

SCIENTIX LESSON PLAN

Title: DNA extraction

Author(s) Sandra Juran

Abstract

DNA is important for all living beings and coding for proteins and the genetic instruction guide .

Keywords

Genetic information, structure of DNA, polymers

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Summary table

<i>Subject</i>	Chemistry, Biology
<i>Topic(s) within the subject</i>	DNA Extraction Lab from Strawberry Cells
<i>Key real-life topic</i>	DNA is important for all living beings and coding for proteins and the genetic instruction guide
<i>Age of students</i>	14-18 years old
<i>Preparation time</i>	20 min (Orientation)
<i>Teaching time</i>	180 min (20+ 60 min + 40 min + 40 min)
<i>Online teaching material</i>	<p>Link 1: What is DNA and How Does it Work? https://www.youtube.com/watch?v=zwiBgNGe4aY</p> <p>Link 2: Nucleic acids - DNA and RNA structure https://www.youtube.com/watch?v=0lZRASHqft0</p> <p>Link 3: Strawberry DNA Extraction https://www.youtube.com/watch?v=vPGKv53zSRQ</p>



	<p>Link 4 : DNA: Definition, Structure & Discovery https://www.livescience.com/37247-dna.html</p> <p>Link 5 : Structure and Function of DNA https://courses.lumenlearning.com/microbiology/chapter/structure-and-function-of-dna/</p> <p>Link 6: Hands-On Workshops https://www.exploratorium.edu/dnafilms/series.html</p> <p>Link 7: DNA: Biology's Genetic Code https://www.edx.org/course/dna-biologys-genetic-code</p> <p>Link 8: Deoxyribonucleic Acid (DNA) https://www.genome.gov/genetics-glossary/Deoxyribonucleic-Acid</p> <p>Link 9: DNA Evidence: Basics of Analyzing https://nij.ojp.gov/topics/articles/dna-evidence-basics-analyzing</p> <p>Link 10: How Your Classmates' DNA Could Affect Your Education https://www.futurity.org/social-genetic-effects-school-1654802/</p> <p>Link 11: Transcription and Translation https://www.youtube.com/watch?feature=player_embedded&v=41_Ne5mS2ls</p> <p>Link 12: DNA extraction https://en.wikipedia.org/wiki/DNA_extraction</p> <p>Link 13: DNA extraction https://www.sciencelearn.org.nz/resources/2036-dna-extraction</p> <p>Link 14: Different types of DNA extraction methods https://geniceducation.co.in/different-types-of-dna-extraction-methods/</p>
<i>Offline teaching material</i>	Paper (students sheet)

Integration into the curriculum

Genetics is part of the Croatian National curriculum of biology. This lesson plan expands and deepens students' knowledge of the genomic structure and DNA.

Aim of the lesson

At the end of the lesson, students will learn more about:

- what are the steps of DNA extraction
- why the DNA has to be removed from the cell
- why the DNA must be protected from DNA-digesting enzymes
- why alcohol must be used in DNA extraction

Outcome of the lesson

Using materials will also searching for relevant websites to expand their knowledge of structure of DNA and DNA extraction.

Trends

Project based learning, STEM learning, Collaborative learning

21st century skills

Lab methods, Collaboration, Communications, Creativity, Critical Thinking

Activities

Name of activity	Procedure	Time
<p>Orientation</p>	<p>Introducing the topic of DNA, than scientist Johann Miescher and his work- this was the historical beginning of everything we now know about DNA. In conversation with the teacher, students answer the following questions:</p> <p>What are three basic steps in extracting DNA?</p> <p>Why the DNA has to be removed from the cell?</p> <p>Why the DNA must be protected from DNA-digesting enzymes?</p> <p>Why the DNA must be separated from the rest of the material of the cell?</p> <p>Give them a link 1(see the on line teaching materials section above).</p> <p>After watching this students answer the questions (useful links are Link 2, Link 3 ,Link 4 and Link 5).</p> <p>DNA is found in the nucleus of membrane-bound cells and is also membrane bound. Why the cell membranes must be lysed?</p> <p>DNA is a polymer made up of repeating chains of nucleotide monomers. Which part of the DNA are readily soluble in water?</p> <p>Detergents are amphipathic molecules. What this means?</p> <p>Encourage students to search for information from the Internet.</p>	<p>20 min</p>

<p>Procedure- Strawberry DNA Extraction</p>	<p>Materials</p> <ul style="list-style-type: none"> ● 2 teaspoons (10 ml) 0.9 percent salt water (2 teaspoons table salt in one quart/liter of water) ● disposable plastic cup ● large test tube (or any clear tube that can be sealed with a rubber or cork stopper) ● 1 teaspoon (5 ml) 25 percent mild detergent or dishwashing soap, e.g., Palmolive or Dove (1 volume detergent or soap + 3 volumes water) ● 1 teaspoon (10 ml) 95 percent ethanol, chilled on ice <p>Procedure - Strawberry DNA Extraction</p> <ol style="list-style-type: none"> 1. Remove the stems from 3 strawberries. Put them in a ziploc bag, squeeze out the air, and seal the bag. Mash the bag with your hands for 2 minutes. 2. Add 3 g salt, 80 mL water and 15mL detergent to the ziploc bag. Gently mash the bag (avoid making too many bubbles) for 1 more minute. 3. Pour the strawberry mixture through a filter into a large test tube. 4. Open and slightly tilt the tube and pour 1 teaspoon (5 ml) of the chilled 95percent ethanol down the side of the tube so that it forms a layer on the top of your soapy solution. 5. Allow tube to stand for 2 or 3 minutes. 6. Place a thin acrylic or glass rod into the tube. 7. Twirl the rod in one direction to wind the DNA strands onto the rod. Be careful to minimize mixing of the ethanol and soapy layers. If too much shearing has occurred, the DNA fragments may be too short to wind up, and they may form clumps instead. You can try to scrape these out with the rod. 	<p>60 minutes</p>
<p>Analysis questions and discussion of results (story map)</p>	<p>Students analyze and compare the answers to the questions asked in the student sheet.</p> <p>After discussion and analysis, students answer the following analysis questions:</p> <ol style="list-style-type: none"> 1. When we extracted DNA from a cheek cell, what parts of the cell did we need to break through in order to free the DNA? 2. What other parts need to be broken down in the strawberry cell? 3. Articulate why each main step and material in the procedure is important: <ul style="list-style-type: none"> ● Salt ● Detergent ● Cold ethanol 4. We've also learned about four classes of macromolecules. What were those four classes and the monomers that make them up? Which class does DNA fall under? 	<p>40 min</p>

	<p>5. What other macromolecules play a role in today's activity? (List and explain the role of as many as you can!)</p> <p>6. In the objective section DNases were mentioned as an enzyme that is active in cells. Use DNases as an example to explain what an enzyme is and how it works. What part of the cell is important for protecting DNA from DNases?</p> <p>7. The sample you created today was actually a mix of DNA and protein. What do you think the role of the protein in your sample might be? How do you think scientists might have gone about determining that DNA was in fact the genetic material rather than protein?</p> <p>8. Strawberries have a high volume of DNA because they are octoploid. What benefits might there be to having a larger number of copies of sets of chromosomes?</p>	
Dissemination and evaluation	The students answers poster could be presented during the lesson in a Padlet form.	25 min
Assessment and students feedback	Described in section below	15 min

Student feedback

Reflection activities will help students to think critically about their own learning process.

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