</th>
</tr>
</thead>
<tbody>
<tr>
<td>• What causes the DNA to split?</td>
<td></td>
</tr>
</tbody>
</table>
Copying the Code
The Role of Enzymes  Enzymes have several important jobs in DNA replication. The jobs of some enzymes are listed below.

Write the jobs in the order in which they occur.

| 1. join free nucleotides to existing DNA strand |
| 2. unzip DNA |
| 3. unwind DNA |

The diagram below shows the replication of DNA. Look carefully at the diagram.

Answer the questions.

4. In your own words, define the word replicate.

5. Enzymes usually end in -ase. What is the name of the enzyme that joins individual nucleotides?

6. Circle the correct answer to complete the sentence. A(n) ________ is the place where a DNA strand opens to make new strands.
   
   original strand  old strand  replication fork
Replication in Living Cells

During replication, a DNA molecule copies itself. In eukaryotes, DNA is organized into chromosomes within the nucleus. In prokaryotes, DNA is a circular molecule that is free in the cytoplasm.

Follow the directions.

1. Label one diagram as Prokarytic DNA.
2. Label the other as Eukaryotic DNA.
3. Label both drawings with the following terms: unreplicated DNA, replication fork, origin of replication.

Answer the questions. Circle the correct answers.

4. In which type of cell is DNA circular?
   prokaryotic    eukaryotic

5. In which type of cell does replication begin at several points?
   prokaryotic    eukaryotic