Lesson: *DNA Replication & Repair Introduction*

Learning Goals & Success Criteria:

Students will be able to explain and understand the mechanism behind DNA replication at an introductory level. They will be able to describe the semi-conservative nature of DNA, and the enzymes involved in the process.

Relationship to Unit Structure:

Students will have been reminded of the structure of DNA ie) the double stranded nature, and the base pairs that make it up and given an introduction to the history of molecular genetics and biotechnology.

Engage (10 min - 15 min):

At the beginning of class, students are assigned a base pair letter by a letter on their desks. Students will be instructed that we are trying to build a DNA strand and to find a base pair buddy to start building our DNA strand. Students will quickly figure out that, despite finding pairs, they cannot find the overall order of the strand. Students will be encouraged to discuss what information they would need in order to actually build the DNA strand, guiding them towards understanding they need one complete strand to build the other.

Explore (15 min):

Students, now knowing that they need one complete strand to make the other, are given a physical zipper structure with labelled nucleotides etc and also a bunch of loose nucleotides. Students are asked to try and model a way that makes sense for DNA to be replicated. They are guided towards the unzipping and adding nucleotides via the zipper structure. Students will also be told that they can only build in the 5' to 3' direction and these will be labeled on the zipper structure. This should guide towards the leading and lagging strand. Students will be prompted with guiding questions and asked to share their replication method. Students should be able to identify that they had to unzip the DNA and bring in matching nucleotides and also that there is a replication fork.

Explain (40 min) :

DNA replication will be modelled with the zipper structure the students had, while a powerpoint lesson is delivered with a worksheet note formalizing the semi conservative nature of DNA replication, the lagging and leading strands, Okazaki fragments, and enzymes involved. This will be semi-introductory and more of an overview since the topic will be continued the next day.

Elaborate (10 min):

Students, in groups, are given a single strand of DNA on a piece of paper, and are asked to replicate the strand with base pairs as fast as they can. Once they complete one strand, they pass it along to the next student to work off of their strand. They complete as many as they can in 3 minutes. They are told they are not allowed to erase and must focus on going as fast as they can. In the end, students are debriefed on the if they had made errors, and how those

errors got propagated. This discussion extends into how errors could be made frequently and how precise DNA replication must be. This gets them thinking about DNA repair and error catching which prepares them for future lessons.

Evaluate:

Students are provided an exit card with a few understanding questions and also asking for students to explain one aspect that made perfect sense, and one aspect that made no sense. Students will complete a practice quiz at the start of next class.

Exit Card Contents:

DNA is replicated in a _____ way.

A. Semi conservative

B. Conservative

C. Non-conservative

D. Dispersive

Which of the following enzymes is responsible for adding new nucleotides to a growing DNA strand?

A. DNA helicase

B. DNA polymerase

C. DNA ligase

D. RNA primase

What is the difference between the leading and lagging strand during DNA replication?

A. The leading strand is copied continuously, while the lagging strand is copied in fragments.

B. The leading strand contains RNA, while the lagging strand contains only DNA.

C. The leading strand is built from 3' to 5', while the lagging strand is built from 5' to 3'.

D. There is no difference—they are replicated the same way.

What role does DNA helicase play in DNA replication?

A. Joins Okazaki fragments together

B. Unwinds the DNA double helix

C. Builds RNA primers

D. Corrects errors in the DNA code

Explain one part of the lesson that made perfect sense to you (minimum 3 sentences):

Explain one part of the lesson that you need clarification on or made no sense at all: