

Unit 1

Genomics

Description

Having determined the complete DNA nucleotide sequence of several organisms, including humans, attention shifts to identifying genes within those sequences and determining their function. Tools, including BLAST searches and microarray experiments, coupled with computers that can handle the tremendous amount of data generated, allow researchers to examine thousands of genes at a time, and gain insight into how organisms normally function and how diseases might be treated.

Menu of Unit Activities

Note: All activities, handouts, solutions, and tips can be found in the Appendix of this guide.

Activity 1: Before and After (20 minutes + 30 minutes of video)

A list of terms to consider and discuss before and after viewing the video.

Activity 2: Making a Microarray (40 minutes)

A diagram to fill in to predict the results of a microarray. The microarray measures changes in gene expression in yeast growing aerobically and anaerobically.

Activity 3: “CSI, Crime Scene Investigation” (45 minutes)

DNA fingerprints are used to come up with possible solutions to a mystery.

Activity 4: Quick Discussion (15 minutes)

A discussion on the application of genomic information to predicting and diagnosing medical conditions.

Before the Session

Facilitator: Copy and assemble the following activity materials. (See the Activities section in the Appendix of this guide for master copies of transparencies and handouts, plus Tips and Suggested Answers.)

Activity 1: Before and After requires:

- One copy of the List of Terms and Topics per two people (master copy provided)
- Tips and Suggested Answers

Activity 2: Making a Microarray requires:

- One copy of the Microarray Grid Diagram per two people (master copy provided)
- One copy of the Key to the Genes on the Microarray per two people (master copy provided)
- Transparency of the Microarray Grid Diagram (or a sketch of the grid on a blackboard)
- Transparency of Aerobic and Anaerobic Pathways in Yeast (master copy provided)
- Transparency of Figure 5 from the Genomics online text chapter (master copy provided)
- One copy of the Genomics online text chapter per two people (available online at <http://www.learner.org/channel/courses/biology>)
- Optional: red, green, and yellow pens *or* red, green, and yellow sticky dots (one set per two people)
- Tips and Suggested Answers

Activity 3: “CSI, Crime Scene Investigation” requires:

- One copy of the Mystery Story per person (master copy provided)
- One Figure of DNA Fingerprints From the Inhabitants per person (master copy provided)
- One set of the Figures of DNA Fingerprint Evidence (master copy provided) **Special Instructions:** After making a copy, cut along the dotted lines into individual samples.
- Transparency of the Map of the Room (master copy provided)
- Tips and Suggested Answers

Activity 4: Quick Discussion requires:

- One copy of the Discussion Questions per two people
- Tips and Suggested Answers

Facilitator: Make sure that the room has these supplies:

- pens or pencils and paper
- VCR and TV
- overhead projector and markers
- black/white board with chalk or markers

Session Activities and Video

Activity 1a: Before and After—Pre-Video Discussion (10 minutes)

- Arrange into pairs.
- Read the Setup and have each pair take a List of Terms and Topics.
- Spend 10 minutes discussing and writing thoughts and questions about the terms.
- Emphasize that these are “off the top of your head” answers that will be updated after watching the video.

Video (30 minutes)

- Watch the Genomics video.

Activity 1b: Before and After—Post-Video Discussion (10 minutes)

- Go over the list of terms again as a group. For each term come up with a brief definition or description.
- Example definitions are in the Tips and Suggested Answers.
- Variation: For each term, ask for volunteers to say what they wrote down before the video and what they wrote down afterwards, and if they still have questions about the topic. Ask if anyone has anything to add.
- Variation: Have each person write one question they still have about the topic. As a class, go over the questions and see if the entire group can come up with an answer.

Activity 2: Making a Microarray (40 minutes)

- Arrange into pairs and read the Setup.
- Have each pair take one Microarray Grid Diagram and one Key to the Genes on the Microarray, and a set of colored pens/pencils or dots (if used).
- Put the Aerobic and Anaerobic Pathways in Yeast diagram on the overhead projector.
- Spend 20–25 minutes reading the background and then coloring or marking each dot on the microarray grid as red, green, or yellow.
- Have the Genomics online text chapter available as a reference for microarrays.
- Hints for getting started, if necessary:
 - One way to begin is to decide if expression for each gene would be higher, lower, or the same in anaerobic vs. aerobic conditions; then go through and decide what color its spot would be in the microarray.
 - For genes that are not involved in anaerobic or aerobic growth, decide if their expression would change or not in anaerobic vs. aerobic conditions and then color them accordingly.

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Session Activities and Video, cont'd.

(Activity 2, continued)

- When everyone is finished, put a transparency of the grid on the overhead and go over it as a group, discussing any spots for which there is no consensus.
- Look in the Tips and Suggested Answers section for an explanation of each spot.
- As a group, discuss the Post-Activity Discussion question.

Activity 3: “CSI, Crime Scene Investigation” (45 minutes)

- Read the Setup.
- Have each person take a copy of the Mystery Story and a Figure of DNA Fingerprints From the Inhabitants.
- Pass around the individual Figures of DNA Fingerprint Evidence until every person has at least one and they are all distributed.
- Put the Map of the Room on the overhead projector.
- Spend 10 minutes individually determining who contributed the pieces of evidence and where the evidence was found in the room.
- As a group, go over the map of the room, marking where the inhabitants were, according to the evidence that was collected.
- Discuss scenarios that explain the evidence.
 - Hint: DNA fingerprints can be used for more than just matching evidence samples with suspects and victims.
- See the Tips and Suggested Answers for possible explanations.

Activity 4: Quick Discussion (15 minutes)

- Arrange into pairs and read the Setup.
- Have each pair take a copy of the Discussion Questions.
- Spend 10–15 minutes discussing the questions, with an overall group discussion if time permits.
- See the Tips and Suggested Answers.

Summary (5 minutes)

- If time permits, as a group or in pairs define the major ideas or “take home” lessons of this unit and its applications.