

# Homer's Forbidden Donut (A Gel Electrophoresis Exercise)



*Written by Eva McLanahan*

## **Annotation:**

This activity is used to explain the concept behind gel electrophoresis. Students work in groups to determine who committed a crime by taking a bite out of Homer Simpson's forbidden donut.

## **Primary Learning Outcomes**

Students will learn how restriction enzymes operate and the basis behind DNA fingerprinting. Students will use their knowledge and the "gel" they create to solve the crime.

## **Assessed QCC Standards:**

Grade: 9-12

*Science*

Biology

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*Topic:* Science Process Skills, and Laboratory Safety

*Standard:* Uses terms and processes employed in scientific research. 1.1. Demonstrates proficiency in the use of science process skills in laboratory and/or field activities involving observation, classification, communication, metric measurement, prediction, inference, identifying variables, formulating hypotheses, controlling variables, making operational definitions, designing investigations, experimenting, collecting qualitative and/or quantitative data, constructing a data table, graphing, analyzing, and interpreting data and/or drawing conclusions. 1.2. Produces written reports of laboratory and/or field activities in accepted formats and use precise language for presentations of procedure, tables of data, graphs, analytical methods, results, and analyses of error. 1.3. Uses laboratory equipment to conduct safe and accurate laboratory work. 1.4 Demonstrates the proper care and use of the microscope and how to prepare slides.

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*Topic:* Biochemistry (Protein Synthesis)

*Standard:* Explains the structure of DNA and RNA and their role in protein synthesis. 8.1 Describes the double-helix model. 8.2 Summarizes the processes of replication, transcription, and translations.

## **Procedures/Activities**

*Step: 1 Duration: 15-20 minutes*

Use a PowerPoint presentation to present the components of gel electrophoresis and its applications. The end of the PowerPoint presentation contains brief instructions to guide the students on how to solve the crime.

### **Attachments for Step 1**

**Title:** Gel Electrophoresis PowerPoint presentation

**FileName:** GelEL.ppt

**Description:** This presentation will prepare your students to solve the crime of Homer's forbidden donut.

*Step: 2 Duration: 45-50 minutes*

Place the students in six groups (Analysis Units) of 4-5 students each and provide them with the "Bulletins." Allow the students to read through the "Bulletins" before the remaining materials are distributed. The students should be able to work through the exercise with little guidance by following instructions provided in the PowerPoint and the "Bulletins." After each group has processed the "gel" with the suspects' DNA, provide them with their evidence DNA found at the crime scene. The exercise is designed such that each Analysis Unit has a different criminal--to prevent groups from sharing answers.

### **Attachments for Step 2**

**Title:** Bulletins

**FileName:** Homer\_Bulletins.pdf

**Description:** This file contains the "Bulletins" to pass out to the group and instructions for creating the poster board (gel). The poster boards can be created and laminated for reuse which will save time in the classroom. Also, the discussion questions are included at the end of the file.

**Title:** Strands of DNA for activity (should be printed on legal size paper)

**FileName:** Homer\_DNA.pdf

**Description:** This file contains the strands of DNA to distribute to each group and a sheet of "Evidence DNA" that should be distributed by the Lead Analyst to each Analysis Unit after they have correctly processed the suspects' DNA.

### **Materials and Equipment**

1/2 sheet of poster board for each group, marker, tape, scissors for each student, pencil

### **Total Duration**

60-70 minutes

### **Technology Connection**

This activity will teach the concept behind gel electrophoresis and enable the students to better understand a lab using the actual gel electrophoresis equipment.

**Assessment**

Discussion questions and completion of exercise.

**Extension**

After completion of this exercise a lab using "real" gel electrophoresis will be better understood by students.