Teacher's Name(s): Lisa Franchetti, London Smith
Subject/Course: Biology
Date: 6/28/17

Unit: DNA Unit
Lesson 5: How are proteins produced using a RNA template?

Essential Questions from CB Course of Study:

- How might transcription and translation help us to produce a protein?
- What is the general structure of a DNA molecule?
- What do the processes of replication, transcription, and translation do?
- What are mutations, how can they form, and what effects can they have?

Academic Standards:

- BIO.B.1.2 Explain how genetic information is inherited
    - BIO.B.1.2.1 Describe how the process of DNA replication results in the transmission and/or conservation of genetic information.
    - BIO.B.1.2.2 Explain the functional relationships between DNA, genes, alleles, and chromosomes and their roles in inheritance.
- BIO.B.2.2 Explain the process of protein synthesis (i.e., transcription, translation, and protein modification)
    - BIO.B.2.2.1 Describe the process of transcription and translation are similar in all organisms
    - BIO.B.2.2.2 Describe the role of ribosomes, endoplasmic reticulum, Golgi apparatus, and the nucleus in the production of specific types of proteins.

Objectives/Learning Targets:

- Describe how the processes of transcription and translation are similar in all organisms
- Compare and contrast transcription and translation.
- Explain the steps in translation.
- Model the steps in translation.
- Create a computer based model of translation.
- Understand that a gene is a set of instructions in the DNA sequence of each organism that specifies the sequence of amino acids in polypeptides characteristics of that organism.
- Understand the general steps by which ribosomes synthesize proteins, using information from mRNA and from amino acids delivered by tRNA.
- Describe how scientific knowledge, explanations and technological designs may change with new information over time (e.g., the understanding of DNA, the design of computers).

Differentiation:
Flexible Grouping
Individual v Group Work
Pick your Station
Peer to Peer Instruction
Scaffolded Instruction based on pretest results

Different Pacing for Assignment completion
Read and write learners write a book report.
Visual learners create a graphic organizer of the story.
Auditory learners give an oral report.
Kinesthetic learners build a diorama illustrating the story.

Checking for Understanding:
Pretest
KWL Charts
5 hardest questions
Open Ended Questioning
Individual conferences- individualized feedback
Formal Assessments- quizzes, unit test
Lab

Homework/Academic Practice:
Science Skills Worksheet

Materials:
Translation Slides
Science Skills Worksheet
Protein Synthesis Sentence Activity

Knowledge Taxonomy:
DNA
mRNA
tRNA
rRNA
Transcription
Translation
Amino acids
Ribosome

Instructional Procedures
Review the general structure of Proteins as introduced during the Organic Compound Unit (Chapter 2 Holt Biology Textbook). Students should be able to identify the structure of Proteins as being composed of Amino Acids connected by peptide bonds, there are 20 different amino acids,the primary structure is in the form of a single strand, there are more complex structures (secondary, tertiary, quaternary) that form 3 dimensional shapes, proteins are used to perform many biological functions the most important of which is to form enzymes that are used to catalyze chemical reactions.

Anticipatory Set (5 minutes)
Propose a model describing how the genetic code gets out of the nucleus. In your answer include the functional unit (chromosome, gene, DNA, etc) and cellular structures involved.

Instructional Input (40 minutes)
Introducing New Learning (20 minutes)
Introduction to Translation- Google Slides- Teacher guides students through the steps of Translation. (Attached in Shared Folder).
Students view Translation video

https://www.youtube.com/watch?v=5bLEDd-PSTQ
Teacher demonstrates how to use the Codon chart to determine the amino acid that is generated by the translation of a codon.

Student Practice (20 minutes)
Protein Synthesis Sentence Activity- Students are given an activity to work through the process of translating proteins from DNA.

Interactives
https://biomanbio.com/HTML5GamesandLabs/LifeChemgames/protsynthracehtml5page.html

Checking for Understanding (Ongoing)

- Key Idea, Question, or Challenge: Students write a key idea they've learned, a question they have, or something they're finding challenging.
- T or V: Students can choose to summarize information using either a T-chart or a Venn diagram, whichever will best help them communicate their understanding.
- Write or Draw: To relay key ideas, summarize information, or even ask a question, students can choose to either write a few sentences or draw a picture or diagram.
- Alone or Together: Students will list questions they have about a topic being studied. They can brainstorm questions either alone or in a small group, whichever they think best.
- Highlight an Example: If students have been working on a variety of problems or examples, at the end of the period they choose one. You decide what the focus will be: One they are proud of? One that was hard? One they aren't sure about? Students can explain their choice, jotting a sentence or two on a sticky note and attaching it to the problem.
- Square, Triangle, or Circle: Students choose one of these shapes as a form of reflection. A square is for something that squared with their thinking (reinforced something they already knew/believed). A triangle is for three key/important ideas. And a circle indicates a question still circling around in their mind.

Closure (5 minutes)
Have the students write a paragraph describing roles of DNA and RNA in the production of a protein.

Lesson Reflection
In this lesson, I ……
Stated my learning targets in clear, student friendly language
Actively engaged students
Checked for understanding
Kept the pace of the lesson, completed in the time allotted, and provided student-centered closure

Teacher's Name(s): Lisa Franchetti, London Smith
Subject/Course: Biology
Date: 6/28/17

Unit: DNA Unit

Lesson 6: Coding for Translation

Essential Questions from CB Course of Study:

- How might transcription and translation help us to produce a protein?
- What is the general structure of a DNA molecule?
- What do the processes of replication, transcription, and translation do?
- What are mutations, how can they form, and what effects can they have?

