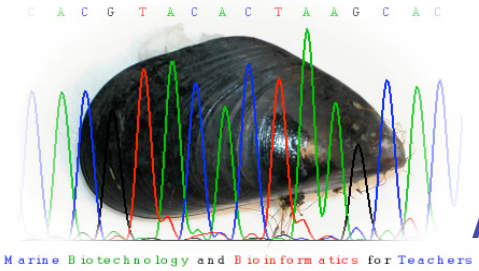

A lesson plan for

Webquest: From DNA to Protein
A Review of DNA and Gene Expression Concepts

Designed by
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Background
This activity is a Webquest that guides students through the DNA to Protein tutorials on the University of Utah Genetics website. Students can review quickly or more slowly the fundamentals covered in the tutorials.

Description of Audience:
This genetics/biotechnology activity is designed for use in an introductory high school Biology course.

State Standards: Genetics

4. Genes are a set of instructions encoded in the DNA sequence of each organism that specify the sequence of amino acids in proteins characteristic of that organism. As a basis for understanding this concept:

    a. *Students know* the general pathway by which ribosomes synthesize proteins, using tRNAs to translate genetic information in mRNA.
    b. *Students know* how to apply the genetic coding rules to predict the sequence of amino acids from a sequence of codons in RNA.
    c. *Students know* how mutations in the DNA sequence of a gene may or may not affect the expression of the gene or the sequence of amino acids in an encoded protein.
    d. *Students know* specialization of cells in multicellular organisms is usually due to different patterns of gene expression rather than to differences of the genes themselves.
    e. *Students know* proteins can differ from one another in the number and sequence of amino acids.
    f. * *Students know* why proteins having different amino acid sequences typically have different shapes and chemical properties.

5. The genetic composition of cells can be altered by incorporation of exogenous DNA into the cells. As a basis for understanding this concept:
    a. *Students know* the general structures and functions of DNA, RNA, and protein.
    b. *Students know* how to apply base-pairing rules to explain precise copying of DNA during semiconservative replication and transcription of information from DNA into mRNA.

National Science Standards:
This biotechnology/bioinformatics activity fulfills the following National Science Standards:

Content Standard A: Science as Inquiry
Content Standard C: Life Science
Content Standard E: Science and Technology

STEM Connection:
Genetics and biotechnology are important career paths for students to consider. Exposure to introductory as well as more advanced content at the University of Utah site provides students with a reliable resource for building their biological expertise.

Technology Integration:

This lesson uses desktop and laptop computers with internet access. Students access the University of Utah Genetics Website to complete the online tutorials.

Goals(s):

The goals of this lesson are to:

- Review protein synthesis process.
- Review DNA & gene expression vocabulary and concepts.

Learning Objective(s)

Upon completion of this lesson, students will be able to:

- Explain base pairing rules.
- Explain the process of DNA replication
- Explain (and compare/contrast) the processes of transcription and translation in protein syntheis.
- Explain how luciferase functions and generalize the process for gene expression.
- Link the structures of DNA and RNA to their roles in protein synthesis.

Purpose/Rationale

I am teaching this lesson using a Webquest so all students have hands-on access to technology and experience using reliable online information to deepen their biological knowledge. As students answer the accompanying questions on their handout, they are required to research information on the web with the teacher as a coach and not a disseminator of information. This is a review activity and allows students to spend more time with concepts they need to review, and less time on concepts they already have mastered. This flexibility allows students to deepen and reinforce their content knowledge while allowing choices in how they focus their review time. Please note that the review questions include recall, synthesis and application questions.

Materials/Resources

Note: Make a vertical list. Include quantities, resources, & websites

In order to complete this lesson, the following materials are needed:

- Student access to computers with internet connection (ideally, 1 computer per student)
- The following website URL:
  http://learn.genetics.utah.edu/content/begin/dna/
- Handout for WebQuest (includes materials adapted from Teacher Resources at the above website).

Teacher Preparation

Before this lesson, the teacher should test out the website to make sure it is are still accessible and all the modules are functional.

