

Unit 2

Proteins and Proteomics

Description

It is the proteins made by a cell that determine what that cell does. The complement of proteins in a cell varies not only from organism to organism, but also within an organism depending upon the type of tissue, the age of the organism, and the environment. Understanding protein structure and knowing how proteins interact with one another is crucial to understanding the mechanisms of normal cell function.

Menu of Unit Activities

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

Activity 1: Word Series (20 minutes + 30 minutes of video)

Terms used in the field of proteomics to think about before, and define after, watching the video.

Activity 2: Form and Function (30 minutes)

Pairs examine figures that show different ways of representing proteins and look for specific protein structure features.

Activity 3: 2D (15 minutes)

Shows 2D gel data and explains how it can detect protein modification in response to cellular changes.

Choose either Activity 4 or Activity 5:

Activity 4: Tool Box (45 minutes)

Defines protein investigation techniques and gives examples of how they are applied.

Activity 5: Two-Hybrid (45 minutes)

Uses diagrams that represent the components of a two-hybrid experiment to show how this technique detects interactions between proteins. Data from a large-scale two-hybrid experiment are examined.

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(Menu of Unit Activities, continued)

Choose either Activity 6 or Activity 7:

Activity 6: Quick Discussion on Proteomic Profiling
(10 minutes)

Discussion on the use of proteomics in medicine.

Activity 7: Quick Discussion on *Deinococcus*
(10 minutes)

Discussion on the use of proteomics to decipher a stress-resistant bacterium.

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: Word Series requires:

- One copy of the Word List per person (master copy provided)
- One copy of the Proteins and Proteomics online text chapter (available online at <http://www.learner.org/channel/courses/biology>)

Activity 2: Form and Function requires:

- Transparency of Protein Structure Terms and Discussion Questions (master copy provided)
- One set of Protein Structure Diagrams (master copy provided; to make a set, make one copy and cut along dotted lines)

Activity 3: 2D requires:

- Transparencies of 2D Gels, each on a separate transparency (master copies provided)
- One copy of the Discussion Questions per person (master copy provided)
- Tips and Suggested Answers

Before the Session, cont'd.

Choose either Activity 4 or Activity 5:

Activity 4: Tool Box requires:

- One copy of the Tool Set for every person (master copy provided)
- Transparency of Tasks and Applications (master copy provided), or can be written on board
- One copy of the Proteins and Proteomics online text chapter per two people (available online at <http://www.learner.org/channel/courses/biology>)
- Tips and Suggested Answers

Activity 5: Two-Hybrid requires:

- One set of the Yeast Two-Hybrid Diagram Parts per four people (master copy provided; to make a set, cut on the dotted lines after copying)
- One copy of the Yeast Two-Hybrid Diagram Instructions per four people (master copy provided)
- Transparency of Prey Data (master copy provided)
- One copy of the Discussion Questions per person (master copy provided)
- One copy of the Proteins and Proteomics online text chapter per two people (available online at <http://www.learner.org/channel/courses/biology>)
- Tips and Suggested Answers

Choose either Activity 6 or Activity 7:

Activity 6: Quick Discussion on Proteomic Profiling requires:

- One copy of the Discussion Questions per person (master copy provided)

Activity 7: Quick Discussion on *Deinococcus* requires:

- Transparency of the Discussion Questions (master copy provided)
- 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: Word Series—Pre-Video Discussion (10 minutes)

- Read the Setup and arrange into pairs.
- Have each person take a copy of the Word List.
- Spend 10 minutes discussing the words. Pairs should work at their own pace, but don't use more than 10 minutes. The emphasis is on starting to think about the unit topic.

Video (30 minutes)

- Watch the Proteins and Proteomics video.

Activity 1b: Word Series—Post-Video Discussion (10 minutes)

- Spend a few minutes as a group discussing the significance of each term to the field of proteomics. Have one person look up terms that are still unclear in the Proteins and Proteomics online text.

Activity 2: Form and Function (30 minutes)

- Read the Setup and arrange into pairs.
- Have each pair take one of the Protein Structure Diagrams. Extra diagrams can be put into a separate pile.
- Put the transparency of Protein Structure Terms and Discussion Questions on the projector.
- Spend about 2 minutes working in pairs on each diagram, finding any of the structures listed on the transparency. When one pair is finished with a diagram, they should swap with another pair or take a new diagram from the pile of extras.
- When all pairs have seen all diagrams, discuss the questions as a group.
- Variation: Instead of working in pairs, make transparencies of the diagrams and put them on the overhead projector. Go through the diagrams and discuss the questions as a group.

Activity 3: 2D (15 minutes)

- Read the Setup.
- Put the first transparency (0 minutes) on the projector.
- Examine the data for a few seconds, then lay the second transparency (3 minutes) on the projector, lining up the corners so it is easy to see which spots moved and which did not.
- Repeat with the transparencies of the subsequent timepoints.
- Discuss the questions and mark the gel orientation on the transparencies. (See the Tips and Suggested Answers section for the correct gel orientation.)

Session Activities and Video, cont'd.

If you chose Activity 4: Tool Box (45 minutes)

- Read the Setup.
- Have each person take one copy of the Tool Set.
- As a group, come up with a brief description of each item in the Tool Set, focusing on the method of the technique rather than its function. Consult the Proteins and Proteomics online text if necessary.
- Put the transparency of Tasks and Applications on the overhead projector. Look at only one at a time.
- For each task, allow 1–2 minutes for everyone to choose a tool from their set and discuss their choice with their neighbor. Consult the Proteins and Proteomics online text if necessary.
- Then, as a group, spend 2–3 minutes discussing the various tools that could be used for that task before moving to the next task. Confirm decisions by looking in the Tips and Suggested Answers section.

If you chose Activity 5: Two-Hybrid (45 minutes)

- Read the Setup and arrange in teams of four.
- Have each team take one set of the Yeast Two-Hybrid Diagram Parts and the Yeast Two-Hybrid Diagram Instructions.
- Allow 20 minutes for Part 1, then go over the expected outcomes for each situation as a group.
- Allow 10 minutes for Part 2, then show the Prey Data transparency with the lists of prey proteins.
- As a group, discuss the questions. See the Tips and Suggested Answers section for answers to some questions.

If you chose Activity 6: Quick Discussion on Proteomic Profiling (10 minutes)

- Read the Setup and have each person take a copy of the Discussion Questions.
- Discuss the questions as a group.

If you chose Activity 7: Quick Discussion on *Deinococcus* (10 minutes)

- Read the Setup and put the transparency of the Discussion Questions on the overhead projector.
- Discuss the questions as a group. (See the Tips and Suggested Answers section for potential 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.

Notes
