Biotechnology:
Applications in Agriculture

Curriculum Guide: *Biotechnology: Applications in Agriculture*

Unit: IV. Foundations of Genetic Engineering

Unit Objective:

Students will demonstrate an understanding of an aspect of genetic engineering by extracting DNA from a plant or animal source and analyzing the results in a written report.

Show-Me Standards: 1.3, SC7

References:

Biotechnology: Applications in Agriculture. University of Missouri-Columbia, Instructional Materials Laboratory, 1998.

DNA Extraction From Kiwi. Office of Biotechnology. Iowa State University. Accessed October 31, 2003, from http://www.biotech.iastate.edu/publications/lab_protocols/DNA_Extraction_Kiwi.html.

DNA Extraction From Onion. Office of Biotechnology. Iowa State University. Accessed October 31, 2003, from http://www.biotech.iastate.edu/publications/lab_protocols/DNA_Extraction_Onion.html.

DNA Extraction From Onion – Teacher Guide "Chemical Version." Biotech Project. University of Arizona. Accessed October 31, 2003, from http://biotech.biology.arizona.edu/labs/DNA_extraction_onion_teach.html.

How to Extract DNA From a Banana. Biology. About, Inc. Accessed October 31, 2003, from http://biology.about.com/c/ht/00/07/How_Extract_DNA_Banana096293248 1.htm.

How to Extract DNA From Anything Living. Genetic Science Learning Center. University of Utah. Accessed July 24, 2003, from http://gslc.genetics.utah.edu/units/activities/extraction/.

Onion DNA Extraction. Solarwind.com. Accessed October 31, 2003, from http://www.solarwinds.com/users/neumann/onion_dna_extraction.htm.

Teacher Guide: What is DNA? DNA Extraction From Kiwifruit. Biotech Project. University of Arizona. Accessed October 31, 2003, from http://biotech.biology.arizona.edu/labs/DNA_Kiwifruit_teacher.html.

Instructional Strategies/Activities:

- Students will engage in study questions in lessons 1 through 3.
- Students will complete AS 1.1, Comparing Plant and Animal Cells; and AS 2.1, Mitosis and Meiosis.
- Additional activities that relate to the unit objective can be found under the heading "Other Activities" in the following locations: p. IV-5 (2) and p. IV-21.

Performance-Based Assessment:

Students will form teams of three to extract DNA from a specific plant or animal material. After completing the process, each team will compare its findings with those of other teams and write a brief summary report of its findings.

Assessment will be based on the application of proper laboratory procedure and technique, team cohesiveness, the time needed to conduct the procedure, the degree of success resulting from the procedure, and conclusions drawn from the comparison of findings.

Unit IV—Foundations of Genetic Engineering
Instructor Guide

The instructor should assign the performance-based assessment activity at the beginning of the unit. Students will work toward completing the activity as they progress through the unit lessons. The assessment activity will be due at the completion of the unit.

1. Students will form teams of three to conduct the procedure to extract DNA material from a plant or animal source.

2. The teacher will provide, or assign responsibility for providing, the following to each team of students:
   - ❑ Organic material (plant or animal sources) to be used as subjects of the DNA extraction procedure (NOTE: To promote diverse results, each team should analyze material from a different source.)
   - ❑ Equipment and material to conduct the procedure
   - ❑ A description or plan for extracting DNA, including maximum time for the procedure (NOTE: The teacher is advised to consult one or more of the web sites listed among the references for this performance-based assessment activity to determine the specific equipment, material, and procedure outline to supply to each team of students.)

3. Each team will conduct the procedure a minimum of twice; if time permits, each member of the team will conduct the procedure to duplicate and verify results.

4. After completing the procedure, each team will rotate through all other team stations and visually compare one of its samples to the one or two samples remaining at each team's station.

5. After completing the rotation through all stations, each team will briefly summarize in a written report the results of its procedure and its findings during the visual comparison of other teams' results. The report should be no more than two short paragraphs.

6. Assessment will be based on the quality of effort for the following factors:
   a. Application of proper procedure and technique during the laboratory exercise
   b. Team cohesiveness (i.e., how well team members worked together)
   c. The time needed to conduct the procedure
   d. The degree of success resulting from the procedure
   e. Conclusions drawn from the comparison of results

Unit IV—Foundations of Genetic Engineering
Student Handout

1. You will form a team with two other students to conduct the procedure to extract DNA material from a plant or animal source.

2. Your teacher will provide, or assign responsibility for providing, the following to your team:
   - ❑ Organic material (plant or animal sources) to be used as subjects of the DNA extraction procedure
   - ❑ Equipment and material to conduct the procedure
   - ❑ A description or plan for extracting DNA, including maximum time for the procedure

3. Your team will conduct the procedure a minimum of twice; if time permits, each member of your team will conduct the procedure to duplicate and verify results.

4. After completing the procedure, your team will rotate through all other team stations and visually compare one of your samples to the one or two samples remaining at each team's station.

5. After completing the rotation through all stations, your team will briefly summarize in a written report the results of your procedure and your findings during the visual comparison of other teams' results. The report should be no more than two short paragraphs.

6. Assessment will be based on the quality of your effort for the following factors:
   a. Application of proper procedure and technique during the laboratory exercise
   b. Team cohesiveness (i.e., how well team members worked together)
   c. The time needed to conduct the procedure
   d. The degree of success resulting from the procedure
   e. Conclusions drawn from the comparison of results

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Scoring Guide
Laboratory Subject/Team Members_____

Criteria	0 Points	1 Point	2 Points	3 Points	4 Points	Weight	Total
Proper procedure and laboratory technique were used	Failed	Poor	Fair	Good	Excellent	X 12.5	
Team members worked well together	Failed	Poor	Fair	Good	Excellent	X 7.5	
Amount of time for procedure was appropiate	Failed	Poor	Fair	Good	Excellent	X 2.5	
Procedure results were successful	Failed	Poor	Fair	Good	Excellent	X 1.25	
Conclusions from comparisons were thorough and valid	Failed	Poor	Fair	Good	Excellent	X 1.25	
TOTAL							

Final Assessment Total _____/100 pts.

Comments: