Title: Biotechnology: Hands on laboratory explorations with DNA and genetics.

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Abstract:
Students will employ hands on lab activities to make connections to science content taught in the classroom. Students will combine knowledge learned about DNA, inheritance and genetics with lab activities designed to bring the knowledge to life and make it applicable to their lives. Students will start by getting a basic knowledge of DNA structures and functions through normal curriculum lessons and progress through simple and more complex labs. The goal of this project is to have students make connections with heredity and inheritance with their own lives. A comparison will be made between learning groups who do not have the hands on labs to see if hands on labs affect the amount of learning taking place in the classroom. The comparison will be based on pre and post test scores.

Rational:
Students will learn genetics and the functions of DNA by integrating standard book based curriculum issued by Pinellas County Schools and hands on real life labs to explore the applications of DNA in real life. Students will start with normal district issued curriculum for Big Idea 16 for heredity and reproduction. Their learning will then be enhanced by explorations in lab techniques, biotechnology, Outbreak! Lab to help them apply their learning to real life science and lives.

Description:

Step 1: Background
Students will start by getting a basic knowledge of DNA structures and functions through normal curriculum lessons. Both the control (students without additional hands on labs) and the test group (students who will get additional hands on labs) with engage in this curriculum (Please see appendix A.) Both the control and the test group will receive the Pre and Post test (Please see appendix B.)

Step 2: Beginning Lab activities
Student will progress to learning laboratory techniques with pipetting, laboratory safety, laboratory procedures and scientific inquire skills through a series of simulations. Next, students will apply their knowledge by extracting DNA from a strawberry or tomato (Please see appendix C-1 and C-2.) . Students will reflect on what they have done in their lab journals and prepare to do more advanced Labs.

Step 3: Advanced Lab Activities
The Blood Typing Lab will help students connect DNA knowledge learned about phenotype and genotype to themselves (Please see appendix D-1 and D-2.) The final lab, OutBreak! Fingerprinting Virus DNA Kit will incorporate all skills learn previously and require students to solve a real life problem. It will

allow students to be forensic detectives to discover where a virus outbreak originated (Please see appendix E.)

Tracking Student Progress:
Throughout the student's journey through genetics, students will record their thoughts, wonderings and results in a science notebook. Evidence of student growth will be provided by a pre- and post- test.

Next Generation Sunshine State Standards:
SC.7.L.16- Heredity and Reproduction

A. Reproduction is characteristic of living things and is essential for the survival of species.
B. Genetic information is passed from generation to generation by DNA; DNA controls the traits of an organism.
C. Changes in the DNA of an organism can cause changes in traits, and manipulation of DNA in organisms has led to genetically modified organisms.

Lesson Plan:
Please see Lesson Plan in attached Appendix F.

Data Collection:
1. Students will take a pretest that includes the ideas for Big Idea 16 Heredity and Genetics using the Next Generation Sunshine State Standards. Students will also take a post tested to show learning and growth.
2. Students will record observations and wonderings in their science journals.
3. Students will record laboratory activities in their science notebooks and including science laboratory procedure, data and results.

Equipment Lockers and UF resources:
1. Pipetting Stations Locker: Designer Plates, Practice Gels, Practice Tubes
2. Introduction to Gel Electrophoresis Locker, Crime Scene Investigator DNA Kits
3. Advanced Gel Electrophoresis Locker: Modes of Inheritance, AP Biology Lab 6, Crime Scene Investigators DNA Kit and Outbreak!
4. Pipetting stations
5. Introduction to GEL Electrophoresis
6. Advanced Gel Electrophoresis

ICORE summer institute elements:
ICORE will provide support for both the teacher and the students in the following ways:

1. Technical assistance from an UF instructor such as Julie Boker or Drew Joseph
2. Classroom visit from a UF instructor to assist teacher to set up lab equipment and insure teacher has an excellent understanding of labs and equipment before attempting to run labs with the students.

3. Web Conferences with several UF professors to stimulate science interest with students.
4. UF will provide equipment lockers and simulation activities via mail.

Literature Cited:

1. Pinellas County Schools, Science Department written 7th grade curriculum, Read The Instructions Workshop. https://portal.pcsb.org/focus/index.php
2. Strawberry DNA xtraction Teacher's Manual, UCBiotech.org, Peioneer Hi-Bred International, Inc. Educational Services Program, revised 2/18/04, http://ucbiotech.org/resources/display/files/dna_extraction_from_strawberrie.pdf
3. DNA Isolation from Strawberries, Sweeney, Diane. Department of Genome Sciences, University of Washington, The Genetics Project, http://www.gs.washington.edu/outreach/dhillon_dnaprocedure.pdf
4. Blood Group Genetics With Synthetic Blood Kit Teachers manual, Carolina online resource, http://www.carolina.com/category/teacher+resources/instructions+and+buying+guides/biotech+kit+instruction+manuals/blood+group+genetics+with+synthetic+blood+manual.do
5. ABO-Rh Blood Typing With Synthetic Blood, Carolina online resource, http://www.carolina.com/category/teacher+resources/instructions+and+buying+guides/biotech+kit+instruction+manuals/abo-rh+blood+typing+with+synthetic+blood+manual.do
6. Outbreak! Fingerprinting Virus DNA Kit Student Worksheet, Carolina online resource, http://www.carolina.com/category/teacher+resources/instructions+and+buying+guides/biotech+kit+instruction+manuals/outbreak!+fingerprinting+virus+dna+kit+student+worksheet.do
7. Outbreak! Fingerprinting Virus DNA Kit Teacher's Manual, Carolina online resource, http://www.carolina.com/category/teacher+resources/instructions+and+buying+guides/biotech+kit+instruction+manuals/outbreak!+fingerprinting+virus+dna+kit+teacher%27s+manual.do

Budget and budget justification:

A. Blood Typing Lab: Carolina™ Synthetic Blood Group Genetics Kit(#700-1007) quantity 4 X 26.00=$104.00
B. DNA Fingerprinting Lab Identifying virus DNA (Safe): Carolina™ Outbreak! Fingerprinting Virus DNA 6-Station Kit (#211208) quantity 2x 89.00 = $178.00

Total of $282.00 + shipping

Lesson Plan: Strawberry or Tomato DNA Extraction

Key Questions:

1. Do all living things contain DNA?
2. Can DNA be extracted from a fruit and seen with the naked eye?

Science Subject, Grade and Ability Level::
Advanced, Life Science, 7th grade.

