

CHAPTER 5

ACTIVITY IDEA 5A LAB: DISSECT SOME BEANS

You will need:

- a selection of beans or peas (green beans, snap peas, even some dried beans that have been soaked)
- optional: You can provide utensils for dissecting beans, but fingers can do a pretty good job, too.

What to tell the students:

This is your chance to see those parts you read about in the chapter. Can you find the plumules and embryo in each seed? Can you peel off the seed coat? Can you find the cotyledons?

What to do:

- 1) If working with pods, peel the pods open slowly and carefully so you can see how the seeds are attached. (After the beans detach from the pod, the scar left on the bean (where it was once attached) is called the hilum.)
- 2) Are all the seeds the same size? Sometimes you'll find a "runt" that seem to not be developing much at all compared to the other seeds in the pod.
- 3) Open each bean or pea seed carefully and find the plumule leaves, the two cotyledons, and the radicle (the future root).

ACTIVITY IDEA 5C SNACK: TRY SOME PLANT-BASED "MEATS"

Buy a selection of different plant-based meats and cook according to package directions. Have the students read the ingredients labels to get an idea of what is in each product. Have the students discuss their reactions to each food. Is the company trying to fool you into thinking you are eating meat, or have they made a product that stands on its own as a unique food product?

ACTIVITY IDEA 5C SNACK: TRY SOME BEANS

Buy one can each of as many types of canned beans as you can find (dark kidney, light kidney, black beans, cannellini, fava or butter beans, navy beans, mung beans, black-eyed peas, great northern beans, chickpeas (a.k.a. garbanzo beans), pintos, limas). Drain the beans (keep the liquid if you want to do activity 5D, making "aquafaba"). Have the students compare taste and textures. Which one holds its shape best? Which one has the strongest flavor? The least flavor? Have them vote for their favorite, or least favorite, bean.

ACTIVITY IDEA 5D COOKING ACTIVITY: MAKE "AQUAFABA" (an egg-free alternative meringue)

You will need:

- the liquid from a can of chickpeas (also called garbanzo beans) (If you can't use chickpeas, substitute with liquid from another type of bean, such as kidney beans)
- cream of tartar
- granulated sugar
- vanilla (either real or imitation)
- an electric hand mixer or a stick blender

What to do:

- 1) Put the bean liquid into a bowl. Add 1/4 teaspoon cream of tartar.
- 2) Beat this mixture until it is foamy and soft peaks start to form.
- 3) Add the sugar gradually, while beating.
- 4) Add vanilla, and beat until stiff (pointed) peaks form.
- 5) Now it is ready to use. If you don't have a pie to put it on, you can bake it into cookies. Put spoonfuls of meringue onto a cookie sheet and baked on greased cookie sheet at 200° F (95° F). Bake for 90 minutes, until crisp and dry.

ACTIVITY IDEA 5E PLAY MORE "FRUIT AND VEGGIE CARD GAMES"

Hopefully, you didn't play all the games already! Since we studied beans and potatoes in this chapter, vegetable cards fit right in with the theme of this chapter. Play at least one more game with the cards.

ACTIVITY IDEA 5F REVIEW CARD GAME:

You will need:

- copies of the following pattern pages (printed onto card stock if possible)
- scissors
- tape or string to divide your playing area

How to prepare:

1) This game is played with two teams. A team can be from one to four players (though in a pinch you could have as many as six on a team.) You don't need the same number of players on each team. For example, you can have three on one team and four on the other. You will need two sets of cards (two copy of each of the three pattern pages) if you have a total of two to six students playing. Make three copies of each page if you have a total of seven to twelve players.

3) Use string or tape to divide your playing space. (I used blue painter's tape on my long plastic table.) You need a three areas, as shown. The middle strip is a neutral zone that does not belong to either team. All the cards will be scattered, face down, around the length of the neutral zone at the beginning of the game.



How to prepare:

1) Before you start to play, let the students see all the cards. Help them to find all the matches.

Here are the molecules you can make:

- | | |
|--|---|
| 1) amino acid (the only set that has three cards instead of two) | 2) acetic acid (C_2COOH) |
| 3) sodium bicarbonate NaHCO_3 | 4) calcium phosphate $\text{Ca}^{2+}\text{PO}_4^{3-}$ |
| 5) triglyceride (fatty acids plus glycerin "hanger") | 6) water, H_2O |
| 7) potassium benzoate | 8) beta-carotene (one bunny card will be upside down) |
| 9) sucrose (gray carbon atoms) | 10) lactose (white carbon atoms) |

2) Pull out these cards: lactase enzyme, sucrase enzyme, beta-carotene enzyme, pH card. These four cards are able to split molecules. Make sure the players can identify which molecules they can split (lactose, sucrose, beta-carotene, water).

3) Stack all the cards together and shuffle thoroughly.

How to play:

1) The object of the game is for your team to work cooperatively to form all ten molecules listed above. You will lay your finished molecules out on the table so both teams can see them. The first team to make all ten molecules wins the game.

2) Shuffle the cards well, then scatter them, face down, along the neutral zone.

3) Each player then draws 2 cards to start. Each player's hand of cards can be seen by other members of their own team, but should be kept hidden from the other team.

4) The teams will take turns playing. During a team's turn, each player on that team will choose ONE of the following actions.

OPTION #1: Draw a card from the pile in the neutral zone.

OPTION #2: Trade one card with another player on your team. When this option is used, it will count as both players' chosen option. This option is used in order to bring pairs of cards together so you can lay them down. As you play, you will discover that you often need to look at everyone's hands to determine what the best trade will be. Each player can only trade one card per turn, so you can't have three players all trading cards. If two players decide to trade cards (in order to put a match in one person's hand), then those two players have used their move for that turn and a third player will have to make a move on their own. As the game progresses, you will begin to see trading strategies that are more advantageous than others.

OPTION #3: Play a TRADE card if you have one. The TRADE card allows you to return one of your cards to the neutral zone, along with TRADE card, then draw a fresh card.

OPTION #4: Play an enzyme card or a pH card against the other team. For example, if the other team has a completed a sucrose molecule, and you have a sucrase enzyme, you can destroy their molecule and return the parts to the neutral zone. Once a destruction card (enzymes and pH) is played, it is removed from the game.

5) The only "free" move that does not count as your chosen option is laying down a completed set/pair of cards. For example, you can choose the option to draw a card from the neutral zone, and if it happens to match a card in your hand, you can immediately lay down the finished molecule.

6)

Adaptation of the rules for playing with only two players (one against one):

1) Start with four cards instead of two.

2) Obviously, you can't share or trade cards with another player so you can't use option #2. However, the game will still work even without this option.

ACTIVITY IDEA 5G MOLECULE MAT for chapter 5

You will need:

- a copy of the Molecule Mat chapter 5 pattern page
- toothpicks
- the materials for the atoms

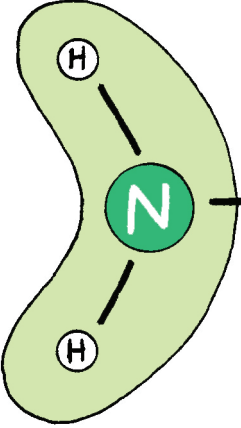
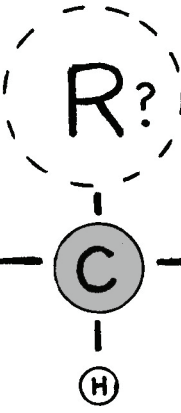
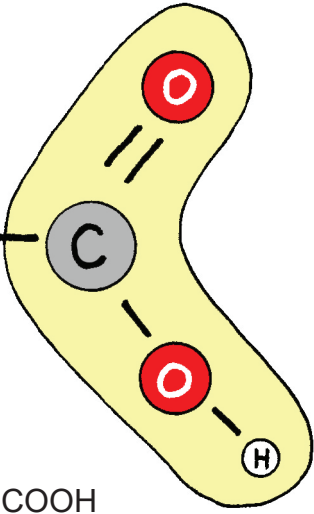
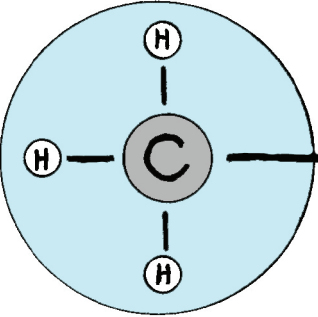