Academic Standards:

- BIO.B.1.2 Explain how genetic information is inherited
    - BIO.B.1.2.1 Describe how the process of DNA replication results in the transmission and/or conservation of genetic information.
    - BIO.B.1.2.2 Explain the functional relationships between DNA, genes, alleles, and chromosomes and their roles in inheritance.
- BIO.B.2.2 Explain the process of protein synthesis (i.e., transcription, translation, and protein modification)
    - BIO.B.2.2.1 Describe the process of transcription and translation are similar in all organisms
    - BIO.B.2.2.2 Describe the role of ribosomes, endoplasmic reticulum, Golgi apparatus, and the nucleus in the production of specific types of proteins.

Objectives/Learning Targets:

- Describe how the processes of transcription and translation are similar in all organisms
- Compare and contrast transcription and translation.
- Explain the steps in translation.
- Model the steps in translation.
- Create a computer based model of translation.
- Understand that a gene is a set of instructions in the DNA sequence of each organism that specifies the sequence of amino acids in polypeptides characteristics of that organism.
- Understand the general steps by which ribosomes synthesize proteins, using information from mRNA and from amino acids delivered by tRNA.
- Describe how scientific knowledge, explanations and technological designs may change with new information over time (e.g., the understanding of DNA, the design of computers).

Differentiation:

Flexible Grouping
Individual v Group Work
Pick your Station
Peer to Peer Instruction
Scaffolded Instruction based on pretest results
Different Pacing for Assignment completion
Read and write learners write a book report.
Visual learners create a graphic organizer of the story.
Auditory learners give an oral report.
Kinesthetic learners build a diorama illustrating the story.

Checking for Understanding:

Pretest
KWL Charts

5 hardest questions
Open Ended Questioning
Individual conferences- individualized feedback
Formal Assessments- quizzes, unit test
Lab

Homework/Academic Practice:
https://www.codecademy.com/learn/python

Materials:
Projector
Student computers/laptops
Coding instructions

Knowledge Taxonomy:
Len ()
String
Variable
While loop
If/else
Comments (#)
Print
Operators (==, +=)
Splits [i : i + 3]

Instructional Procedures
Anticipatory Set (5 minutes)
Review information from Lesson 5
What is translation?
Instructional Input (40 minutes)
Introducing New Learning (10 minutes)
Review Python coding vocabulary from Lesson 4 and new coding concepts (if/else, and splitting [:])
Use the code from Lesson 4 for review
Student Practice (25 minutes)
Based on the code to replicate and transcribe the DNA what Python tools might you use to translate a DNA sequence?
Make a plan with your students for what the code needs to do
Work through the code with your students on the board as they play with the code individually on their computer

```
 #translate RNA sequence to the protein codes
amino_acid = ""

rna_seqlen = len(rna)

print rna_seqlen

rna_count = rna_seqlen - 1

i = 0
while (i <= rna_count):
```

```
    print rna[i: i +3]
    if rna[i: i + 3] == "uuu" or "uuc":
        amino_acid += "-Phe-"
    if rna[i: i + 3] == "uua" or "uug" or "cuu" or "cuc" or "cua" or "cug":
        amino_acid += "-Leu-"
    if rna[i: i + 3] == "auu" or "auc" or "aua":
        amino_acid += "-Ile-"
    if rna[i: i + 3] == "aug":
        amino_acid += "-Met-"
    if rna[i: i + 3] == "guu" or "guc" or "gua" or "gug":
        amino_acid += "-Val-"
    if rna[i: i + 3] == "ucu" or "ucc" or "uca" or "ucg":
        amino_acid += "-Ser-"
    if rna[i: i + 3] == "ccu" or "ccc" or "cca" or "ccg":
        amino_acid += "-Pro-"
    if rna[i: i + 3] == "acu" or "acc" or "aca" or "acg":
        amino_acid += "-Thr-"
    if rna[i: i+3] == "gcu" or "gcc" or "gca" or "gcg":
        amino_acid += "-Ala-"
    if rna[i: i+3] == "uau" or "uac":
        amino_acid += "-Tyr-"
    if rna[i: i+3] == "cau" or "cac":
        amino_acid += "-His-"
    if rna[i: i+3] == "caa" or "cag":
        amino_acid += "-Gln-"
    if rna[i: i+3] == "aau" or "aac":
        amino_acid += "-Asn-"
    if rna[i: i+3] == "aaa" or "aag":
        amino_acid += "-Lys-"
    if rna[i: i+3] == "gau" or "gac":
        amino_acid += "-Asp-"
    if rna[i: i+3] == "gaa" or "gag":
        amino_acid += "-Glu-"
    if rna[i: i+3] == "ugu" or "ugc":
        amino_acid += "-Gys-"
    if rna[i: i+3] == "ugg":
        amino_acid += "-Trp-"
    if rna[i: i+3] == "cgu" or "cgc" or "cga" or "cgg" or "aga" or "agg":
        amino_acid += "-Arg-"
    if rna[i: i+3] == "agu" or "agc":
        amino_acid += "-Ser-"
    if rna[i: i+3] == "ggu" or "ggc" or "gga" or "ggg":
        amino_acid += "-Gly-"
    if rna[i: i+3] == "uaa" or "uag" or "uga":
        amino_acid += "-STOP-"
    i = i + 3

print amino_acid
```

Checking for Understanding (5 minutes)

Give students a different DNA sequence to transcribe with their code

Closure (5 minutes)

Open Ended Questioning: Is there a way to make this code shorter? (dictionaries), Why is this important? What are benefits/disadvantages? Would you rather code or do this by hand?

Lesson Reflection

In this lesson, I ……

Stated my learning targets in clear, student friendly language
Actively engaged students
Checked for understanding
Kept the pace of the lesson, completed in the time allotted, and provided student-centered closure