Catalysts to School Spirit

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

I. Rationale:

This activity will *'catalyze'* the creation of a positive social environment in your Biology classroom by igniting and revitalizing your students' sense of school spirit! Through this lesson, students are provided with an opportunity to personalize their understanding of enzyme function and reflect upon the true meaning of school spirit. Using a school spirit motif, each student invents an enzyme to represent their ideas and insights about what helps to create and maintain school spirit. Students are encouraged to express their uniqueness, celebrate their diversity, and demonstrate their understanding of enzyme function in a very unique way.

II. Pillar Focus (Positive Social Environment):

The students will:

- *represent their learning in personally, socially, and culturally significant ways.*
- *express individuality, appreciate uniqueness, and celebrate diversity within the classroom.*

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:

- **Enzyme PowerPoint (attached)**
- directions for the project (see ***School Spirit*** handout following the lesson)
- strips of 8" X 14" construction paper
- scissors and glue
- an assortment of paper of various types and color (the more diverse, the better)
- gold or white paint pen to label molecules cut out of non-solid paper
- coloured markers for labelling.

V. Procedure:

Teacher Preparation: Make a large cardboard model of the School Spirit molecule, the 'Pride' enzyme, and the separate substrates 'School' 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 have an understanding of enzyme function and be able to explain 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. Review enzyme function by viewing and discussing the attached power point. Use the accompanying diagrams and slides to demonstrate the creation of the school spirit molecule as an example. You could also spend some time talking about different factors that influence enzyme function and various factors influencing their action such as temperature, PH, substrate concentration, feedback inhibition, and competitive inhibition. Have students contribute answers to complete the missing information as they go and record it if necessary as a form of review.

2. Introduce the project using cardboard models to act out the School Spirit Reaction.

3. Ask students to think of an enzyme that would help to create the **School Spirit** molecule and or a **Positive Environment** molecule. 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 express their individual ideas. For example, they might identify **respect** as a critical element (enzyme) needed to facilitate the creation of a positive environment at school.

4. Handout the instructions for the activity and review the expectations and steps involved.

5. As students work, circulate around the room and have them individually explain the steps of their reaction to you. Ask several questions to assess their comprehension level before they paste.

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

7. Lead a class discussion about the assembled story strips. Ask if the enzyme from one strip could catalyze the reaction on a different strip. Discuss factors that influence enzyme action such as temperature, pH, substrate concentration, feedback inhibition, competitive inhibition. 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? (Non-competitive 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).

8. At the end of your discussion, reinforce that although the enzyme falls away from the substrate because it has facilitated the creation of school spirit in one realm of school life, it is not used up. It will be important for the enzyme (pride) to be reinforced throughout all areas of the school community, so that it can continue to develop and inspire school spirit everywhere within the school. Provide examples to illustrate this point further: Creating pride in one’s school work is just as important as ensuring pride is evident in the cafeteria, and as well as on the volleyball court.

VII. Assessment:

- Formative Assessment: Assess the student's oral explanation of the steps in their reaction.
- Summative Assessment: Assess complete diagrams and story strips for accuracy (order of steps, correct labels, frame description) as well as creativity.

Student Handout ***Name: _____***

SCHOOL 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) leaves 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 school spirit motif. Our product will be SchoolSpirit or Positive Environment. What is it that helps produce this feeling for you? Respect? Pride? Acceptance? Encouragement? Responsibility? Integrity? Trust? Achievement? These things help create the school spirit or a positive environment, but are not used up! Choose one (e.g. Acceptance) 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 an 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. School and Spirit - or - Positive and Environment) 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 SchoolSpirit is produced.

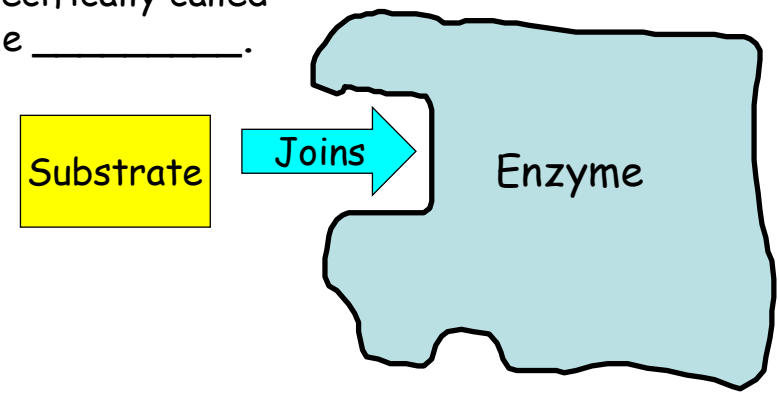
Frame 2: The substrates attach to the active site on the enzyme (arrows).

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

Frame 4: After the product (SchoolSpirit) forms, it falls off of the enzyme (pride). The enzyme is then free to help new substrate molecules to form the product. Pride can move to other areas of the school creating school spirit (sport teams, award ceremonies, volunteerism in the community etc.)
a. Show the product leaving the active site of the enzyme and 2 new substrates coming to the empty active site on the enzyme.
b. Show several product molecules that have been made earlier by the enzyme.)

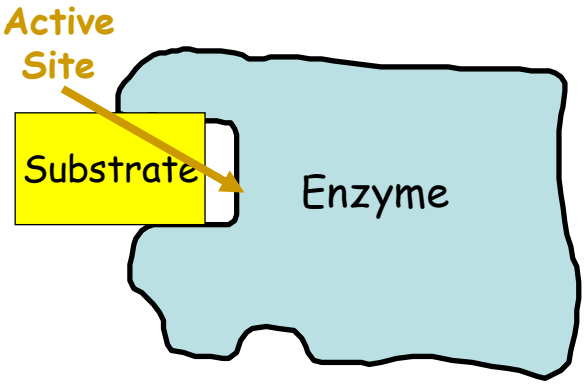
Enzyme-Substrate Complex

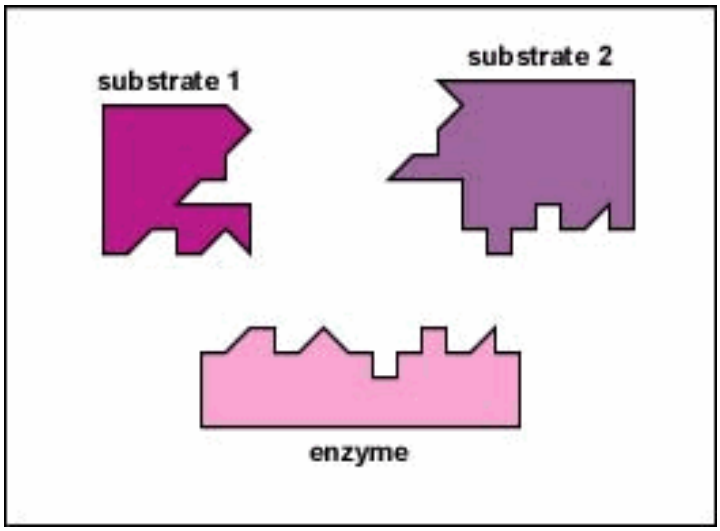
The **reactant** an **enzyme** acts on is specifically called the _____.



_____ _____

- A specific region of an **enzyme** molecule which **binds** to the **substrate**.





EnzymeAnimation : Gary E. Kaiser http://student.ccbcmd.edu/biotutorials/proteins/enzsub.html

View : http://highered.mcgraw-hill.com/sites/0072495855/student_view0/chapter2/animation__how_enzymes_work.html