**Lesson Plan:**

**Inquiry Model**

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| **Name:** | **Lesson length:** 88 minutes |
| **Grade Level:** 10th | **Subject:** Biology |

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| **I. Standards** | |
| **Utah State Core Curriculum Strand(s) and Standard(s):** | **Standard BIO.3.1**  **Construct an explanation** for how the structure of DNA is replicated, and how DNA and RNA code for the structure of proteins which regulate and carry out the essential functions of life and result in specific traits. Emphasize a conceptual understanding that the sequence of nucleotides in DNA determines the amino acid sequence of proteins through the processes of transcription and translation. (LS1.A, LS3.A) |
| **Utah Core Literacy or Math Standard (secondary only):** | [CCSS.ELA-Literacy.W.9-10.3.c](https://www.thecorestandards.org/ELA-Literacy/W/9-10/3/c/)  Use a variety of techniques to sequence events so that they build on one another to create a coherent whole. |
| **Summative (Unit) Assessment:** | Students will be given a multiple-choice test with low-order and high-order questions. |
| **Central Focus:** | The central focus of this lesson will be making observations and identifying patterns with DNA. The central focus will engage students in investigating the essential questions: When it comes to physical characteristics, why do we look similar with some traits but yet different with other traits? What causes genetic variation between individuals within a population? It will cover a similar lab experiment with how DNA was first discovered, and students will be extracting their own strawberry DNA. Then, students will observe an animation of DNA, make observations of the structure of DNA, and note the patterns they see in the animation. The primary objective is for students to be able to identify, make observations, and identify patterns with DNA. Additionally, students will engage in an inquiry lesson with a lab where they can use their previous knowledge to become more familiar with many of the key characteristics of DNA. This approach will help students learn the key characteristics of DNA with the planned lab, making observations and identifying the patterns that make up the structure of DNA. |

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| **II. Intended Learning Outcomes** | |
| **Learning Objective/Target/Indicator:**  **(Know and Do)** | **Know:** Students will know the basic parts of DNA, which would be the (phosphate Group, Sugar molecule (Deoxyribose), Nitrogenous bases (A, T, C, G), and monomers as they start to make observations and identify patterns when it comes to DNA.  **Do:** Students will be asked to draw and label what they know about DNA. They will be asked to label any part of their drawings and provide descriptions of their drawings. Students will then do an inquiry activity, replicating the process of the first discovery of DNA. Once done, they will return and fill out the second part of the graphic organizer, connecting the lab to observations of DNA at a molecular level. |

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| **III. Academic Language** | | |
| **Language Function:** | Analyze and Compare  Students will fill out the graphic organizer after the lab, make observations of DNA, and look for patterns, as they will need to analyze and compare DNA figures. | |
| **Language Demand** | | |
|  | **Vocabulary:** | DNA, Deoxyribonucleic Acid, Bases, Nitrogenous bases, Cytosine, Guanine, Adenine, Tyrosine, Macromolecules, Lipids, Carbohydrates, Proteins, Nucleic acids. |
| **Syntax:** | N/A |
| **Discourse:** | Students will be asked to draw and label what they know about DNA. Students will then be asked to share something they know about DNA that they put on their paper. |
| **Mathematical Precision (secondary math only):** | N/A |
| **Language Support:** | Students will be using a graphic organizer to guide their learning. I will be explaining how to fill out the graphic organizer. | |

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| **IV. Assessment of Student Progress** | |
| **Pre-assessment:** | Students will be asked to write down everything that comes to mind when they hear DNA. When writing down everything they know, they will have the option to draw pictures but need to label what they are depicting. |
| **Formative assessments**: | Students will be the students drawing and labeling what they think the white fibrous precipitate is. |
| **Final formative assessment:** | Students will be asked to zoom in and draw what you think is happening at the microscopic level with your drawing of the white fibrous goop. They will be told that they can use what they have written on 2-3 to answer the question but need to label and write a brief description of why and what they labeled. |
| **Re-engaging Learners**  (additional support or challenge) | Students who did not understand any parts of the lesson or have further questions will be encouraged to come during the remediation on friday.  Students that might need Re-engagement: |

