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

Unit: DNA Unit
Lesson 1: What is DNA? Introduction to DNA Replication.

Essential Questions from CB Course of Study:

- How is the hereditary information in genes inherited and expressed?
- How does DNA control growth and function of cells?
- How is the structure and function of DNA connected to all cellular activities?
- What is the general structure of a DNA molecule?

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.

Objectives/Learning Targets:

- Describe how the process of DNA replication results in the transmission and/or conservation of genetic information
- Explain the functional, relationships between DNA, genes, alleles, and chromosomes and their roles in inheritance
- Understand that, in all living things, DNA (deoxyribonucleic acid) carries the instructions for specifying the characteristics of each organism.
- Understand that DNA is a large polymer formed from four subunits: A, G, C, and T (adenine, guanine, cytosine, thymine, a 5-carbon sugar and a phosphate).
- The chemical and structural properties of DNA explain how the genetic information that underlies heredity is both encoded in genes (as a string of molecular letters) and replicated (by a templating mechanism).

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:
Active Reading Worksheet- DNA Replication

Materials:
Structure of DNA Powerpoint
DNA Replication Powerpoint
DNA Replication Worksheet
DNA Model Kits

Knowledge Taxonomy:
Double Helix
Nucleotides
Deoxyribose
Adenine
Thymine
Guanine
Cytosine
Purine
Pyrimidine
Base Pairing Rules
Complementary Base Pairs
DNA Replication
DNA Helicase
Replication Fork
DNA Polymerase
Semi-Conservative

Instructional Procedures
Anticipatory Set (10 minutes)
Respond to the following statements by either agreeing with them or disagreeing with them. In the space provided put an A if you agree of a D if you disagree
_____ Only four chemicals make up our genetic code
_____ Everything we are and will be is carried in our genetic code
_____ Even though we knew about DNA< it took more than 40 years to figure out how it worked.
_____ Viruses are made of DNA
_____ DNA is made up of five basic parts
_____The most important thing about DNA is the order of the base pairs
_____ We can see DNA.

_____ It is only the attraction between oxygen and hydrogen that holds two strands of DNA together.

Instructional Input
Review the general structure of DNA as introduced during the Organic Compound Unit (Chapter 2 Holt Biology Textbook). Students should be able to identify the structure of DNA as being composed of Nucleotides (containing Sugar, Base, and and Phosphate group), the 4 different bases (adenine, guanine, cytosine, and thymine), is in the form of a double helix (due to formation of the the hydrogen and covalent bonds), and that DNA is used to encoded hereditary information.

Introducing New Learning (15 minutes)
Introduction to DNA Replication- Google Slides- Teacher guides students through the steps of DNA Replications. (Attached in Shared Folder).
Students view DNA replication video
https://www.youtube.com/watch?v=dKubyIRiN84
Students will review the rules of complementary base pairing and teacher will guide the students through a simple base pairing demonstration.

Student Practice (20 minutes)
Students will complete the DNA Replication Worksheet describing the steps of Replication and practice . Students will work with models to simulate DNA replication building complementary DNA strands from sample sequences.
Interactive Websites:
DNA Base Pairing
http://genome.pfizer.com/zipunzip.cfm

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)
Exit Ticket- Describe why DNA replication is required. Explain why DNA replication is considered to be semi-conservative.

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

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Subject/Course: Biology
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Unit: DNA Unit
Lesson 2: How is DNA Replicated?

Essential Questions from CB Course of Study:

- How is the hereditary information in genes inherited and expressed?
- How does DNA control growth and function of cells?
- How is the structure and function of DNA connected to all cellular activities?
- What is the general structure of a DNA molecule?
- What does the processes of replication do?

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.

Objectives/Learning Targets:

- Describe how the process of DNA replication results in the transmission and/or conservation of genetic information
- Explain the functional, relationships between DNA, genes, alleles, and chromosomes and their roles in inheritance
- Model the steps in DNA replication.
- Describe the Central Dogma of biology.
- 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:
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Checking for Understanding:
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Open Ended Questioning
Individual conferences- individualized feedback
Formal Assessments- quizzes, unit test
Lab

Homework/Academic Practice:
Active Reading- DNA Replication
Practice Coding Activities- Sample Sequences
Codecademy.com
https://www.codecademy.com/learn/python

Materials:
DNA Pairing Worksheet
Making a model of DNA Activity
Coding Instructions
Active Reading Worksheet- DNA Replication

Knowledge Taxonomy:
Base Pairing Rules
Complementary Base Pairs
DNA Replication
DNA Helicase
Replication Fork
DNA Polymerase

Instructional Procedures
Anticipatory Set (5 minutes)
What are some differences between you and the person sitting next to you?
Have each set of partners write down five differences that you can see: look at eye color, hair line, ears, thumbs
Write class data on the board
Why do you think these things are different for everyone in class?
What would you call these differences in what you can see?
Instructional Input (40 minutes)
Introducing New Learning (15 minutes)
Give students a short DNA sequence: ATGCCTAGACTTTATATA
How does DNA that looks like this, control the things you observed?
Students will run through the interactive activity individually (or in groups) and record any questions/observations they have. **(5 min)**
http://www.learningliftoff.com/high-school-science-dna-replication/#.WVU0DIgrLIV
Walk around while students work checking for completion and focus
- Should some students finish early, have them write down 5 things they noticed

Share student observations and record them on the board **(5 min)**
Expected answers: A-T and C-G matches, the separated strands are opposites so the new strand is the opposite and reverse
- *What do the new double strands you created look like?*

- *The first strand is the copy you use to replicate it, but the replication is in the opposite direction in order to form the double helix. What you created is the reverse complement.*

What was challenging about what you did? What if I gave you a longer strand? How long would it take you?

Briefly introduce what bioinformatics and Python is.

Introduce key concepts for Python language **(5 min)**

Variables
Strings
len()
Print
While loops
If/elif/else

Student Guided Practice (20 minutes)

Walk students through the code as you have it on the screen and they work individually on their computer

Check for questions at every step

```
sequence = "TGTAacctGGTTGTGCggcctaTCTTGTATATnA"
seqlen = len(sequence)
   #returns the length of the sequence
print sequence, seqlen
rc = ""
   #rc is the reverse compliment

i = seqlen - 1
   #the position of the last base in sequence: minus 1 because strings start counting at zero
print i, sequence[i]

#loops keep running so long as something is true
while i >= 0:
   print i, sequence[i]
   #conditional statement that evaluates to true or false, and if it's true then the indented
things below it will be evaluated
   if sequence[i].upper() == "A":
      rc = rc + "T"
      #adds to rc to make the reverse strand
   elif sequence[i].upper() == "T":
      rc += "A"
   elif sequence[i].upper() == "C":
      rc += "G"
   elif sequence[i].upper() == "n":
      rc += "N"
   elif sequence[i].upper() == "G":
      rc += "C"
   i = i-1

print rc
```

Checking for Understanding (5 minutes)

Give students a different DNA sequence for them to replicate

Closure (5 minutes)

Open Ended Questioning
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