Membranes

Lesson 1 Objectives and Understandings

1. Students will be able to identify that membranes are a key feature of cells for regulating transport of materials in and out of the cell through written explanation
2. Students will be able to describe the key features of membranes and their purpose in the membrane through verbal description and writing.

Lesson 2 Objectives and Understandings

1. Students will be able to illustrate how membranes are selectively permeable, through a group activity.
2. Students will be able to recognize the three types of transport across membranes by a labeling activity

Content Standards

Using biology academic standards, science common core standards, and ELL standards

SCI.B.2.2 2010
Describe the structure of a cell membrane and explain how it regulates the transport of materials into and out of the cell and prevents harmful materials from entering the cell.

Common Core Standard: Science 9-10.RS.4

Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific context relevant to grades 9-10 texts and topics.

Common Core Standard: Science 9-10.RS.7

Translate quantitative information expressed in words in a text into visual form (e.g., a table or chart) and translate information expressed visually or mathematically (e.g., in an equation) into words.

ELL Standard: ELP.9.1 2003

READING: Word Recognition, Fluency, and Vocabulary Development

Language minority students will listen, speak, and read to identify word relationships and origins to negotiate meaning

Beginner Level

ELP 9.1.2: Identify some high-frequency words and roots nonverbally (e.g., by pointing to text) or with spoken words and phrases.

Early Intermediate Level

ELP 9.1.4: Identify high-frequency root words, prefixes, and suffixes to understand unknown words.

Intermediate Level

ELP 9.1.6: Identify and use high-frequency root words, prefixes, and suffixes to understand unknown words.

Advanced

ELP 9.1.9: Determine the difference between literal and implied meanings of words with an expanded spoken and written vocabulary and descriptive sentences.

Fluent English Proficient

ELP 9.1.11: Identify and use literal and figurative language with an expanded spoken and written vocabulary and complex, descriptive sentences.

Materials

- Notes Powerpoint
- Student handouts
- Coloring activity
- Dialysis Tubing
- Iodine
- Water
- Cornstarch

Safety Measures and Behavior Management

- No running or horseplay will not be tolerated and result in the removal of the offender from the lab area.
- Student will need to reminded of lab safety during diffusion lab
- All students must wash hands using soap and water prior to the lab.
- Students instructed to clean all lab surfaces with warm soapy water prior to starting the lab.
- All foreign liquids to be treated as pathogens and hazardous.
- Cornstarch, iodine, and water present
  - Googles on
  - Glassware present--so broken glassware bucket may be necessary.

Procedures

DAY ONE/ LESSON ONE

1. Engage:
    - Red Rover activity
    - Students form a barrier
    - Assign student roles
        - Water: small uncharged polar molecule
        - Potassium
        - Glucose: Large uncharged molecule
    - Pre Test
2. Explore: Hands on Inquiry (at lab stations)
    - Build a membrane
3. Explanation (at desks)
    - Powerpoint Notes
4. Exit Slip: Give me Five and Homework Sheet
    - Five facts about a membrane

DAY TWO/ LESSON TWO

5. Review key points from notes and continue if necessary
    - Give me 5 things the class needs to know about membranes
6. Elaboration (in groups at lab tables)
    - Dialysis tubing and cornstarch- Diffusion Lab
7. Evaluation (in partners)

    Create a Vine for Transport

    Post Test

Adaptations

Not necessary for this group

Potentially the exit slip activity can be completed in partners, verbally, or in small groups if necessary.

Assessment Evidence

Performance Tasks:

Creating a membrane (Formative)

Lab Activity (Summative)

Homework Sheet (Summative)

Vine (Summative)

Pre and Post Tests

Other Evidence (Formative):

Observations

Extensions

Continue with the rest of the cell

Biology: Diffusion Lab

Introduction: In this lab you will observe the diffusion of a substance across a semi-permeable membrane.

Prelab Observations: Add a small amount of starch to your beaker. Add a couple drops of iodine. Describe what happened when iodine came into contact with starch.