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| **V. Preparation** | |
| **Students’ prior knowledge, skills and assets:** | Students will know where DNA is located in the nucleus cell. Some students might be familiar with how crime scene investigators use DNA to solve crimes, and if revealed, then I could leverage their prior knowledge to aid with the lesson. |
| **Student preparation (if applicable):** | No student preparation is needed. |
| **Teacher preparation:** | Lesson slides: [Miescher's DNA Extraction Lab With DNA Observation](https://docs.google.com/presentation/d/1jQa_4YDo0-h_9WGv5PQKjLTLzsw9b9T2cPi9BGPk2zA/edit?usp=sharing)  Have the lab materials set up: Students will work in pairs, and we have ~21 students.  Need to have steps 1-5 prepared for class.  [Modifaction of Crimean War DNA Extraction STUDENT](https://docs.google.com/document/d/1fcn5tWU0COv4dZBppNyLyqyPTuXzJLEJs-R85PP1Zb8/edit?usp=sharing)  [SPAINISH Translated copy of Modification of Crimean War DNA Extraction STUDENT](https://docs.google.com/document/d/1CWUrGzdi4yvwprCV63L8vPFnHKftmBsR80uJ-8g_E9A/edit?usp=sharing)   1. Beaker (10) 2. 25 mL weather 3. 1 Tsp of Salt 4. 1 Tsp of shampoo 5. Strawberries   Students   1. 25 mL graduated cylinders (7) 2. Test tubes (7) 3. Oozing Bandages (7) 4. Cheesecloth 5. coffee filters ( 7) 6. Sodium sulfate rinsing solution. The shampoo will be used as a substitute, and students will need to measure out 20 mL 7. Isopropyl alcohol ( 5mL)   The lessons Graphic Organizers will need to be printed out and ready for students to use.   * Make sure to have the english and spanish version.   [What I Know About DNA](https://docs.google.com/document/d/12UCKWY1ilWcbvwlJK77LriTj0XaVIcN7D06HaNeFGsA/edit?usp=sharing)  [SPANISH Translated copy of What I Know About DNA](https://docs.google.com/document/d/1wurRkF3T8oJ7IN_kKc6mM1WxhyzY-rc11YmMbuEOHv4/edit?usp=sharing) |
| **Technology integration:** | The technology that will be used is the computer to present the lab's background history (how Messiner discovered DNA) and a molecular depiction of DNA so the students can make observations and identify patterns in DNA. |

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| **VI. Addressing Learners’ Needs** | |
| **Differentiation/Individualization:** | Those with accommodations will be able to work with dedicated peer mentors, DJ and Andrea  All students will be using a graphic organizer for the lesson.  The lab has been modified to define words that might be unknown to the students. |
| **Support for ELLs:** | Slides will be presented in Spanish and English, and the graphic organizer will be translated into Spanish. Andrea will have a peer mentor and Johander will be able to work with her peer mentor and translator. |
| **Accommodations/Modifications for IEPs/504s:** | DJ: Has a dedicated peer mentor to help him with the class material  Chis: has a para educator who him with the class material  Mateo: Reread Directions and check for understanding |

