**Name(s):** \_\_\_Pamela Esprívalo Harrell\_

**Date/Time: 1 days (90 minutes)**

**Name of Course, Grade, and Level:** \_\_Biology I\_\_\_\_\_\_

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| **Science Topic** | **RNA Structure and function** |

**Title of Lesson: Did You Get My Message?**

**Concept Statements:**

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| * mRNA is the intermediary that carries genetic information outside the nucleus. * DNA provides the template for RNA transcription, * Nucleotides are the building blocks of RNA molecules. * Enzymes facilitate the synthesis of RNA. |

**Source of Lesson:**

Harrell, P. E. &Taylor, S.C. (2014). BIO 6 (C) Simply Outrageous Science.

**List of appropriate TEKS:** Chapter 112.34 Biology

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| **TEKS #** | **Student Expectation** |
| BIO 1 (A) | demonstrate safe practices during laboratory and field investigations |
| BIO 3 (E) | evaluate models according to their limitations in representing biological objects or events |
| BIO 6 (C) | explain the purpose and process of transcription and translation using models of DNA and RNA |

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|  | Objectives | Evaluation Questions |
| 1 | Describe RNA synthesis (i.e., base pairings, nucleotide composition, purine and pyrimidine fit) | List the four nitrogenous bases for RNA.  Describe RNA base pairing  Name the sugar molecule found in an RNA nucleotide.  Differentiate purines and pyrimidines. |
| 2 | List and describe the role of enzymes in RNA. | What is the function of RNA polymerase?  What is the function of RNA ligase?  What is the role of ribozymes in mRNA processing? |
| 3. | Describe transcription (mRNA synthesis). | Describe the relationship between DNA and RNA?  How is mRNA created? |
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**Resources, Materials, Handouts, and Equipment List in the form of a table:**

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| **ITEM**  **(Specify worksheets)** | **Quantity**  **(How many do you need?)** | **Source**  **(Who is responsible?** | **List who this is for (teacher, student, group)** |
| Lyrics for RNA song. | 1 per student | teacher | student |
| Blackline master: Decoding Directions | 1 per student | teacher | student |
| Blackline master: Making a Model of mRNA | 1 per student | teacher | student |
| 5 E Lesson Plan for RNA | 1 | teacher | teacher |
| Presentation | 1 | teacher | teacher |

**Advanced Preparations:**

1. Copy Blackline masters for each learning experience.
2. Place container of isopropyl alcohol in freezer overnight.
3. Mix extraction buffer for Strawberry DNA lab. Mix together the following ingredients in a 150 mL beaker.
   * 90 mL of water
   * 10 mL of Dawn dish detergent
   * 1.23 mL (1/4 teaspoon) salt
4. Purchase and organize all materials
5. Reserve computers

**Safety:**

Practice ordinary lab safety protocols.

**5E Lesson Plan**

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| **Objective Statement:** Students will describe the components, structure, synthesis, and function of RNA and mRNA. |

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| **ENGAGEMENT Time : Minutes 5 minutes** | | |
| What the Teacher Will Do | Probing/Eliciting Questions and Students Responses | What the Students Will Do |
| The teacher will use the music for YMCA performed by the Village People. The lyrics for the courses will be sung as follows:  m.R.N.A. It's from the nucleus!  m.R.N.A. Looking for ribosomes!  The blueprint, look it’s coming, to start making proteins So our bodies can be hap happy. | Based on the lyrics to the song, “Where is mRNA created?” | Students will listen and be encouraged to sing the lyrics. |

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| **Transition Statement** |
| Before we start dancing, we better focus on the lesson for today which is getting the messenger for DNA out to do the work of the cell which is to make those proteins that help us digest food, protect us from disease, and provide structure for our bodies. |

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| **EXPLORATION Time: 15 Minutes** | | |
| **What the Teacher Will Do** | **Probing/Eliciting Questions and Student Responses** | **What the Students Will Do** |
| Prepare and organize the materials for the learning experience.  Make copies of the Blackline Master *Making A Model of RNA.*  Monitor students and assist as required. Provide feedback as needed. |  | Create a model of RNA using the *Making A Model of RNA* Blackline Master Handout.  The students will participate in the a discussion about their model (i.e., components and structure). *The Checklist for Making a Model of mRNA*  \_\_\_\_\_\_ Nitrogenous bases are correctly paired (6 points possible)  \_\_\_\_\_\_ Nitrogenous bases are color coded properly (12 points possible)  \_\_\_\_\_\_ Sugars and phosphates are color-coded properly (24 points possible)  \_\_\_\_\_\_ Hydrogen bonding is correct (6 points possible) |
| **Transition Statement:** | | |
| Now that we have investigated the synthesis of mRNA let’s discuss our findings. | | |

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| **EXPLANATION Time: 10 Minutes** | | |
| **What the Teacher Will Do** | **Probing/Eliciting Questions and Student Responses** | **What the Students Will Do** |
| The teacher will provide the following information to students.  DNA never leaves the nucleus and the transfer of genetic information is relayed by another molecule messenger RNA (mRNA).  The process that initiates the production of mRNA begins by using a strand of DNA as a template.  First DNA unzips and free-floating nucleotides float in and join to the DNA with the help of certain enzymes such as RNA polymerase.  Once the strand is complete, the RNA is released. This process is referred to as transcription.  The RNA then undergoes further processing in which noncoding nucleotide segments are cut out. The result is called mRNA  mRNA travels from the nucleus to the cytoplasm where it is short-lived in the cytoplasm surviving several minutes to days. http://www.ncbi.nlm.nih.gov/pmc/articles/PMC87307/pdf/mb005879.pdf | Questions:  Name the nitrogen base found in RNA but not DNA. Uracil  Which nitrogen base does Adenine pair with during RNA synthesis. Uracil  Name the sugar found in RNA. Ribose sugar  What happens to DNA when the RNA molecule is released? The DNA anneals (zips back up).  What happens to the RNA after it is released from the DNA? The RNA is processed (spliced) and the noncoding, intervening sequences are removed. There is an average of 7.8 introns and 8.8 exons per unit of heredity (gene). <http://www.ncbi.nlm.nih.gov/pubmed/15217358> | Students will answer questions and record information on the Blackline master using observations and inferences from the learning experience.  Students will participate in the question debriefing session. |