Procedure:

1. Put a large spoonful of corn starch in the Dialysis tubing. Add about 30 mL of water. Tie both ends of the bag tightly with thread.
2. Add about 100-mL water to a 250-mL beaker.
3. Add about 20 drops of iodine to the water in the beaker.
4. Place the tubing in the bag so that the cornstarch mixture is submerged in the iodine water mixture. Try to place it so that the tied ends of the bag is not in the water.
   - Make a drawing of the beaker and bag in your notebook. Label the contents of each. You do not have to write the procedure.
5. Collect data after 15 minutes. While you are waiting, answer the questions in your notebook.

Questions: *Answer in complete sentences so that the answers are meaningful by themselves.*

1. Define diffusion.
2. Molecules tend to move from areas of _____ concentration to areas of _____ concentration.
3. Is the bag or beaker more concentrated in starch?
4. Is the bag or beaker more concentrated in iodine?

Data Table – copy into notebook

	Starting color	Color after 15 minutes	Are iodine and starch together?
Solution in beaker			
Solution in bag			

Post Lab Analysis -- Answer in notebook

1. Sketch the cup and baggie in the space below. Use arrows to illustrate how diffusion occurred in this lab.
2. Based on your observations, which substance moved, the iodine or the starch?
3. The plastic baggie was permeable to which substance? Which substance did not go through the bag?
4. Is the plastic baggie selectively permeable? Define selective permeability in your answer.
5. What would happen if you did an experiment in which the iodine solution was placed in the baggie, and the starch solution was in the beaker? Describe what you would observe (color changes) and why.

“Red Rover” Activity

Characters:
Water: Liz
Potassium: Cecilia
Glucose: Neil
Narrator: Christina

Script:

We will be playing a game of Red Rover. What I want you guys to do is create chain by holding hands. As a barrier, your guys’ job is to allow hydrophobic molecules (oil soluble), nonpolar, or small uncharged polar molecules in and keep out large uncharged molecules, polar molecules and ions. Also incorporated into your barrier are “gates” that allow specific things in or out, without resistance. In your particular barrier, we have a sodium potassium channel and you guys jobs’ is to allow either one of these molecules in without resistance.

Given those guidelines, here we have 3 subjects.

Our first subject is Water: water is a **small** uncharged polar molecule.

Our second subject is Glucose: Glucose is large uncharged molecule

Our third subject is potassium

Now with these rules laid out, you guys are now ready to play our version of Red Rover

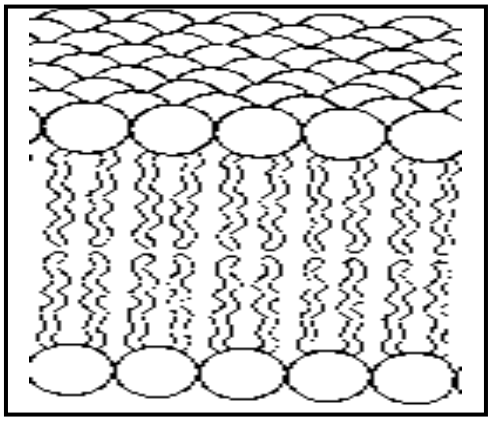
~~~~~~
~~~~~~

CELL MEMBRANE COLORING ACTIVITY

Name_____
BLOCK #_____

A cell's membrane has a double layer. It is made up of phospholipids molecules. *Lipids sound familiar?* This molecule looks like a tadpole! It has a head end and a tail end.

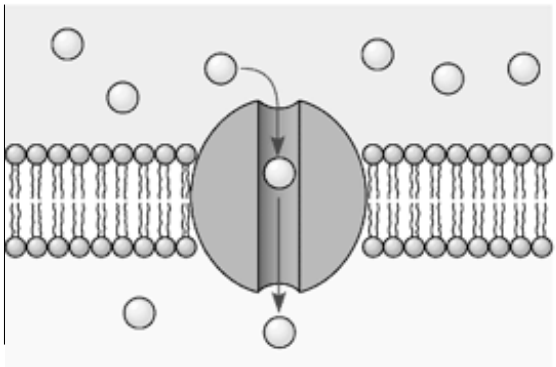
1. Color the heads purple and the tails yellow.
2. The tails "hate" water and repel from water. They are hydro_____.
3. The heads "love" water and face out toward water. They are hydro _____.