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| **VII. Instructional Procedures (including models of instruction, strategies, assessments, differentiation, transitions, etc.)** | |
| **Step 1:**  **Pre-Assessment (10 minutes)** | At the start of the class, I will present and write on the board our overarching question for the Unit:  Ask the question in a Think-Pair-Share method.  Ask what is DNA used for? Think about TV shows where DNA is used. Who gives you your DNA?   * Have questions pre-written on the board.   **When it comes to physical characteristics, why do we look similar with some traits but yet different with other traits?**  **What causes genetic variation between individuals within a population?**  Educator: We are working towards identifying the patterns of nucleotide pairing with DNA.  I can statement:  I can identify patterns observed in DNA.  Have students come get the Graphic Organizers.   * Explain the Graphic Organizer * Box 1 is after the lab * Box 2 is for later in the lesson and I'll tell you when to fill it out * Box 3 is for later in the lesson and I’ll tell you when to fill it out * Box we will do this last and I will let you know when to fill box number four out.   Slide 1: Students will be asked to fill out the first part of the graphic organizer. They will be asked to draw what they know about DNA. They will be asked to label any of your drawings with descriptions. Students will also be asked to list the previous three macromolecules they learned about.   * Make sure to go over the MUST HAVE CHECKLIST.   Prompting for Macromolecules:  Where do we get our food from?  What would be the Macromoles for A hamburger?  What would be the Macromoles for bread?    Previous macromolecules learned:   1. Lipids 2. Proteins 3. Carbohydrates   Students will then be able to share what they have put as they will be asked to come up to the dot cam.  The educator will select two responses for the students to share their ideas.  Educator: For this pre-assessment, I will go around and look at what the students have been writing on their papers. I will then look for two students to ask to come up and share what they have placed on their papers. I will then ask the selected students to give a short explanation. If the students do not want to come up and share, they can explain what they put on their paper from their seats. |
| **Step 2:**  **25 minutes** | **Transition:** Into the brief historical background of the first discovery of DNA with Meischer’s Discovery of Nuclein.  Slide 2: Friedrich Miescher lived 1844-1895  Slide 3: Friedrich Miescher originally wanted to become a doctor  Slide 4-5: While he was going to school to be a Doctor, he got a fever, and it was so bad that he had permanent damage to his hearing and permanent hearing loss. He didn’t think that working with patients was the best for him since he could not hear their issues.  Slide 6: So he went to Germany and started to study the field of Biochemistry.  Slide 6: In Germany, he researched to identify what is in a cell.  Slide 7: He wanted to look for what allowed for cell growth and to explain our similarities and differences.  Slide 8: His cell of choice was a neutrophil due to its availability due to the Crimean War. Here is a simple diagram of a neutrophil (A type of white blood cell)  Show the model of the cell and what is like the Headquarters of the cell.  Ask the question in a Pair-Share.  “Talk to your table mates and we will share your ideas with the class”    Now what do we know about DNA and why would a neutrophil be a good choice to study?  Some Promoting questions:    What was found in the nucleus? Look at the diagram of the neutrophil. Can we see any similarities with the animal cell and a neutrophil?  Turn to your table mates and then we will share  Nuclei have DNA → purple spots and could be extracted.  Slide 9: So, how is he going to get a lot of neutrophils?  Well, there was a war going on, and he was next to a major hospital, collecting all the bandages and bringing them back to the lab.  Slide 10: Have a student read the slide.  Slide 11: Have a student read the slide.  Slide 12: Here is how he set up his experiment. In a bit, we will be able to recreate his experiment.  **Note**: At the time, scientists thought they had extracted proteins. Later, this would come to be known as Nucleic acids, one of the four macromolecules.  Communication and collaboration is key in the scientific community and all other jobs and relationships.  Science is it not is not done alone and only with communication and collaboration discoveries are shared along with thoughts and ideas. SCIENCE is very collaborative and we want to share the information so others can see if it's repeatable and adhered to the scientific method.  Side 12: Here is a simple diagram of what his materials set looked like. In a bit you will be able to replicate his experiment.  Slide 13: I will review the first part of the lab with the class and show the students where the oozing bandages are located.   * The main goal of this is to show how to read the lab and get the students started.   Slide 14: How to read the volume in with a Graduated Cylinder.   * Make sure its eye level * Go over the units mL. * We will also go procedure #2 as an example.   Slide 15: Ask for any questions before they are released to do the lab.   * Tell them I want them to think about what the white fibrous goop could be. |
| **Step 3:**  **20 minutes** | Transition to the lab:  Groups will be assigned with a random wheel picker.  [Picker Wheel](https://pickerwheel.com/pw?id=Gx9JJ) (individual picker)  <https://pickerwheel.com/rtg?id=NbxtM> (group picker)  Slide 17: Remind them to clean up when they are done and to go back to their seats to draw what they think is the white fibrous goop they have just extracted.   * Box 1   No questions and after reading the second bullet point then let them go to do the lab.  I will be going around helping students and checking for understanding and promoting students when needed.  When we come back  Side 16: Have students volunteer to read the slide.   * Tell the students I want them to think about what this (leftover stuff) could be while doing the lab. * The discovery was huge at the time as the fourth macromolecule was discovered at the time although still not fully understood the name at the time was **nuclein.**   Side 17: Have a student read the slide   * Ask them what they think the white fibrous goop is? * Tell the students that we eat the white fibrous goop if you had breakfast or lunch today you have eaten it today already.   Slide 18: Due to the discovery of Friedrich Miescher and many years of teaching, there are buildings named after him. |
| **Step 4: Making observations and patterns of DNA.**  **10 minutes for observations** | Transition to making observations with DNA.  Promoting give an example of what an observation is and what patterns are:  Example: When you are looking at the mountains and see a bird fly by, that is an observation.  Now as you are sitting for a longer period and you see another bird fly by then it becomes a pattern as you start to count the birds go by.  **Transition** to the last part of the activity, which is the observation of DNA and then the patterns.  Slide 19: A selected representative from each table will be asked to pick a representative from their table group and come to the board to write two observations and briefly explain their observations.   * Students will answer this in box 2   Educator: The educator will make room on the board for the students to come up and write their two observations.  We will discuss the observations that they have written on the board.  If groups share the same observation then point out that many of them have the same observation and use that in the lesson. Use the wheel picker if needed. |
| **Step 5:**  **10 minutes for patterns.** | **Transition** into the second part of slide 20:    Students will look for patterns with the animation. A student who was not previously a representative for the table will be asked to come up to the board and write two patterns on the board and briefly explain why they thought it was a pattern.  We will discuss the observations that they have written on the board.  If groups share the same patterns then point out that many of them have the same observation and use that in the lesson. Use the wheel picker if needed. |
| **Lesson closer.**  **13 minutes and final formative assessment.** | Now that we have observed patterns, what do you think this white fibrous goop is?  Students might say that it is DNA. Since they will not know that it is strawberry DNA, I will have to tell them that what they have extracted is strawberry DNA.  Directions:  Draw what you think is happening at the microscopic level with your drawing of the white fibrous goop. You can use the observations and patterns you have in box 2 and 3.  Now, with the time that is left, I want each of you to fill out box 4 on the graphic organizer and draw what you think your white furious goop would look like at the molecular level.  Show an example of what I'm looking for on the board. What I'm looking for is a zoomed in look at the microscopic level of what they think the white fibrous goop is?  In the next class, we will review more well-known features of DNA and examine its structure. The last thing you are asked to do is write down one question you still have about DNA. |

<https://pickerwheel.com/pw?id=Gx9JJ>