

Biotechnology: Applications in Agriculture

Curriculum Guide: *Biotechnology: Applications in Agriculture*

Unit: VI. Plant Technologies

Unit Objective:

Students will demonstrate an understanding of the purpose and process of electrophoresis by constructing and using an electrophoresis device and writing a summary of the results.

Show-Me Standards: 1.2, SC3

References:

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

Electrophoresis. Nexus Research Group. Accessed August 11, 2003, from http://www.nexusresearchgroup.com/fun_science/electrophoresis.htm.

Gel Electrophoresis – Teacher Instructions. Biological Sciences Initiative. University of Colorado. Accessed December 3, 2003, from http://www.colorado.edu/Outreach/BSI/pdfs/electrophoresis_teacher.pdf.

Instruction Guide. Genetic Science Learning Center. University of Utah. Accessed December 3, 2003, from <http://gslc.genetics.utah.edu/units/activities/electrophoresis/guide.cfm>.

Lane, L., Loh, P., & Roe, B. A. "Experiment #5 – Butter Dish Electrophoresis." *Biotechnology & Recombinant DNA Techniques for Middle and High School Students and Teachers*. Accessed August 11, 2003, from <http://www.genome.ou.edu/HHMI/workshop.pdf>.

Moeed, A. *Electrophoresis Procedure*. AgResearch 2000. Accessed November 4, 2003, from http://www.agresearch.cri.nz/scied/search/tools/electro/background_electro_photos.htm.

Teacher Guide: Build a Gel Electrophoresis Chamber. Genetic Science Learning Center. University of Utah. Accessed December 3, 2003, from http://gslc.genetics.utah.edu/teachers/units/basics/gelbox_build.pdf.

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Instructional Strategies/Activities:

- Students will engage in study questions in lessons 1 through 5.
- Students will complete AS 3.1, The Current State of Plant Biotechnology; and AS 4.1, Designer Plants – The Agricultural Products of the Future.
- Additional activities that relate to the unit objective can be found under the heading “Other Activities” in the following locations: p. VI-4 and p. VI-15 (1).

Performance-Based Assessment:

Students will work in teams of three to build an electrophoresis device. The instructor will provide materials and directions. In addition to constructing the device, each team will use its device to separate DNA material into groups based on length.

Assessment will be based on the application of the proper construction procedure and the time required, the application of the proper DNA processing procedure and the time required, and the degree of success resulting from the procedure. Laboratory technique and team cohesiveness also will be factors in the assessment.

Unit VI—Plant Technologies 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 assemble a simple electrophoresis device and to use it to separate DNA material.
2. The teacher will provide to each team of students the following:
 - Equipment and material to assemble a simple electrophoresis device
 - A description or plan for assembling the device using the equipment and material provided (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 assembly procedure outline to supply to each team of students.)
 - Directions for processing DNA samples with the electrophoresis device each team has assembled (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 DNA material to be processed and for a list of the material needed and description of the process to be conducted with the electrophoresis device.)
3. Each team will construct an electrophoresis device using the equipment and materials provided and according to the procedure outlined by the teacher.
4. After completing assembly of the electrophoresis device, each team will process the designated DNA material using the device the team assembled. If time permits, each member of the team will conduct his or her own processing of the DNA material to serve as duplication and verification of the process.
5. After completing the processing of DNA material, each team will briefly summarize in a written report the results of its procedure or multiple procedures. The report should not be more than two short paragraphs.

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6. Assessment will be based on the quality of effort for the following factors:
 - a. Application of the proper procedure to construct the electrophoresis device
 - b. Time required to build the device
 - c. Application of the proper procedure during the DNA material processing exercise
 - d. The time needed to conduct the processing
 - e. The degree of success resulting from the DNA material processingAdditional factors to be considered are laboratory technique (i.e., orderly, clean, and careful use of facilities and equipment) and cohesiveness of the team (i.e., how well team members worked with each other).

Unit VI—Plant Technologies Student Handout

1. You will form a team with two other students to assemble a simple electrophoresis device and to use it to separate DNA material.
2. The teacher will provide to your team the following:
 - Equipment and material to assemble a simple electrophoresis device
 - A description or plan for assembling the device using the equipment and material provided
 - Directions for processing DNA samples with the electrophoresis device each team has assembled
3. Your team will construct an electrophoresis device using the equipment, materials, and directions provided.
4. After completing assembly of the electrophoresis device, your team will process the designated DNA material using the device your team assembled. If time permits, each member of your team will conduct his or her own processing of the DNA material to serve as a duplication and verification of the process.
5. After completing the processing of DNA material, your team will briefly summarize in a written report the results of its procedure or multiple procedures. The report should not be more than two short paragraphs.
6. Assessment will be based on the quality of your team's effort for the following factors:
 - a. Application of the proper procedure to construct the electrophoresis device
 - b. Time required to build the device
 - c. Application of the proper procedure during the DNA material processing exercise
 - d. The time needed to conduct the processing
 - e. The degree of success resulting from the DNA material processingAdditional factors to be considered are laboratory technique (i.e., orderly, clean, and careful use of facilities and equipment) and cohesiveness of the team (i.e., how well team members worked with each other).

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Unit VI—Plant Technologies

Scoring Guide

Experiment Topic/Team Members _____

Criteria	0 Points	1 Point	2 Points	3 Points	4 Points	Weight	Total
Proper construction procedure was used	Failed	Poor	Fair	Good	Excellent	X 3.75	
Amount of time to build the device was appropriate (the less time, the better)	Failed	Poor	Fair	Good	Excellent	X 2.5	
Proper DNA processing procedure was used	Failed	Poor	Fair	Good	Excellent	X 3.75	
Amount of time to conduct the procedure was appropriate (the less time, the better)	Failed	Poor	Fair	Good	Excellent	X 2.5	
Procedure results were successful	Failed	Poor	Fair	Good	Excellent	X 10	
Proper laboratory technique was used	Failed	Poor	Fair	Good	Excellent	X 1.25	
Team worked well together	Failed	Poor	Fair	Good	Excellent	X 1.25	
TOTAL							

Final Assessment Total _____/100 pts.

Comments:

