Holiday Spirit Reactions

Pillar: Positive Social Environments
Division: IV
Grade Level: 11
Core Curriculum Connections: Biology 20

I. Rationale:

This activity is sure to be a catalyst to creating a positive social environment in Biology classroom and get your students into the holiday spirit! Students are provided with an opportunity to personalize their understanding enzyme function. Using a holiday motif, each student invents an enzyme and its substrates to represent what produces the holiday feeling for them. This activity encourages students to exercise their creativity and celebrate their diversity while demonstrating their understanding of enzyme function in a very unique way.

II. Activity Objectives:

The students will:

- *represent their learning in personally, socially, and culturally significant ways that allow them to express their individuality.*
- *appreciate their uniqueness and celebrate this diversity within the classroom environment.*

III. Curriculum Outcomes: Biology 20

Unit D: Human Systems
General Outcome 1 *Students will* explain how the human digestive and respiratory systems exchange energy and matter with the environment.
20–D1.3k explain enzyme action and factors influencing their action; i.e., temperature, pH, substrate concentration, feedback inhibition, competitive inhibition

IV. Materials:

- directions for the project (see Holiday Spirit handout following the lesson)
- strips of 8" X 14" construction paper
- scissors and glue
- holiday paper of various types (the more diverse, the better)
- gold or white paint pens to label molecules cut out of non-solid paper
- markers for labelling.

V. Procedure:

a. Teacher Preparation:

Make a large cardboard model of the Holiday Spirit molecule, the Love enzyme, and the separate substrates Holiday and Spirit to show students when introducing the activity. Suspend the models from the ceiling for the duration of the activity.

b. Student Prior Knowledge:

Students should know that enzymes are protein catalysts which facilitate and control all of the chemical reactions of life. They should know that enzymes work by combining temporarily with their substrates to bring about favourable orientation for the formation of a chemical bond between the substrates. The idea that the function of an enzyme depends on its shape will emerge in this activity.

1. Introduce the project using cardboard models to act out the Holiday Spirit Reaction.

2. For homework, ask students to think of a holiday molecule and an enzyme they would like to illustrate. If you have them, post some examples from previous years, or make a model story strip yourself, but emphasize that students should be creative and encourage them to celebrate their culture if they wish.

3 . As students work, circulate around the room and have them individually explain the steps of their reaction to you. They should be able to do this and identify terms in their model before they paste.

4. Display the different story strips to recognize individuality and celebrate diversity.

5. Lead a discussion about the assembled story strips. Ask if the enzyme from one strip could catalyze the reaction on a different strip. What determines the shape of an enzyme? What would happen if a molecule similar to the enzyme's substrate stuck onto the active site and didn't fall off? (Noncompetitive inhibition). What if something attached to the enzyme and distorted the shape of the active site? (allosteric inhibition). What if there were other molecules which, like the real substrates, could attach briefly to the active site, but fell away without forming the product? (competitive inhibition).

VII. Assessment Ideas:

- grade diagrams and story strips for accuracy (order of steps, correct labels, frame description) as well as creativity.

VIII. Source:

- adapted from the National Health Museum: Access Excellence.

Student Handout:

HOLIDAY SPIRIT REACTION

Enzymes are protein molecules that help other molecules (substrates) react together (or break apart). They have active sites which hold the substrates in position so that a chemical bond can form between them with less activation energy. The combination of an enzyme and its substrate is called an enzyme-substrate complex. Once the bond is made, the enzyme-substrate complex breaks up. The joined substrates (now called the product) leave the enzyme. The enzyme is now free to help another pair of substrates bond together.

1. Visualize this process by making a model with a holiday motif. Our product will be HolidaySpirit (or any two-word holiday phrase you choose: HabariGani (Kwanzaa), FelizNavidad, ProsperousNewyear, MerryChristmas, HappyHanukkah, etc.). What is it that helps produce this holiday feeling for you? Love? Friendship? Peace? These things help create the holiday feeling but are not used up! Choose one (e.g. Love) to be your enzyme.

a. Draw your combined enzyme and substrates to the right. This is the enzyme-substrate complex.
b. Write the names you have chosen for the enzyme, and product on the drawing.
c. Using your drawing as a pattern, cut out 5 enzyme shapes of one color, and ten of each substrate shape using different colors.

2. Obtain a 8" X 14" strip of construction paper and fold it into 4 frames. Arrange your shapes to illustrate the enzyme-catalyzed reaction. CHECK WITH YOUR TEACHER BEFORE YOU DO ANY PASTING OR PERMANENT WRITING. Write these captions below each frame, and put in arrows and labels to show substrates, enzyme, active site, and product.

Frame 1: The substrates (e.g. Holiday and Spirit) can't react together by themselves. They bump together in ways that do not fit. They have too little or too much energy to form a bond. No HolidaySpirit (or your choice) is produced.

Frame 2: The substrates attach to the active site on the enzyme (arrows).

Frame 3: An enzyme-substrate complex is formed. Now the substrates (Holiday and Spirit) can react together. The (Love) enzyme holds them in the correct position.

Frame 4: After the product (HolidaySpirit) forms, it falls off of the enzyme. The enzyme is then free to help new substrate molecules to form the product. (Show the product leaving the active site of the enzyme and 2 new substrates coming to the empty active site on the enzyme. Show several product molecules that have been made earlier by the enzyme.)