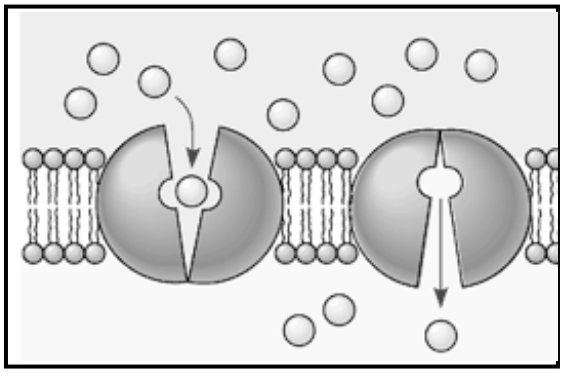
Water is so small it can squeeze between the phospholipids and enter the cell. Draw blue dots "squeezing" for H_2O.

Embedded within the phospholipid bi-layer are 3 different structures that are made of protein.

- **CHANNELS**-special tube-like structures that allow large molecules to enter the cell. Color the channels blue and the phospholipids pink. Some are always open, some open and shut, some are 1 way and some are 2-way.
  Is this one open or shut?_____



Unlike water, many molecules are too large to squeeze, like glucose and they MUST go through the channels. Color the glucose molecules (dots) green.

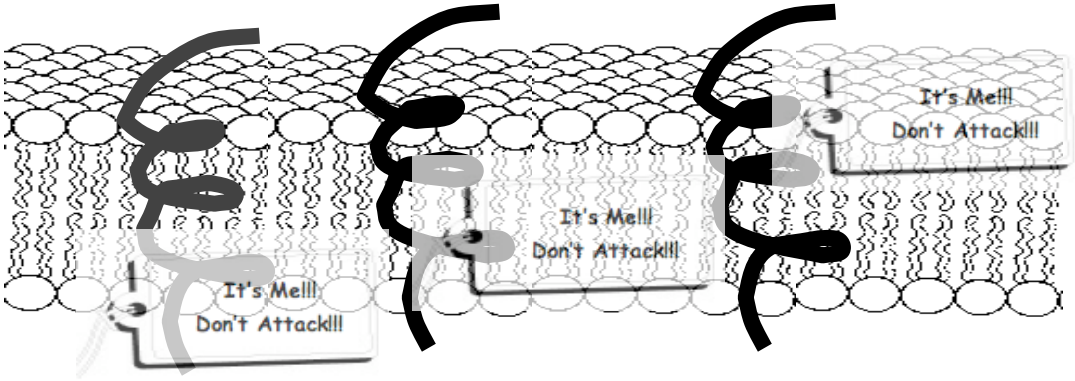


How are these two different from the open one above?

_____

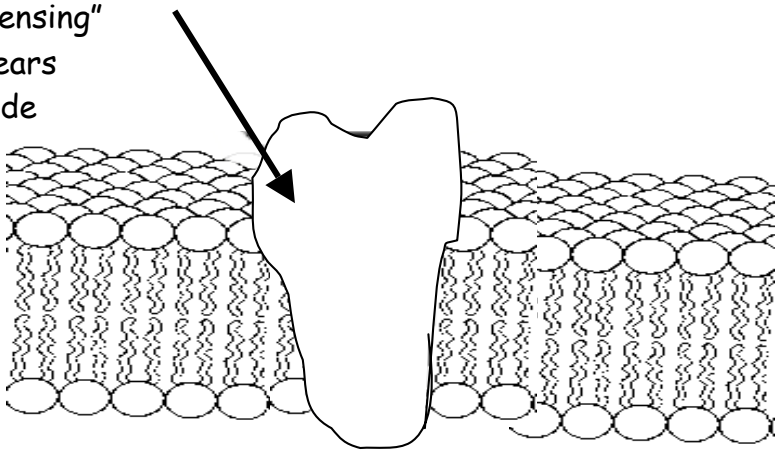
If they are to open and shut, what is needed? _____

