



MARINE BIOTECHNOLOGY & BIOINFORMATICS FOR TEACHERS
MOSS LANDING MARINE LABS NSF ITEST GRANT
TEACHER LESSON PLAN FOR CLASSROOM USE
*****READING THE DNA CODE:**
MAKING PROTEIN***

Title of Lesson: Reading the DNA Code: Making Protein

Designed by

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Background

This is an introductory lesson for DNA decoding and protein synthesis. It is designed to introduce students to the 3-base pair DNA coding for amino acid translation. The lesson builds background knowledge on DNA translation, so students can begin to use some biotechnology and bioinformatics programs. It may serve as a gateway for teaching students about open reading frames for species identification.

Description of Audience: This biotechnology/bioinformatics activity is designed for use by middle school or 9th grade teachers.

State Standards: This biotechnology/bioinformatics activity fulfills the following State of California Science Standards:

Genetics

2. A typical cell of any organism contains genetic instructions that specify its traits. Those traits may be modified by environmental influences. As a basis for understanding this concept:

d. *Students know* plant and animal cells contain many thousands of different genes and typically have two copies of every gene. The two copies (or alleles) of the gene may or may not be identical, and one may be dominant in determining the phenotype while the other is recessive.

e. *Students know* DNA (deoxyribonucleic acid) is the genetic material of living organisms and is located in the chromosomes of each cell.

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

- **TEACHING STANDARD A:** Teachers of science plan an inquiry-based science program for their students. In doing this, teachers select science content and adapt and design curricula to meet the interests, knowledge, understanding, abilities, and experiences of students.

STEM Connection. This activity can lead to any type of career in biotechnology or bioinformatics. It is a launching point for the basic understanding of DNA and genetics.

Goals(s):

The goal of this lesson is to:

- Introduce students to how DNA is decoded in cells
- To give students understanding of how proteins are built by DNA

Learning Objective(s)

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

- Use the amino acid table to translate DNA
- Break DNA strands into three nucleotide codons
- Translate nucleotides into amino acid protein codes

Purpose/Rationale

The purpose of this lesson is to give students an understanding of how DNA codes for proteins. It is an introduction to translating nucleotide three-base codons into the corresponding amino acid. This will serve as a launching point for explaining open-reading frames so students will understand how to use bioinformatics data.

Materials/Resources

- Worksheet: Reading the DNA Code: Making protein
- Article on amino acids

Prior Teacher Preparation

Students will need to know the basic structure of DNA and the 4 nucleotide bases. Students will need to know what an amino acid is and why it is important to cells and their bodies.

3-Step Procedure

#1 Introduction

- Find out what students ideas are on this topic - uncover misconceptions!
- Review what was learned in prior lessons - then introduce content and vocabulary necessary for today's lesson.
- Use web-based video clips show DNA transcription.

#2 Exploration

- Describe in detail the worksheet with clear directions.
- Practice using the amino acid table with the class.
- Guide students through the practice problem.
- Allow students to work on the worksheet.

#3 Application

- Students may research the importance of amino acids for their bodies. They can also research nutritional values of the food they eat to assess what amino acids they are getting for their bodies to function.
- A follow-up activity is to introduce open-reading frames.
- Career Connection: This activity is a building block of knowledge on the basic structure and understanding of the function of DNA. This basic understanding of DNA will lead to understanding of higher level concepts of DNA transcription and can lead to a host of biotech and bioinformatics careers.

Assessment

- Completion of the "Reading the DNA Code: Making Protein" worksheet.
- Students design their own DNA strand message based on DNA transcription.

Teachers' Self Evaluation

Reflect on strengths and weaknesses of the lesson as taught.

- Describe individual student responses to techniques used. How did they react?
- Discuss student "thinking" and ideas.
- Include samples of students answers on lab sheet or journal entry (photocopy is fine).
- Ask students for a brief evaluation of lesson. Include their responses.
- Discuss fulfilled and unfulfilled expectations. Any surprises?
- In retrospect, how would you modify this lesson?