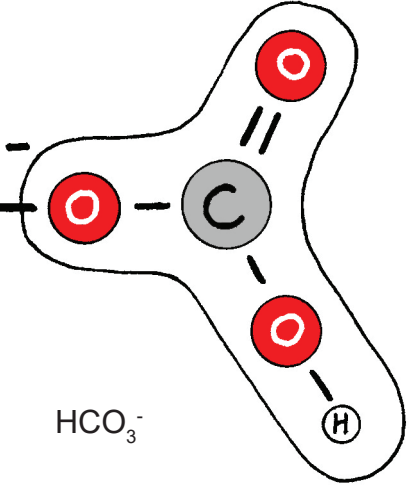
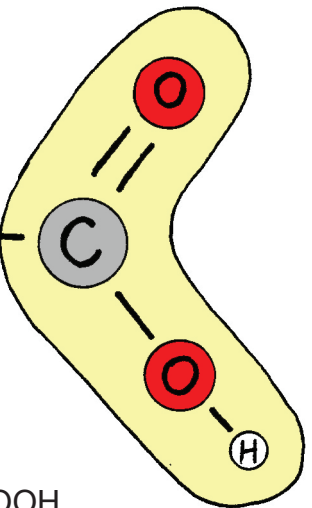
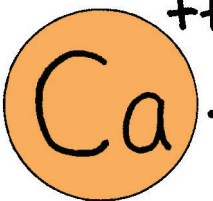
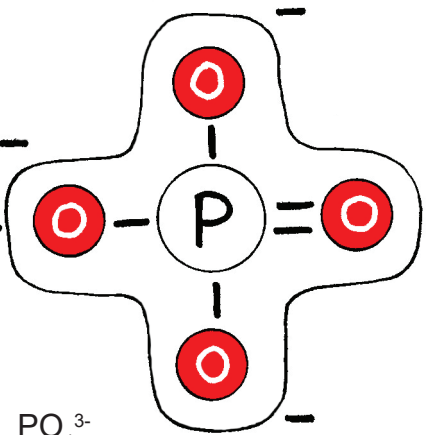
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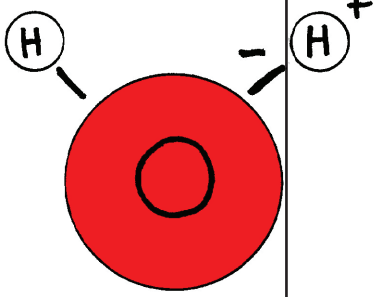

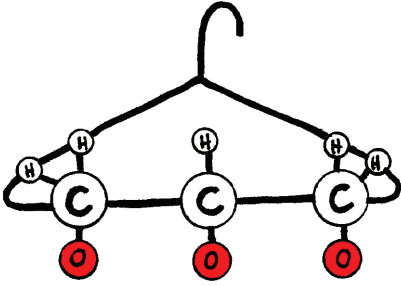
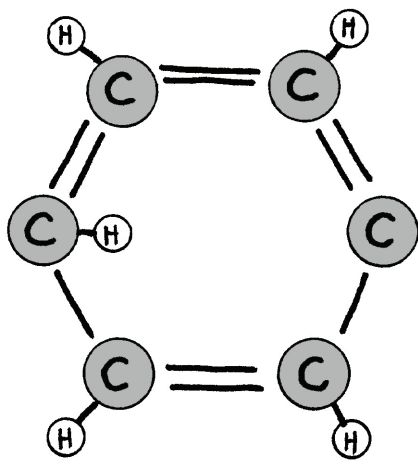
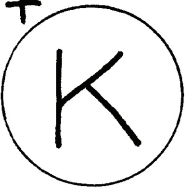
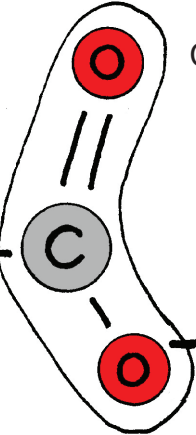
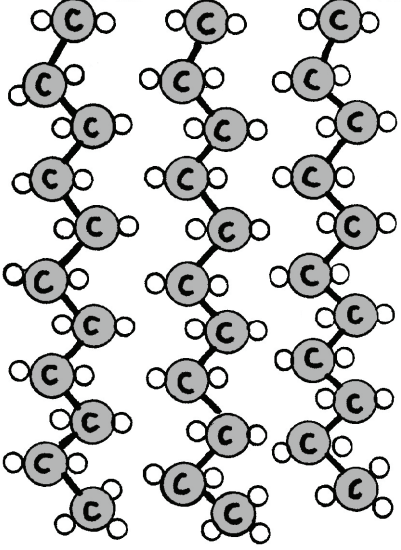
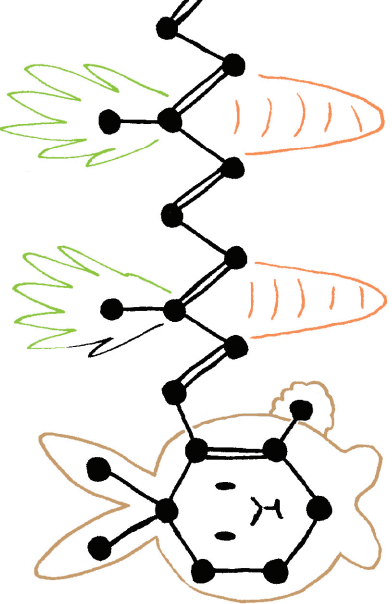
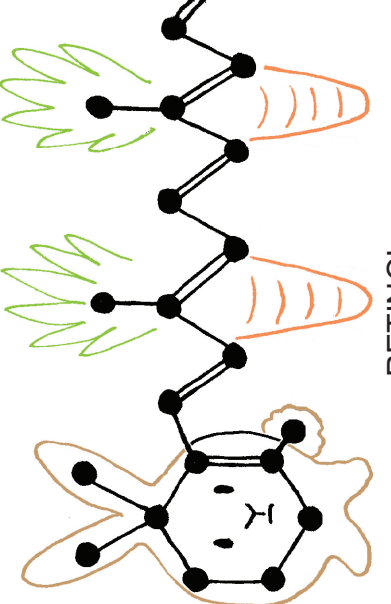
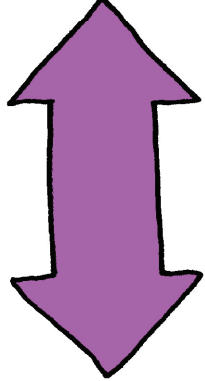
1) Put your chosen materials inside the boxes on the bottom of the page (or in small dishes if they won't fit inside the boxes). Toothpicks can be set in a dish, or simply in a pile, within the student's reach.