This lesson assumes that students already have a basic understanding of the structure of DNA, RNA, and the process of protein synthesis. This lesson is designed as a review activity to reinforce recently learned material and to have students organize their learning in new ways.

3-Step Procedure

#1 Introduction

- Ask students to walk you through the major steps of protein synthesis. Ask students where each step happens in the cell.

- Give a quick overview of how to access the website and navigate. Use the URL on the handout and visit each of the modules listed in italics on the handout.
- On the back of the handout see if you can complete the Venn Diagram and table without looking at your notes or online. If you have to look anything up, but sure to study that material for tomorrow's test. *You want to use this opportunity to identify material you need to study before the test.*
- Remind students to work on the accompanying questions as they navigate through the various websites.

#2 Exploration

- Students will be working relatively individually following the directions on the webquest and answering the questions that go along with it. They are welcome to work together, but must submit their own paper.
- Rotate around the room to answer questions.

#3 Application

- The questions on the bottom of the first and second pages of the student worksheet requires students to synthesis – respectively - the scientific importance of the production and use of the protein luciferase, and the relationship of structure and function for DNA and RNAs.
- With some knowledge of the online tutorials at the University of Utah website, students may explore more detailed topics independently.

Assessment

- Webquest completion and performance on quiz the following day. Student work samples are available upon request.

Teachers' Self Evaluation

- Students generally enjoyed having a hands-on, web tutorial based review of material. Several students said they liked completing the modules at their own pace.
- Although most students took advantage of the web based review, students with low reading skills struggled with some of the vocabulary on the website – not just the scientific terms, but also more generic words. Some of these students became overwhelmed and only completed a couple modules.
- Several of these same students did not attempt the second page of the review handout – Venn diagram and structure/function table. Again, since they had not yet become comfortable with the basic vocabulary, the expectation to synthesize ideas was overwhelming.
- In the future, I think I will spend two days on this review. Day 1 will be the web quest, and Day 2 will review correct answers and have whole class drills on vocabulary and concepts.

Webquest: From DNA to Protein

Name: _____

Log on to http://learn.genetics.utah.edu/content/begin/dna/ . Use the *DNA to Protein* module to find the answers to the questions below.

Build a DNA Molecule:

1. What are the base pairing rules for DNA?

2. How is DNA replicated?

Transcribe and Translate a Gene:

3. The two-step process by which cells can read a gene and produce a string of amino acids that will eventually become a protein is called

   _____ and _____.

4. How is mRNA different from DNA? (Hint: read the sidebar on this page for help.)

5. What is the correct starting position for translation?

6. Write the amino acids used to assemble your protein in order below.

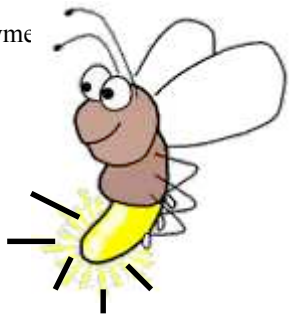
7. Summarize the differences between transcription and translation in the chart:

Process	Beginning Material	Ending Material	Location
Transcription			
Translation			

What Makes a Firefly Glow?

