

Teacher's Name(s): Lisa Franchetti, London Smith

Subject/Course: Biology

Date: 6/28/17

Unit: DNA Unit

Lesson 7: What types of mutations can occur in the genetic code?

Essential Questions from CB Course of Study:

- How is the hereditary information in genes inherited and expressed?
- How is the structure and function of DNA connected to all cellular activities?
- How are my views about biotechnology shaped by my new knowledge of DNA?
- What are mutations, how can they form, and what effects can they have?

Academic Standards:

- BIO.B.2.3 Explain how genetic information is expressed.
 - BIO.B.2.3.1 Describe how genetic mutations alter the DNA sequence and may or may not affect phenotype (e.g., silent, nonsense, frame-shift).

Objectives/Learning Targets:

- Predict how changes in chromosome number or structure can affect development.
- Describe the difference between DNA and Chromosomal mutations
- Describe the various type of mutations that can occur and identify the mutations in a given DNA sequence

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:

DNA Mutations Practice Worksheet

Materials:

Mutations Slideshow
Quick Lab- Analyzing Mutations
DNA Mutations Practice Worksheet
Notecards
Pencils
Tape

Knowledge Taxonomy:

Mutation
Disjunction
Nondisjunction
DNA Mutations
Chromosomal Mutations
Gene Rearrangements
Point Mutations
Insertion Mutations
Deletion Mutations
Frameshift Mutations
Missense Mutations
Silent Mutations

Instructional Procedures**Anticipatory Set (10 minutes)**

1. What is a mutation?
2. Did you know mutations can be both beneficial and harmful?
3. Can anyone think of mutations that could be beneficial and one that would be harmful?

Instructional Input (Total minutes)**Introducing New Learning (15 minutes)**

Lecture on genetic mutations- Mutations Slide Presentation. Focus on the causes and effects of mutations, large-scale genetic mutations, the difference between DNA mutations and chromosomal mutations, and an introduction to the different types of genetic mutations.

Student Practice (20 minutes)

Quick Lab- Analyzing Mutations. Students will model various mutations using a quick-lab activity. Students will continue analyzing mutations by exploring the first 2 problems on the DNA Mutations Practice Worksheet.

Interactive

<https://concord.org/stem-resources/mutations>

http://highered.mheducation.com/sites/0072556781/student_view0/chapter11/animation_quiz_4.html

Checking for Understanding (Ongoing)

1. Key Idea, Question, or Challenge: Students write a key idea they've learned, a question they have, or something they're finding challenging.
2. 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.
3. 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.

4. 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.
5. 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.
6. 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)

Exit Ticket

- 1.) Name three different types of mutations.
- 2.) Why are mutations advantageous from an evolutionary standpoint?
- 3.) Compare DNA mutations with chromosomal mutations in terms of the severity of the results of each.

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 8: How does mutation cause disease?

Essential Questions from CB Course of Study:

- How is the hereditary information in genes inherited and expressed?
- How is the structure and function of DNA connected to all cellular activities?
- How are my views about biotechnology shaped by my new knowledge of DNA?
- What are mutations, how can they form, and what effects can they have?

Academic Standards:

- BIO.B.2.3 Explain how genetic information is expressed.
 - BIO.B.2.3.1 Describe how genetic mutations alter the DNA sequence and may or may not affect phenotype (e.g., silent, nonsense, frame-shift).

Objectives/Learning Targets:

1. As viruses reproduce they will accumulate mutations in their genomes.
2. Since mutations accumulate overtime, analyzing virus sequences from infected individuals can help researchers track, understand, and treat diseases.
3. Students will analyze and interpret sequence data.
4. Students will understand that single-nucleotide changes in the genome may or may not have effects on the structure or function.

Differentiation:

Flexible Grouping

Individual v Group Work

Pick your Station

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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.