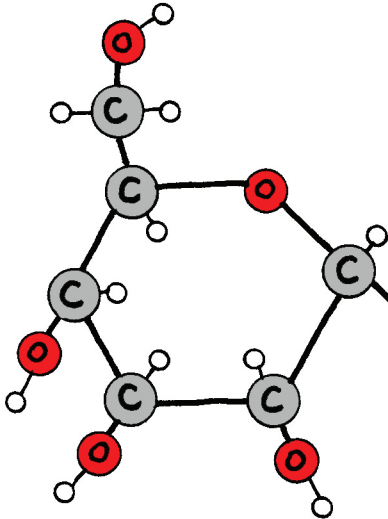
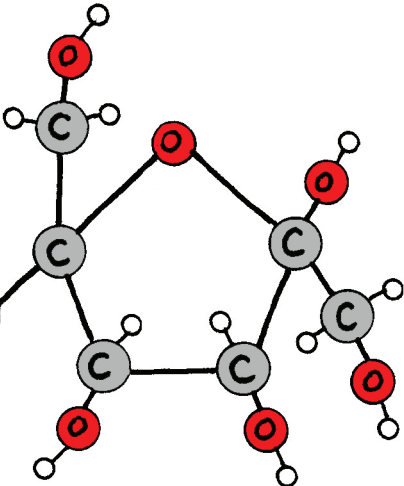
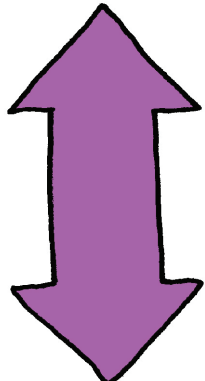
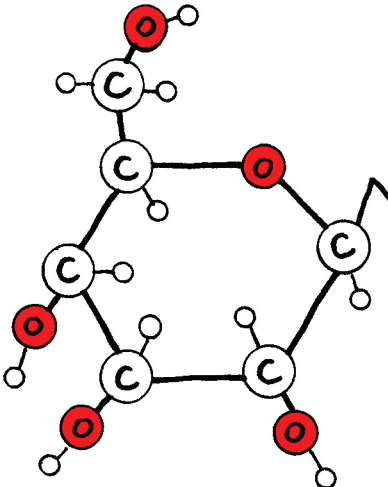
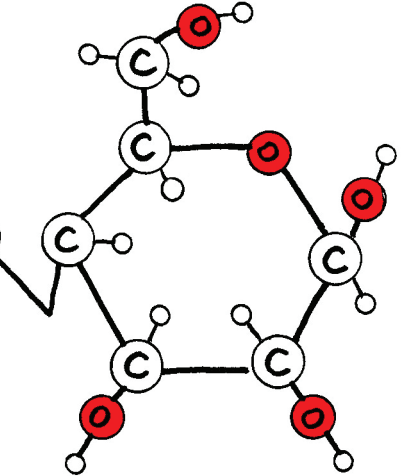
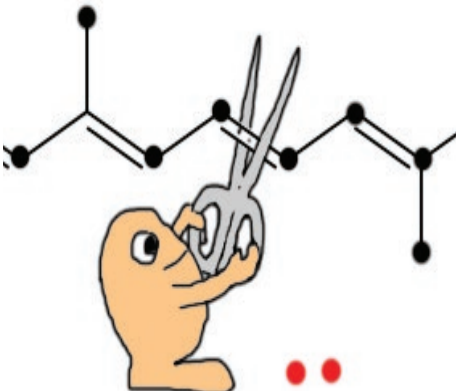