Science Concepts:
SC.7.L.16- Heredity and Reproduction

A. Reproduction is characteristic of living things and is essential for the survival of species.
B. Genetic information is passed from generation to generation by DNA; DNA controls the traits of an organism.
C. Changes in the DNA of an organism can cause changes in traits, and manipulation of DNA in organisms has led to genetically modified organisms.

Overall Time Estimate:
This lesson is meant to take approximately 65 minutes, which is approximately one block or two class periods.

Learning Styles:
This lesson plan addresses visual learners and kinesthetic learners best. Students are able to take information they have learned in class and apply it to a hands-on lab that allows them to see DNA.

Vocabulary:

DNA	Pipette	Gene	Ethanol
Cell	Nucleus	Extraction Buffer	Heredity
Chromosome	Chromosome	Cell membrane	Cell wall

Lesson Summary:
Students will extract DNA from a ripe strawberry or tomato. The idea behind this activity is to help students understand that DNA is part of every living thing. Students will be able to conceptualize that DNA is physically present in all living things, including the food we eat.

Student Learning Objectives[1][i]:

1. The student will be able to extract DNA from a ripe strawberry or tomato.
2. The student will be able to see what DNA looks like to the naked eye.
3. The Student will understand that DNA is found in the food we eat.

Materials:

1. Student notebooks
2. Lab Sheets "Strawberries and DNA[1]"

Background Information:

Students should have an understanding of cells and where DNA is located in the cells. They should understand that they will be crushing the cell walls. They should understand that the dish soap helps to dissolve the cell membrane. They should understand that sodium Chloride (salt) helps to remove the protein from the DNA and the Ethanol or isopropyl alcohol precipitates the DNA out of solution.

Advanced Preparation:

Obtain the materials ahead of time. Make sure the strawberries or tomatoes are extremely ripe. Ethanol or isopropryl alcohol needs to be kept as cold as possible. Keep it in the refrigerator or on ice.

Procedure and Discussion with Time Estimates:

Introduction: (approximately 15 minutes with student discussion)

Introduce the lab (see appendix C for lab sheets.) and discuss what the objectives are for the lab. . Have students copy the lab into their science notebooks.

Run the lab and collect data in science notebooks. (approximately 30 minutes with student discussion)

Lab procedure: (appendix C for lab sheets.)

1. Remove the green sepals from the strawberries.
2. Place strawberries into a Ziploc TM bag and seal shut.
3. Squish for a few minutes to completely squash the fruit.
4. Add 10 ml DNA Extraction Buffer (soapy salty water) and squish for a few more minutes. Try not to make a lot of soap bubbles.
5. Filter through a moistened paper towel set in a funnel, and collect the liquid in a clear tube. *Do not* squeeze the paper towel. Collect about 3 ml liquid.
6. Add 2 volumes ice cold isopropyl alcohol to the strawberry liquid in the tube. Pour the isopropyl alcohol carefully down the side of the tube so that it forms a separate layer on top of the strawberry liquid.

DNA Isolation from Strawberries, Sweeney, Diane. Department of Genome Sciences, University of Washington, The Genetics Project, http://www.gs.washington.edu/outreach/dhillon_dnaprocedure.pdf

7. Watch for about a minute. What do you see? You should see a white fluffy cloud at the interface between the two liquids. That's DNA!
8. Spin and stir the coffee stirrer or transfer pipet in the tangle of DNA, wrapping the
9. DNA around the stirrer.

Have students draw conclusions based on their results. (approximately 20 minutes with student discussion)

1. Have students decide it DNA is located in the strawberry or tomato.
2. Have students reflect in their science journal about what they did and what they saw.
3. Have a class discussion to share their findings.

9. Pull out the stirrer and transfer the DNA to a piece of saran wrap or clean tube. The fibers are thousands and millions of DNA strands.
10. To view in a microscope, put the glob on a clean slide and gently tease/stretch apart using 2 toothpicks or dissecting pins. The fibers will be easier to see in the teased-apart area.
11. Rinse your funnel. Put the Ziploc TM bag and paper towel in the garbage.

Assessment Suggestions:

Informal assessment of class discussion is suggested. This lab is part of a larger grouping of labs. The focus is mainly developing lab skills and following procedure. It should lead students to understand that DNA is present in all living things.

Resources and References:

1. [1] Strawberry DNA xtraction Teacher's Manual, UCBiotech.org, Peioneer Hi-Bred International, Inc. Educational Services Program, revised 2/18/04, http://ucbiotech.org/resources/display/files/dna_extraction_from_strawberrie.pdf
2. DNA Isolation from Strawberries, Sweeney, Diane. Department of Genome Sciences, University of Washington, The Genetics Project, http://www.gs.washington.edu/outreach/dhillon_dnaprocedure.pdf

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[i] Strawberry DNA xtraction Teacher's Manual, UCBiotech.org, Peioneer Hi-Bred International, Inc. Educational Services Program, revised 2/18/04, http://ucbiotech.org/resources/display/files/dna_extraction_from_strawberrie.pdf