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| **Transition Statement** |
| Now that you have been introduced to the mRNA, you will participate in an interactive simulation of how mRNA is synthesized at the molecular level. |

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| **ELABORATION Time: 10 Minutes** | | |
| **What the Teacher Will Do** | **Probing/Eliciting Questions and Student Responses** | **What the Students Will Do** |
| Reserve computers is needed or make sure computers are fully charged are plugged into a power source. Bookmark the website:  <http://www.biotechnologyonline.gov.au/popups/int_transcription.html>  Monitor students as they interact with the simulation. Provide feedback as required. | 1. Where is DNA found in the cell? In the nucleus. 2. How many strands are there in DNA? 2 3. What is the process by which mRNA is made from DNA? Transcription 4. Name the enzyme involved in transcription. RNA Polymerase 5. How would you describe the length of the mRNA compared to the DNA molecule? It is shorter since it only represents one part of the DNA being copied. 6. Describe the nitrogen base pairing. Adenine pairs with Uracil and Cytosine pairs with Guanine. 7. What happens to the DNA once transcription is finished? It anneals or winds back up. 8. What happens to the mRNA? The mRNA goes to the cytoplasm where proteins are made. | The student will create a RNA model using the interactive simulation  <http://www.biotechnologyonline.gov.au/popups/int_transcription.html>  Students will participate in discussion and debriefing for the activity. |

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| **Transition Statement** |
| Now that we have reinforced our understanding of mRNA synthesis, let’s summarize what we know. |

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| **Closure Statement** |
| Today we studied the components and structure of mRNA. Understanding the structure of mRNA helps us understand how messages are carried within the cell between the nucleus and the cytoplasm where proteins are made. They are used in gene therapy to treat diseases such as HIV and the role of RNA in learning and memory is an important area of research. |

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| **EVALUATION Time: 5 Minutes** | | |
| **What the Teacher Will Do** | **Probing/Eliciting Questions** | **What the Students Will Do** |
| Prepare the assessment questions on paper.  Administer the assessment using typical test security precautions. | What are the differences between DNA and RNA?   * + Compare nitrogenous bases and sugar type   + Describe difference in strand number   + Where are the molecules synthesized?   + Where are the molecules located within the cell?   + List the various types of DNA and RNA | Without assistance, the students will individually complete the assessment. |
| KEY for Assessment   |  |  | | --- | --- | | **DNA** | **RNA** | | Found inside the cell nucleus and some cell organelles (chloroplasts and mitochondria in plants) | Mostly found in the cytoplasm of the cell | | Double-stranded | Single-stranded except for some viruses | | Sugar is deoxyribose | Sugar is ribose | | Nitrogen bases in DNA are adenine, thymine, guanine and cytosine | Nitrogen bases in RNA are adenine, uracil, guanine and cytosine. | | Semiconservative replication to form new DNA molecules | Cannot replicate itself, uses DNA as a template | | Occurs in form of chromatin or chromosomes | Occurs in ribosomes or forms association with ribosomes. | | Function of DNA is to transfer genetic information from one generation to the next. | Function of RNA is to direct protein synthesis. | | Two types of DNA: intranuclear and extranuclear | Three types of RNA: m-RNA, t-RNA and r-RNA | | Fixed quantity of DNA for cells | Quantity of RNA is variable in the cell. | | | |

**Making a Model of RNA**

**Blackline Master**

**Making a Model of RNA Handout**

**Explore**

Since DNA never leaves the nucleus, it is the job of another nucleic acid called messenger RNA (RNA) to relay genetic information to the ribosome. The process is similar to DNA replication with a few exceptions. First, the nitrogen base uracil is substituted for thymine. Second, the sugar ribose replaces deoxyribose, and last, the product is a single-stranded molecule as only one strand of the DNA (not both) called the sense strand is used to make RNA. When the RNA is released, the DNA zips back up.

Use the DNA sequence from your DNA model. Label and color all parts using the following key.

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| Deoxyribose – orange | Adenine – red | Cytosine – blue |
| Phosphate – purple | Thymine – green | Guanine – yellow |
| Hydrogen bond – black ---  P  D  P  D  P  D  P  D  P  D  P  D  R  P  R  P  R  P  R  P  R\R  P  R  P | Ribose – pink | Uracil – brown |

**Blackline Master**

**Transcription Handout**

**Elaborate**

RNA Transcription Interactive Simulation

Go to the following URL and complete the RNA Transcription Interactive Simulation.

<http://www.biotechnologyonline.gov.au/popups/int_transcription.html>

Answer the questions while completing the simulation.

1. Where is DNA found in the cell?
2. How many strands are there in DNA?
3. What is the process by which mRNA is made from DNA?
4. Name the enzyme involved in transcription.
5. How would you describe the length of the mRNA compared to the DNA molecule?
6. Describe the nitrogen base pairing.
7. What happens to the DNA once transcription is finished?
8. What happens to the mRNA?