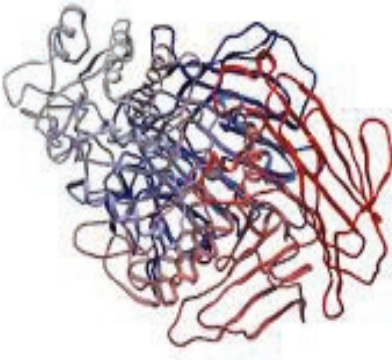
2) Let the students work on their own as much as possible.

3) The molecules are likely to be large enough that all both will not fit onto the page. You can tell your student to build one, then recycle the parts. Notice that we are not going to worry about making these molecules curve. We'll just focus on counting the C's and H's.

4) For students who are keeping a portfolio of their work, take a photo of their paper with all the finished molecules on it.

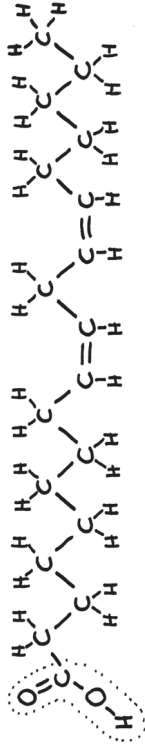
<p>AMINE GROUP</p>  <p>NH₂</p>	 <p>ALPHA CARBON and "R" GROUP (20 possible R's)</p>	<p>CARBOXYL GROUP</p>  <p>COOH</p>
<p>METHYL GROUP</p>  <p>CH₃</p>	 <p>SODIUM ION</p>	 <p>HCO₃⁻</p> <p>BICARBONATE</p>
<p>CARBOXYL GROUP</p>  <p>COOH</p>	<p>CALCIUM ION</p>  <p>PHOSPHATE</p>	 <p>PO₄³⁻</p>

 <p>HYDROXIDE ION</p>	 <p>HYDROGEN ION (PROTON)</p>	<p>GLYCERIN</p> 
<p>BENZENE RING</p> 	 <p>POTASSIUM ION</p>  <p>COOH</p>	 <p>FATTY ACIDS</p>
 <p>RETINOL</p>	 <p>RETINOL</p>	<p>TRADE</p>  <p>TRADE</p>

<p>GLUCOSE</p> 	<p>FRUCTOSE</p> 	<p>TRADE</p>  <p>TRADE</p>
 <p>GLUCOSE</p>	 <p>GALACTOSE</p>	 <p>ENZYME: beta-carotene 15,15' monooxygenase</p>
 <p>LACTASE</p>	 <p>SUCRASE</p>	<p>pH</p> <p>This card will split water into OH⁻ and H⁺.</p>

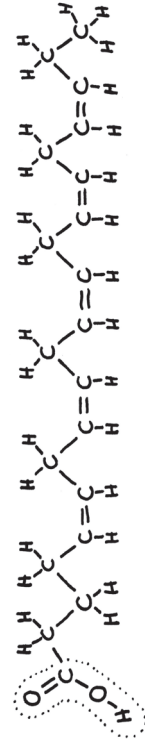
MOLECULE MAT Chapter 5

Omega-6 fatty acid
LINOLEIC ACID (*lin-oh-LAY-ick*)



COOH is marked just to help you see it as a unit. That H might come off, which is why it's called an acid.

EPA Omega-3 fatty acid
(Eicosapentanoic acid)



We saw in the chapter that this molecule is actually curved. However, it will be easier for you if we don't worry about the curve and let you just concentrate on where the H's are.

H - hydrogen	O - oxygen	C - carbon
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