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Checking for Understanding:

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Lab

Homework/Academic Practice:

<https://www.hhmi.org/biointeractive/virus-explorer>

Quick Exploration Activity

Materials:

Disease Detectives worksheet

Ebola Student Worksheet

Ebola Sequences

Quick Exploration Activity

Knowledge Taxonomy:

Virus

Ebola

Reverse Transcription

Mutation

Outbreak

Sequencing

Instructional Procedures

<https://www.hhmi.org/biointeractive/ebola-disease-detectives>

Anticipatory Set (10 minutes)

Students will watch a 8 minute video Think Like a Scientist: Natural Selection in an Outbreak.

<https://www.youtube.com/watch?v=Tq2GhPZvdkU>

Instructional Input (Total minutes)

Introducing New Learning (15 minutes)

Present the background information on Ebola virus to the class and have students answer the background questions

1. Thinking about what you saw in the video and what Drs. Sabeti and Moses discussed, identify three factors that contributed to the number of individuals infected in the Ebola outbreak.
2. Define the term "mutation."
3. In your own words, why is it important to examine the sequence of the Ebola virus genome during an outbreak?

Student Practice (20 minutes)

Students are provided several sequences from the Ebola outbreak and are asked to group the sequences. Students will answer the analysis questions on the student worksheet.

Students will be provided the groupings by the scientists for comparison and will answer the Analysis 2 questions on the student worksheet.

Additional Resources

<http://ebola.bscs.org/> Understanding the Ebola Virus

Checking for Understanding (Ongoing)

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2. 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.

3. 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.
4. 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.
5. 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.
6. 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)

Write a paragraph explaining how Bioinformatics was used to solve a Biological Problem.

Lesson Reflection

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Teacher's Name(s): Lisa Franchetti, London Smith

Subject/Course: Biology

Date: 6/28/17

Unit: DNA Unit

Lesson 9: Coding the Ebola Sequence

Essential Questions from CB Course of Study:

- How is the hereditary information in genes inherited and expressed?
- How is the structure and function of DNA connected to all cellular activities?
- How are my views about biotechnology shaped by my new knowledge of DNA?
- What are mutations, how can they form, and what effects can they have?

Academic Standards:

- BIO.B.2.3 Explain how genetic information is expressed.
 - BIO.B.2.3.1 Describe how genetic mutations alter the DNA sequence and may or may not affect phenotype (e.g., silent, nonsense, frame-shift).

Objectives/Learning Targets:

1. As viruses reproduce they will accumulate mutations in their genomes.
2. Since mutations accumulate overtime, analyzing virus sequences from infected individuals can help researchers track, understand, and treat diseases.
3. Students will analyze and interpret sequence data.
4. Students will understand that single-nucleotide changes in the genome may or may not have effects on the structure or function.
5. Students will use coding to interpret sequence data.

Differentiation:

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Different Pacing for Assignment completion

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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 7&8

Mutations and the Genetic Code, Mutations and Disease

Instructional Input (35 minutes)**Introducing New Learning (5 minutes)**

Review Python coding vocabulary from Lesson 6 and new coding concepts (if/else, and splitting [:])

Use the code from Lesson 6 for review

Student Practice (30 minutes)

Based on the code to replicate and transcribe the DNA what Python tools might you use to determine differences in two or more 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.

```
seq_control = "ATGCTATAGGAT"
```

```
seq_case = "ATCCTATACGAT"
```

```
if seq_control != seq_case:
```

```
    if len(seq_control) == len(seq_case):
```

```
        seq_len = len(seq_control)
```

```
        current_column = 0
```

```
        #store mismatch columns/positions
```

```
        mismatch_columns = []
```

```
        #store mismatch characters
```

```
        mismatch_characters = []
```

```
        count_match = 0
```



```

count_mismatch = 0

while current_column < seq_len:
    if seq_control[current_column] == seq_case[current_column]:
        print "True"
        count_match += 1
    else:
        print "False", current_column
        count_mismatch += 1
        mismatch_columns.append(current_column)
        mismatch_characters.append([seq_control[current_column],
seq_case[current_column]])

    current_column += 1

print count_match, count_mismatch
print mismatch_columns
print mismatch_characters

```

Checking for Understanding (5 minutes)

Students will pick their top three sequences that they think are the most similar and will use the coding to confirm/refute their hypothesis

Closure (5 minutes)

Open Ended Questioning: Why is this process 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