8. Explain in several sentences what makes a firefly glow by using all the terms below:

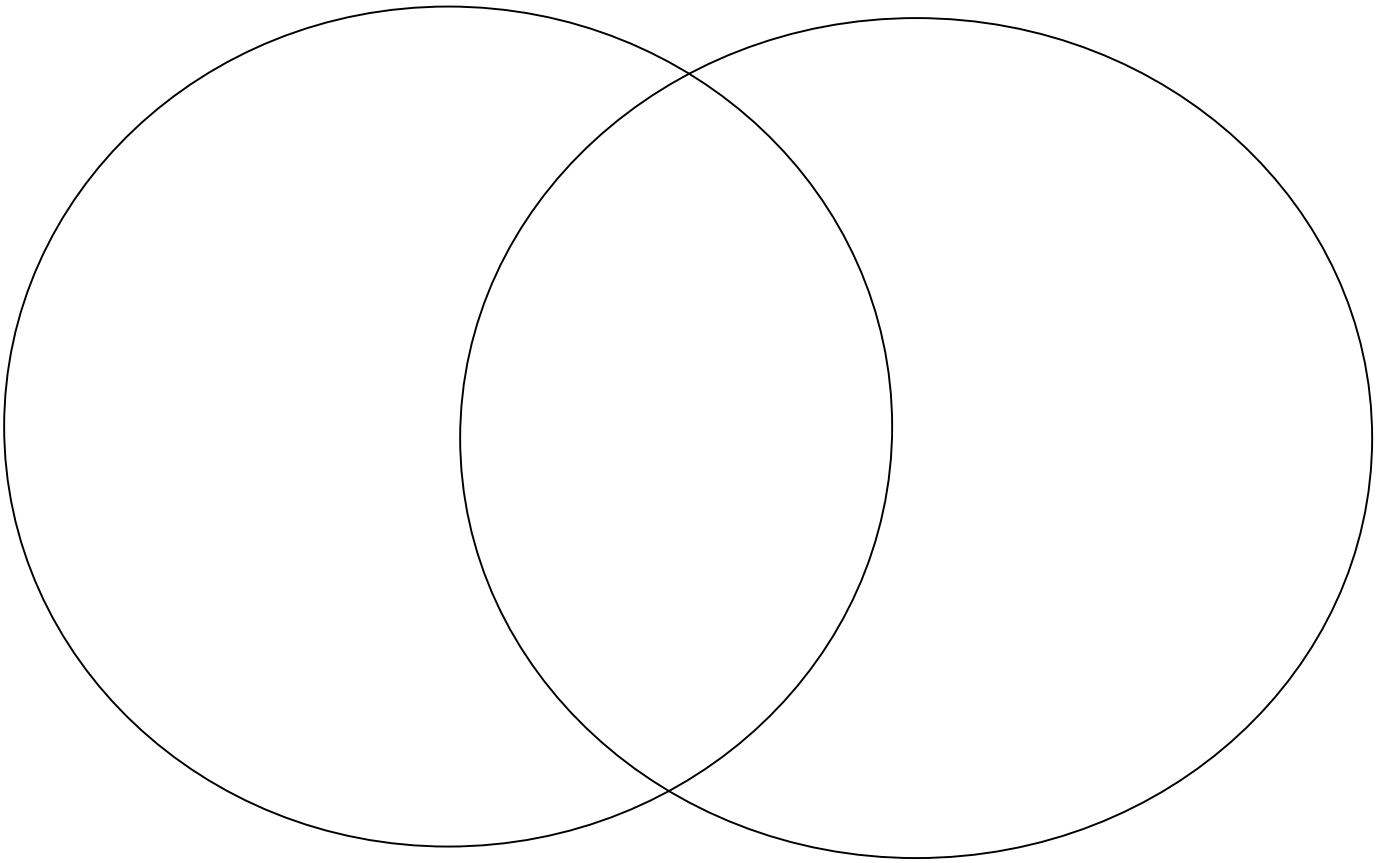
RNA polymerase	LUC gene	Transcription	mRNA
Luciferase enzyme	Ribosome	Translation	Amino Acids
Three dimensional	Luciferin	Oyxluciferin	Functional Luciferase Enzyme



9. Word List

Adenine	Thymine	Covalent Bond	Three types
Guanine	Deoxyribose	Hydrogen Bond	Stays in nucleus
Cytosine	Ribose	Double Helix	Moves all over cell
Uracil	Phosphate	One type	Nucleotides
Stable	Unstable	Triplet	Helicase
Codon	Anticodon	Replication	RNA polymerase

DNA **both** **RNA**



10. Using what you have learned thus far, relate how DNA and RNA's structures allow for the functions of transcription and translation:

	Structure	**Function in transcription/translation**	**How does the structure allow for this?**
DNA			
mRNA			
tRNA			
rRNA			