- **MARKERS**-these are like nametags. All your cells have a protein nametag that says it belongs in your body. If a cell, like a bacteria cell, doesn't have your nametag…the White Blood Cells (your army soldiers) won't recognize and will destroy it. Color the markers orange and the phospholipids layers pink

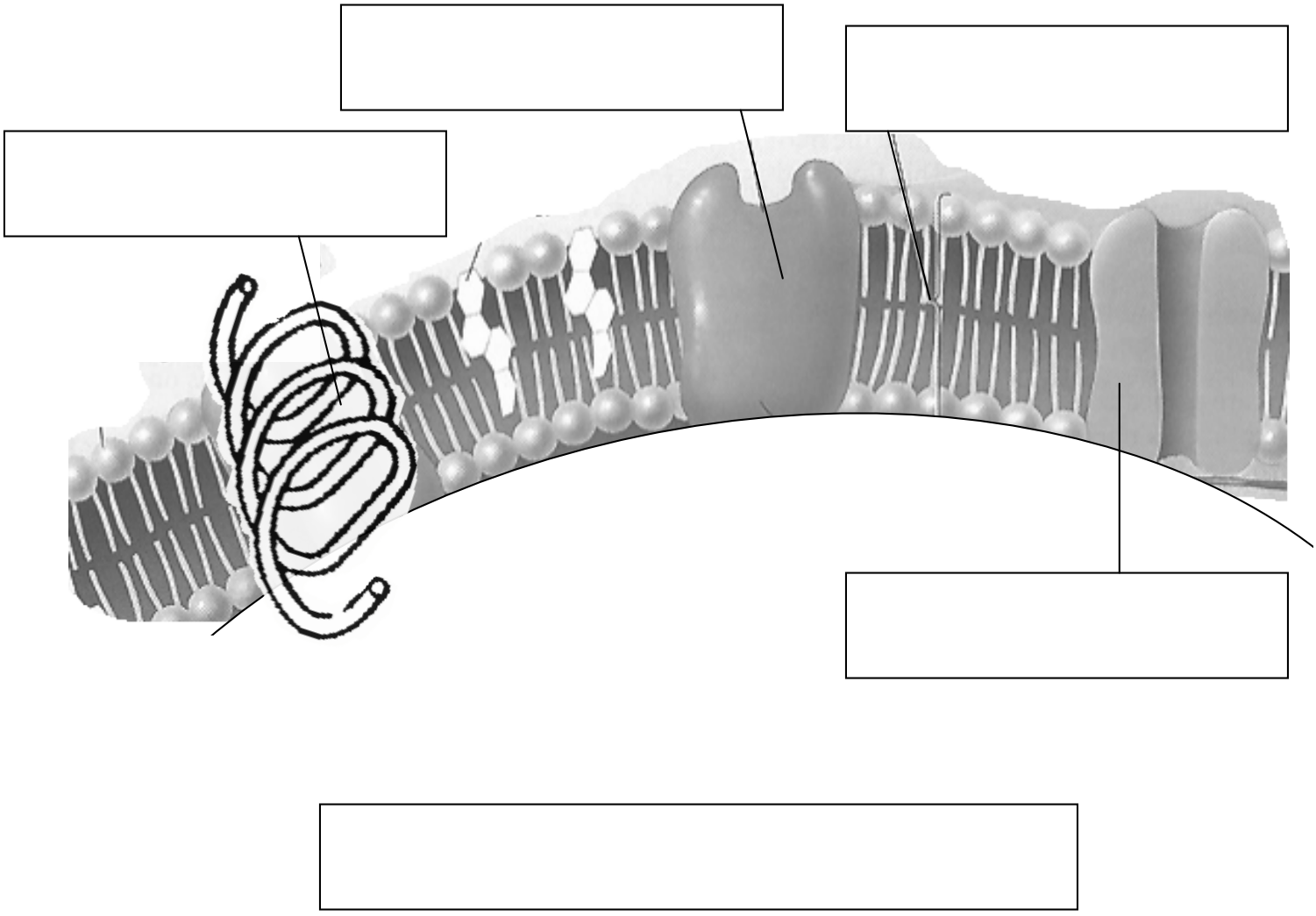


- **<u>RECEPTORS</u>**-these are special "sensing" structures. They are like the cell's eyes, ears and mouths….they communicate to the inside what's going on on the outside!

