Designing a Worksheet Activity

Lecture Concepts
All lecture concepts work

Activity Type
Group problem-solving worksheet

Time Needed
30-50 minutes

Purpose
To practice exam-type short-answer questions on cell biology

Abstract

<table>
<thead>
<tr>
<th>Activity Description</th>
<th>Time</th>
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<tbody>
<tr>
<td>Class works with instructor on simple problem (optional)</td>
<td>5 minutes</td>
</tr>
<tr>
<td>Class works in groups to solve one worksheet problem</td>
<td>10 minutes</td>
</tr>
<tr>
<td>Instructor debriefs class on one problem</td>
<td>5 minutes</td>
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<tr>
<td>(Repeat for each worksheet problem)</td>
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Supplies
- A few printed worksheets for students who did not bring their own

Pre-class prep
Using worksheets and small groups in discussion is a straightforward and powerful activity that you can re-use throughout the quarter. The most common mistakes that discussion leaders make in designing a worksheet is to make them too long and too easy. Here are some critical do’s and don’ts for worksheet design.

Don’t:
- Ask simple recall questions (vocabulary, matching). Create questions that will test the limit of student understanding
- Create more questions than you need. Plan on ONLY getting through three complex questions in 50 minutes – one question for each lecture from the past week.

Do:
- Ask questions that combine information from several lectures, or apply lecture information to a new situation
- Use questions from old exams (multiple choice and short answer)
- Practice solving the worksheet problem ahead of time!
- Share worksheet questions that worked well with other discussion leaders
- Post the worksheets for the students to print the night before discussion, so the whole class can see them and think, “Gosh, I don’t know how to do that problem. I’d better go to discussion!”

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• Ask the instructor for the media CD for the textbook. It contains all the book figures without labels. Labeling unlabeled figures is an excellent worksheet activity.

In Class
(5 min) Have students pull out the worksheets that they printed off your web page the night before). If you feel that the class will really struggle with how to begin, you can work with them through a simpler example.

(10 min) Have students work through the first question on the worksheet. Circulate through the groups and offer encouragement, but avoid providing answers. Reinforce student learning behavior like looking things up in lecture notes and discussing the work amongst themselves. Tell them when the answer is correct.

(5 min) After most groups have finished, bring their attention back to you. Debrief, ask about what part was most difficult, point out how exam questions will be worded, etc.

Repeat the group work / instructor debrief process through the rest of the questions on the worksheet.

General Teaching Tip: Dealing with Difficult Worksheet Problems
When a group struggles with a worksheet problem, resist the urge to work it out with them. Instead, work out a similar problem. This teaches students that:
1. Helplessness is not rewarded
2. They CAN work out difficult problems.

Sample Worksheet Questions

A victim of a serious car accident (blood group B) is rushed to the hospital and needs and urgent blood transfusion. You are the physician on duty. Unfortunately, the labels of your blood reserves have come off and your do not know, which one is which. Using antibodies to antigen A and antigen B, you perform blood typing experiments with the following results:

- Tube 1: A-antibody: agglutination, B-antibody: agglutination
- Tube 2: A-antibody: no reaction, B-antibody: no reaction
- Tube 3: A-antibody: no reaction, B-antibody: agglutination

a) please label the tubes:
   Tube 1: _______________
   Tube 2: _______________
   Tube 3: _______________

b) Which tube can you use to save your patient’s life? _______

c) Is there an alternative tube that you could use? Yes ___ No ___
Please explain your answer.
Which of the properties (a. through e.) will allow you to distinguish between the pairs of transport mechanisms listed in column 1? Please write the property behind the pair in column 2, each property should only be used once (see example)

<table>
<thead>
<tr>
<th>Pair of transport mechanism</th>
<th>Property</th>
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<tbody>
<tr>
<td>Simple diffusion</td>
<td>C.</td>
</tr>
<tr>
<td>Ion channel Carrier-mediated transport</td>
<td></td>
</tr>
<tr>
<td>Symport</td>
<td></td>
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<tr>
<td>Uniport coupled transport</td>
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Property that can be used to distinguish
A.) direction in which solutes move
B.) transport rate
C.) requirement for an integral membrane protein
D.) requirement for energy
E.) requirement for the simultaneous transport of two molecules

**Ouabain**, an inhibitor of the N+/K+ ATPase, cannot pass through cell membranes.

a.) What would happen to glucose transport across the intestinal epithelia if ouabain were applied to the apical side of the epithelium? Mark one answer.

    No effect
    Transepithelial Glc transport stops at once
    Glc transport continues until the Na+ concentration gradient between the intestine and the cell disappears.

b.) To the basolateral side of the epithelium? Mark one answer.

    No effect
    Transepithelial Glc transport stops at once
    Glc transport continues until the Na+ concentration gradient between the intestine and the cell disappears.

You have identified a new compound that causes cells to grow very poorly. Because ATP is not synthesized, your professor suspects that there may be problems with the function of mitochondria.

Your investigations indicate that the respiratory chain and ATP-Synthase work normal.

A) Give two examples of protein that require ATP for their function or organization.

1. __________________________________________________
2. ___________________________________________________

B) How do you explain the effect of the compound?
Action potentials result from regulated opening and closing of gated ion channels. Please indicate below (behind the numbers) which channel is open at the indicated points in the graph.

During your Bio199 project, you have identified a protein of which you suspect that it binds to microtubules. You intend to investigate this further using fluorescence microscopy and test whether your protein is indeed in the same place as α-tubulin. This can be tested by double staining, a method by which you would stain for the localization of your protein and α-tubulin. While a specific antibody (generated in rabbit) to your novel protein is available in your lab, you need to order all the other reagents.

From the list below, please choose the reagents that would allow you to do your experiment.

Goat-anti-mouse antibody coupled to a fluorochrome that emits red light
Goat-anti-rabbit antibody coupled to a fluorochrome that emits red light
Goat-anti-mouse antibody coupled to a fluorochrome that emits green light
Goat-anti-rabbit antibody coupled to a fluorochrome that emits green light
Goat anti-donkey antibody coupled to a fluorochrome that emits green light
Goat anti-donkey antibody coupled to a fluorochrome that emits red light
Antibody to α-tubulin that is generated in rabbit
Antibody to α-tubulin that is generated in mouse
Antibody to actin that is generated in rabbit
Antibody to actin that is generated in mouse