Section 13.1 RNA

How does RNA differ from DNA? How does the cell make RNA?

This handout will guide you through the format as you preview section 13.1 RNA in your textbook.

Part 1. Vocabulary Jigsaw

In this activity you will first become an expert on the definition of the highlighted vocabulary term. After that, you will get the definition of the other words from fellow classmates. Follow the teacher’s instructions for this portion of the assignment.

1. Ribonucleic Acid (RNA): Ribonucleic acid, a long chain of nucleotides, with a phosphate-ribose backbone and a ladder of A-T/G-C. Single strand

2. Messenger RNA: Carries copies of instructions for protein production synthesized from the nucleus to the ribosomes in the cytoplasm.

3. Ribosomal RNA: Forms a part of the subunits of ribosomes where proteins are assembled.

4. Transfer RNA: Carries amino acids to the ribosome and matches them to the coded mRNA message.

5. Transcription: A process in which segments of DNA act as a template (recipe) to produce a complementary strand of RNA.

6. RNA Polymerase: The enzyme that unzips DNA strands during transcription.

7. Promoter: A region of DNA with a specific base sequence where RNA polymerase binds, a start signal.

8. Intron: A portion that is cut out and discarded, spliced.

9. Exon: The pieces left after introns are removed, spliced back to get the final mRNA.

Part 2. Preview Visuals

Before you read, find and look closely at Figure 13-3 on page 364. Write a prediction of how you think a cell makes RNA based on the figure. After further reading and lecture you will compare your notes to your prediction.

Answers will vary.

Continue on back of page.
Part 3. Preview all Figures and Tables
Preview each figure in section 13.1. Write the page number where it is found and a short description of what the figure demonstrates. If there is a question for the figure then answer it. Figure 13.1 is completed as an example. Do not simply write the caption! You must summarize the figure in your own words to describe what you are learning from it.

Answers will vary. Here are examples.

Figure 13.1 on page 363 DNA is like a builder’s master plan because it stays in the nucleus, and RNA is like the builder’s blueprints since it goes outside the nucleus to the building site.

Figure 13.2 Each type of RNA molecule specializes in a different aspect of protein synthesis. mRNA carries the instruction; tRNA brings a part of both subunits of a polypeptide; rRNA carries amino acids to the ribosome.

Figure 13.3 The enzyme RNA polymerase binds to DNA and opens the helix so that a complementary strand of RNA is produced. Page 364

Figure 13.4 Page 365: The mRNA is edited in the nucleus to remove pieces called "introns" before splicing the remaining pieces together to form the strand of mRNA. The mRNA has a 5' cap and a tail.

Part 4. Lecture Notes
How does RNA differ from DNA? To answer this question we must first review the structure of DNA.

DNA controls activities of the cell:

1. Stores hereditary information.
2. Copies hereditary information.
3. Transmits hereditary information.

DNA Structure:
Shape: double helix, formed from chains of nucleotides.

Nucleotides: Three main components.

<table>
<thead>
<tr>
<th>Word Bank</th>
</tr>
</thead>
</table>

Nucleotide:
- phosphate
- deoxyribose
- nitrogen-containing base

2
How does information flow from DNA to RNA to direct the synthesis of proteins?

1. **“CENTRAL DOGMA” DNA \(\rightarrow\) RNA \(\rightarrow\) Protein**

   The **Central dogma** of biology is that DNA encodes the information to make RNA. RNA molecules function together to form proteins.

2. **TRANSCRIPTION** in the nucleus

   DNA is transcribed in the nucleus into RNA. Enzymes & proteins unzip the DNA double helix.

   RNA polymerase uses one DNA strand to make an RNA copy of that gene.

   mRNA is then shipped out of the nucleus into the cytoplasm.

   Base Pairing and the sugar are different between DNA and RNA: #1

<table>
<thead>
<tr>
<th>DNA</th>
<th>Pairs with</th>
<th>RNA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adenine</td>
<td>Adenine</td>
<td>Uracil</td>
</tr>
<tr>
<td>Thymine</td>
<td>Guanine</td>
<td></td>
</tr>
<tr>
<td>Cytosine</td>
<td>Cytosine</td>
<td></td>
</tr>
<tr>
<td>Guanine</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

   RNA has **Uracil** in place of thymine. And **Ribose** in place of deoxyribose.

3. **TRANSLATION** is the process of decoding messenger RNA (mRNA) into a protein (Chap. 13.2)

4. The **DNA** is able to be **reused** to continue producing necessary proteins. *It zips shut after RNA polymerase departs.*
RNA Synthesis

In transcription, RNA polymerase separates the two DNA strands. RNA then uses one strand as a template to make a complementary strand of RNA. RNA contains the nucleotide uracil instead of the nucleotide thymine.

Follow the directions:
1. Label the RNA
2. Label the DNA.
3. Use the key to label the missing nucleotides marked on the diagram.

<table>
<thead>
<tr>
<th>Key</th>
</tr>
</thead>
<tbody>
<tr>
<td>DNA</td>
</tr>
<tr>
<td>A = Adenine</td>
</tr>
<tr>
<td>C = Cytosine</td>
</tr>
<tr>
<td>G = Guanine</td>
</tr>
<tr>
<td>T = Thymine</td>
</tr>
</tbody>
</table>

Answer the questions. Circle the correct answer.

4. In DNA, _______ is always paired with cytosine.
   adenine
   guanine

5. In RNA, _______ replaces thymine.
   uracil
   cytosine
   adenine

6. In DNA, _______ is paired with adenine.
   uracil
   thymine
   guanine
RNA Synthesis

In DNA replication a cell copies its DNA. Both strands of the double helix are used as templates to make complementary, or matching, strands of DNA. In DNA transcription a single strand of DNA is used as a template to generate a strand of mRNA.

Follow the directions.

1. Fill in the missing information. One row has been completed for you.

<table>
<thead>
<tr>
<th>Template</th>
<th>Complementary DNA</th>
<th>Messenger RNA (mRNA)</th>
</tr>
</thead>
<tbody>
<tr>
<td>TTACGGG</td>
<td>AATGCC</td>
<td>AAUGCC</td>
</tr>
<tr>
<td>CGGCCG</td>
<td>GCCGGG</td>
<td>GGCGGG</td>
</tr>
<tr>
<td>TGCATC</td>
<td>ACGTAG</td>
<td>ACGUAG</td>
</tr>
<tr>
<td>AGACTC</td>
<td>TCTGAG</td>
<td>MCUGAG</td>
</tr>
<tr>
<td>CTATTC</td>
<td>GATAAG</td>
<td>GAAAGA</td>
</tr>
<tr>
<td>GACCGATGT</td>
<td>CTGGCTACA</td>
<td>CUGGCUACA</td>
</tr>
</tbody>
</table>

Answer the questions.

2. What is the mRNA if the complementary DNA is TCTGAG? MCUGUC

3. What does a cell copy in DNA replication? DNA

4. How many strands of DNA are used to make complementary strands of DNA?

5. How does the cell make RNA? During transcription, one strand of DNA is used as a transcript to create a single complimentary strand of mRNA by matching bases.

6. What are introns? Non-coding sections of mRNA that are removed.

7. What are exons? The parts left over after introns are removed. These are spliced together to form the final mRNA.

Follow the directions.

Create your own example of DNA. Fill in the chart.

<table>
<thead>
<tr>
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<th>Messenger RNA (mRNA)</th>
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<tbody>
<tr>
<td></td>
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Answers will vary.