They are kind of like blobs with antennas!
Color the receptor brown and the phospholipid layers pink



4. Color the marker orange and label it.
5. Color the receptor brown and label it.
6. Color the channel blue and label it.
7. Color all the phospholipids pink and label them.
8. Color **<u>all</u>** the cytoplasm inside the cell dark red and label it.



Build-A-Membrane

Abstract

Cut, fold, and paste biomolecules to create a three-dimensional cell membrane with embedded proteins.

Learning Objectives

- Membranes have proteins embedded in them.
- Membrane-embedded proteins allow cellular signals and other molecules to pass through the membrane.

Logistics

Time Required

- **Class Time:** 30 minutes
- **Prep Time:** 10 minutes

Materials

Biomolecule cut-outs
Scissors
Tape
Copies of student instructions

Prior Knowledge Needed

None

Appropriate For:

Primary Intermediate Secondary College

Module
Amazing Cells

Build-A-Membrane

Classroom Implementation

Activity instructions:

- Have students work individually or in pairs to build a portion of a cell membrane by following the instructions on the student pages.
- On a large table, have students put their completed membrane sections together, matching channel protein to channel protein, to create one large, protein-studded membrane.

Quantities

Per Group of 2

- Student pages S1 - S4
- Scissors
- Tape

Discussion Points:

- A cell is enclosed, or defined by a membrane.
- A wide variety of proteins are located in and around membranes. These proteins can associate with membranes in a variety of ways.
  - » Integral proteins extend through one or both layers of the phospholipid bilayer.
  - » Some proteins are attached to lipid molecules which anchor them to the membrane.
  - » Receptor proteins transmit signals across a membrane.
  - » Transporter and channel proteins form pores through the membrane that can be opened and closed to allow specific molecules to pass through.
- Membranes also organize the interior of a cell. Cell organelles are defined by membranes.
- Membranes form spontaneously.

Extensions

Research a membrane protein and its specific function.

Standards

U.S. National Science Education Standards

Grades 9-12:

- Content Standard C: Life Science - The Cell; Cells have particular structures that underlie their functions. Every cell is surrounded by a membrane that separates it from the outside world.

B. AAAS Benchmarks for Science Literacy:

Grades 9-12
The Living Environment

- Cells
  - » Every cell is covered by a membrane that controls what can enter and leave the cell.

Module
Amazing Cells

Build-A-Membrane

Credits

Molly Malone, Genetic Science Learning Center
Sheila Avery, Genetic Science Learning Center (illustrations)

Funding

Funding for this module was provided by a Science Education Partnership Award from the National Center for Research Resources, a component of the National Institutes of Health.

SEPA SCIENCE EDUCATION PARTNERSHIP AWARD
Supported by the National Center for Research Resources, a part of the National Institutes of Health

Why Visit Our Website?

Visiting the Teach.Genetics website has its benefits. You'll get exclusive access to great resources just for you!

