

CODON BRACELETS & OPEN READING FRAMES

Designed by

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Background

Investigating mutations within the genetic code helps to understand biodiversity and adaptation through natural selection in a changing world.

Description of Audience:

The audience will be 4th, 5th, and 6th graders at Courtner Elementary School in Milpitas, California. Other audiences include 7th graders team taught with Lorena Rolland at Blach Intermediate in Los Altos, California.

California State Standards

- Grades 4-6: Investigation & Experimentation
- Grade 7: 2e, 3a
- Grades 9-12:
 - 1b, 1d, 1h
 - 4a, 4b, 4c, 4d, 4e
 - 5a, 5b, 5c, 5d, 5e

National Standards (grade 6-12)

- Content Standards A: Science as Inquiry
- Content Standards C: Life Sciences
- Content Standards E: Science & Technology

STEM Connection: Biotechnician, Bioinformatics Researcher, Genomics Technician, Lab Technologist, and Geneticist.

Technology Integration: Student will identify amino acids from bracelets and worksheet. Once amino acid symbol is located, students will research amino acid information on the Internet.

Goals:

- To investigate possible amino acid sequences from 12 nucleotide bases or 4 codons. Once the symbol for their amino acids has been identified on the chart provided on the worksheet, students will research two of their amino acids on the Internet. Completion of activity is when students determine all combinations and answer analysis questions on worksheet.

Learning Objectives:

- Codon Bracelets: Builds on the idea of general conservation of genetic code and confirmed by students assigned specific nucleotide sequences (including start and stop codons). Students will translate the codons.
- Open Reading Frames (ORF): Students will be able to identify variations in a DNA sequence as well as different types of mutations.

Materials/Resources

- Lettered beads
- Twine
- Scissors
- Codon Bracelet and ORF Worksheet
- Computers

3-Step Procedure

#1 Introduction

- Ask students to define mutation...give examples. Misconception: All mutations are negative. In the living world, changes in the genetic code result in numerous variations of species. As a result, there are positive, neutral, and negative mutations.
- Review vocabulary pertinent to codon activity.
- Students will utilize the computer lab to complete vocabulary worksheet.
- Students will be working independently, pairs, and groups of four.

#2 Exploration

- Students will be given a list of applicable vocabulary terms prior to the lesson. Using the vocabulary, the objectives of the lesson will be reviewed. Materials will be introduced and set up in four stations with lettered cups and twine. Review the term “random” and its relativity to genetics. After students have created their bracelet, they will begin to decode their codons using the chart on the worksheet. Remind students that codons are read in threes and there exists multiple codon sequence possibilities within just 12 nucleotides. Once students have identified all possible amino acid combinations, students will answer follow-up questions in class and finish research component in the computer lab.

#3 Application

- Follow-up activity would be to complete a computer generated ORF activity.
- Interview Project: Students interview a family member who is 60+ years and ties in inherited traits including diseases that have been passed on in their family for generations. Students share cultural connections.
- STEM Connection: Have students complete Internet search on jobs related to heredity. Include annual income, years in school, noted professionals and their contributions.

Assessment

- Completed and accurate worksheet as well as weekly assessment through quizzes and daily Journal questions.
- Extension: Make a complement bracelet with a partner in class.