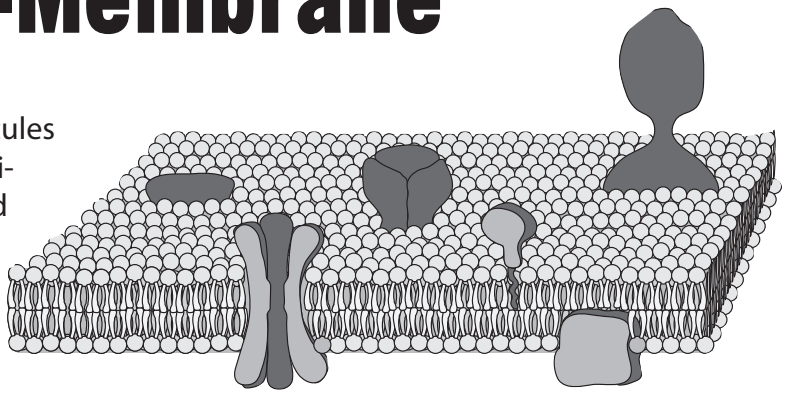
- Get links to resources for this and other Print-and-Go™ activities.
- Access extra media materials for this module.
- Download classroom-ready presentations and graphics.
- Tips for using Print-and-Go™ activities with online materials.

and much more!

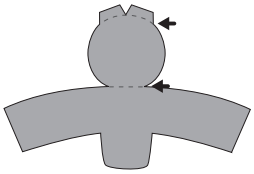
Name _____

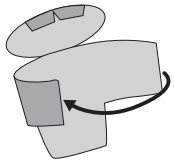
Date _____

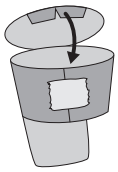
Build-A-Membrane

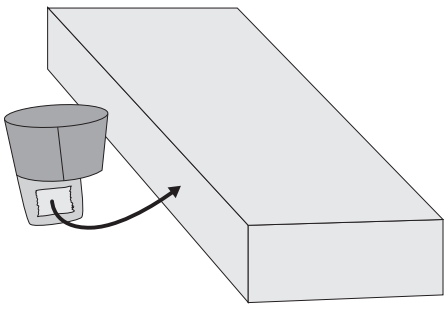


Cell membranes are made of phospholipid molecules that arrange themselves into two rows called a bi-layer. Proteins are embedded in the phospholipid bilayer, through one or both layers. These proteins help other molecules cross the membrane and perform a variety of other functions. Create a model of a small section of cell membrane by following the instructions below.

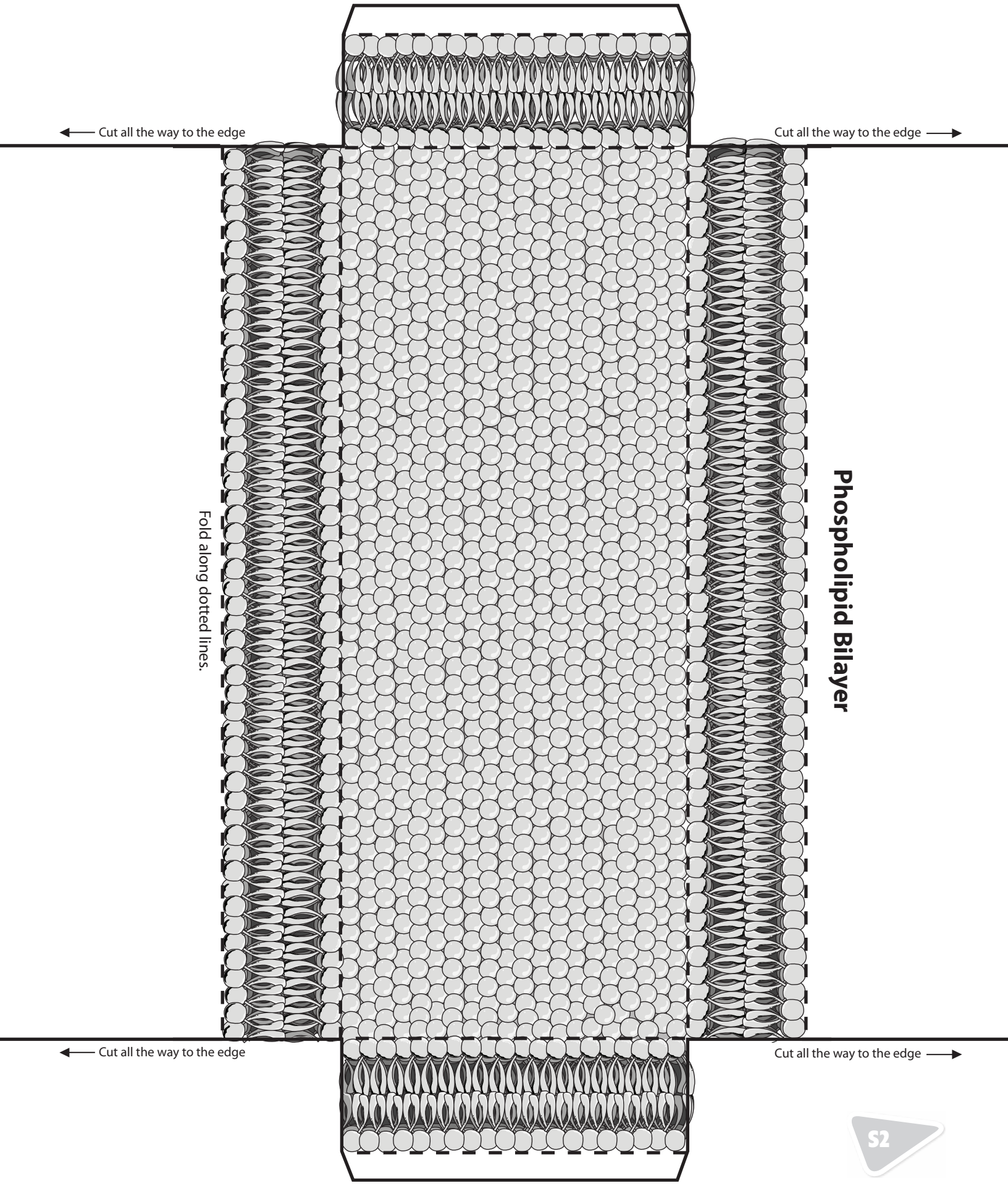




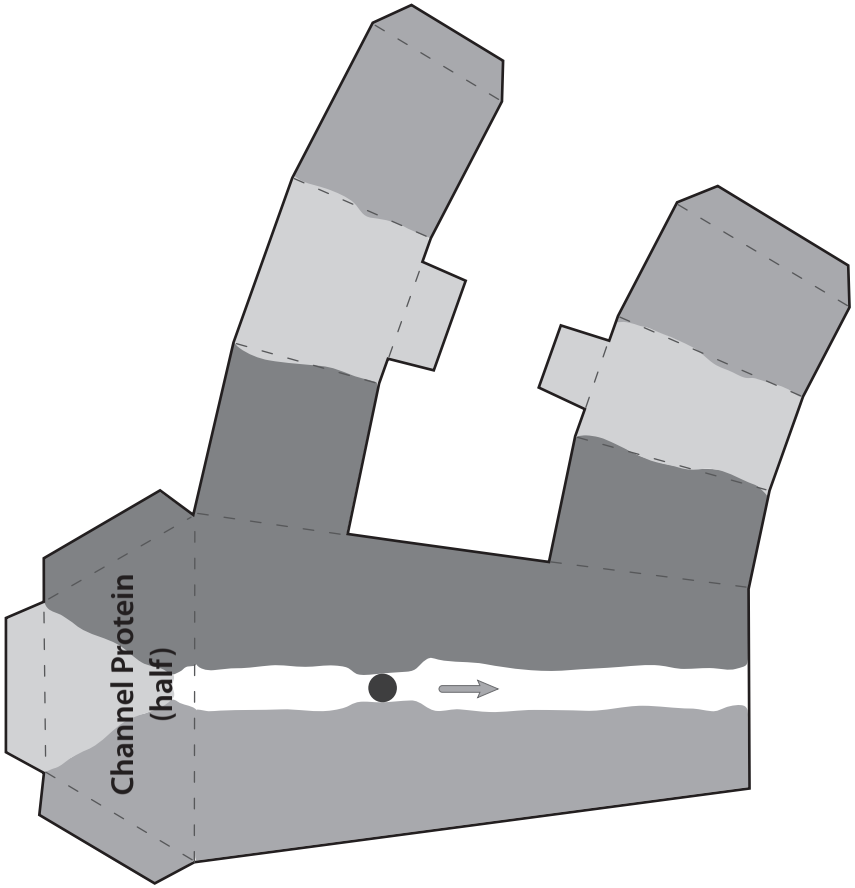


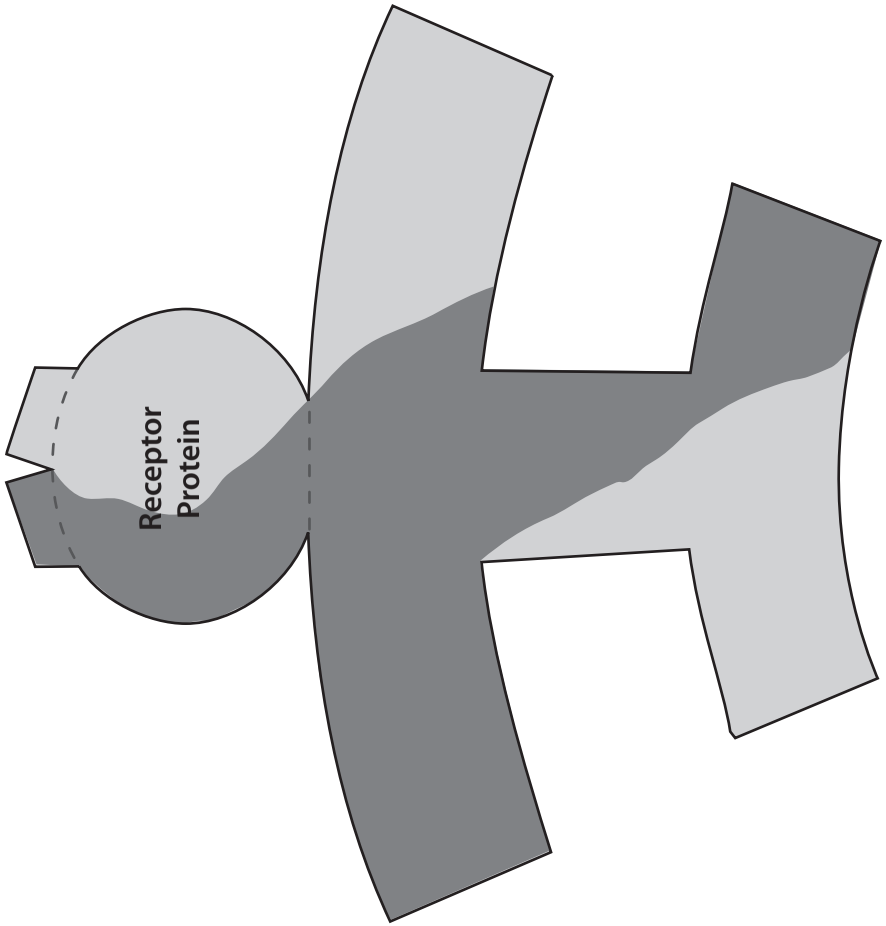


1. Cut out the phospholipid bilayer (page S2) along the solid lines. Cut all the way to the edges of the paper in the direction of the arrows.
2. Fold the phospholipid bilayer along the dotted lines and tape the edges together to form a fully enclosed rectangular box.
3. Cut out each protein (pages S3 and S4) along the solid black lines and fold along the dotted lines.
4. Form a 3-D shape by joining the protein sides and tops together and tape them in to place. Use the tabs to help you.
5. Tape the 3-D proteins into place along the edges of the phospholipid bilayer.
6. By staggering the transmembrane proteins back and forth along both long sides of the bilayer "box", the whole model will stand up by itself on a table.


Cut all the way to the edge
Cut all the way to the edge
Fold along dotted lines.
Phospholipid Bilayer
Cut all the way to the edge
Cut all the way to the edge

Protein Cut-outs





Protein Cut-outs