The Nucleus

Official Quarterly Newsletter of the Texas Association of Biology Teachers

Volume 19, Issue II **Spring, 2006**

President's Message: Spring Is In The Air!

According to Samuel Johnson (1709-1784), "There is, indeed, something inexpressibly pleasing in the annual renovation of the world and the new display of the treasures of nature." Spring's "treasures of nature" often make it a biology teacher's favorite time of year. The very mention of spring brings images of young blossoms and sprouting seedlings, as well as increased awareness of the world around us. Spring is an ideal time of year to bring natural events into the classroom. Better yet, it is a great time to bring the classroom out to nature. An activity is included in this edition that can be used to get your biology students outside for a spring time botanical scavenger hunt.

In keeping with spring's theme of "annual renovation," TABT has reactivated our organization's committees. Each committee has been filled by three members who will serve for one to three years. The newly formed membership roster for our standing committees can be found online at the TABT Web site (***http://www.texarkanacollege.edu/~mstorey/TABT/index.html***). If you have an ideas or suggestions of how our organization can better meet your needs, you are encouraged to contact the committee members or officers. We look forward to a productive season of accomplishment as a variety of members become involved TABT activities and planning.

Spring is the time to shake off the settled, lethargic winter crust and undertake new beginnings. Take advantage of the energy of spring to intentionally plan your personal growth activities. There are some upcoming events and dates that you may want to include as you set your spring and summer calendar of professional activities. For example, April 30 is the deadline for submitting a proposal for a presentation at CAST 2006. You can help others grow by sharing your ideas. When you submit your proposal, indicate that you are part of the TABT strand. Now is the time to register for summer professional development opportunities, such as those listed on TABT's home page. Additional professional growth opportunities through AP and PreAP Biology summer institutes are listed at ***http://apps.apcentral.collegeboard.com***.

Agreeably, "there is, indeed, something inexpressibly pleasing" in the renewal of spring. I encourage you to make plans and take actions to bring an intentional freshness into classroom and professional life.

Debbie Richards, TABT President
debbier@bryanisd.org

In this issue ...

A Simple Enzyme Model

Introduction: Biology teachers know the value of inexpensive models to demonstrate abstract biological concepts. Today's biology students are visual and tactile learners. Hands-on models and manipulatives allow them to engage multiple senses during the learning cycle, making them useful teaching tools. The model described here can be prepared in about 30 minutes using inexpensive, yet colorful, craft foam.

Teaching Objective: The learner will be able to identify the components of a typical catalytic cycle and describe the relationship among the enzyme, substrate, and active site.

Materials Needed: (for a class of 28 students)
28 pieces of 5x7 craft foam (all 1 color)
28 pieces of 5x7 craft foam (of another color)
1 piece of 8x11 craft foam
2 3cm strips of self-stick magnetic tape
1 roll of masking tape
1 pair of scissors

1 gallon sized resealable storage bag

Preparation Instructions: Place two different colored 5x7 pieces of craft foam on top of each other lining up the edges. Cut out a random shape along one side of both the craft foam pieces. This cut (Fig. 1) will produce the substrate and active site shape for two model sets. Repeat this procedure with pairs of different colored craft foam.

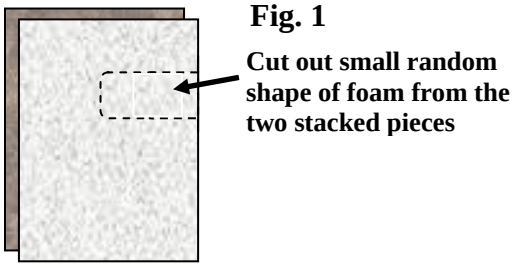


Fig. 1

As you are preparing the model sets, be sure to use random shapes for the active sites. See Fig. 2 below. This will allow you to clearly demonstrate enzyme specificity as you explain the catalytic cycle.

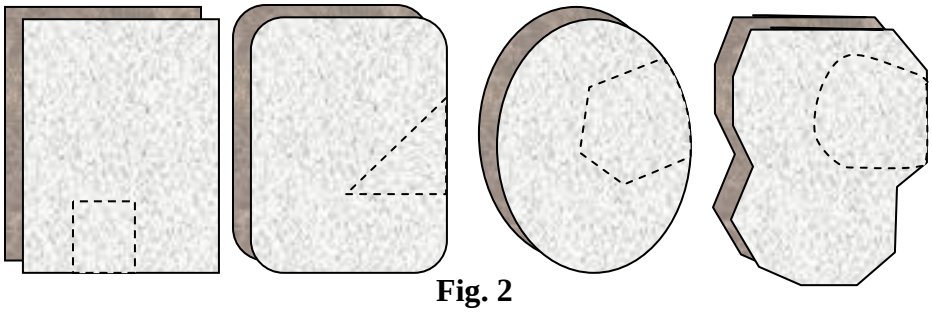


Fig. 2

Remove the small piece from each color of foam (refer to Fig. 1) and cut it in half. Tape one of the ½ pieces to the other colored ½ piece producing a new, two-colored piece that will represent the substrate (Fig. 3). Repeat with the two remaining halves.

Fig. 3

Use the 8x11 sheet of craft foam to prepare an oversized model to use as a teacher demonstration model. Write the labels enzyme and substrate on your teacher model. Attach the self-stick magnetic tape to the back of your model so that you can place the model on a wall or white board.

Suggestions for using the model during an introductory lesson on enzymes:

1. Distribute an enzyme model and a non-matching substrate model to each student upon arrival. Make sure that you do not give a matching enzyme and substrate to the same student.
2. Instruct the students to stand up and move around the room to locate the classmate that is holding the craft foam piece that fits with their large piece. Although the students are not aware of the terminology at this point, what you are really asking them to do is to match their enzyme with its substrate. Once they find their mate, the one holding the larger piece should keep both pieces. (This way at the end of the matching episode, each student has a complete enzyme/substrate set.)
3. When they have located a mate, the partnership should come up with three observations about the pieces. Instruct them to list their observations on the board or be ready to share their observations aloud.
4. After students return to their seats, have them state their observations aloud. Encourage those who have made detailed observations.
5. Using your large teacher demonstration model, explain the role and action of enzymes in biological systems.
6. Have students use their models to demonstrate their understanding of the vocabulary terms. For example, ask the students to hold up the part of their model that represents the enzyme. Practice identifying the components until students clearly understand the terms.
7. Revisit the model using specific enzyme, substrate and product names. For instance, using catalase's cycle as an example, show the students which model components would represent the catalase, hydrogen peroxide, oxygen and water.
8. Write the terms sucrose, glucose, fructose, and sucrase on the board and ask the students to discuss with their partner which model piece represents each term.
9. Have the students use small labels and use them to identify the components of their model. Alternately, students could use Post-it-Notes ™ to label their model pieces by placing the labels directly on the surface of the model. In addition to labeling the components, the students could write a paragraph describing enzymes and the catalytic cycle three things they know about enzymes.

Closure Labels:

Enzyme	Substrate	Product	Product
Lactase	Lactose	Glucose	Galactose

This lesson idea is the result of collaborative efforts of Sandra Gonzales (John Jay High School), Barbara Larger (O'Connor High School), and Debbie Richards (Bryan High School) during James Madison Technology Summer Institute.

Teacher Page: Botanical Scavenger Hunt

Submitted by Debbie Richards, Bryan High School

TEK: 8A

Note:
This activity will allow students an opportunity to be outside as they collect plant specimens and components. Students will collect plant specimens or components that meet a specific set of criteria. Most scavenger hunt items can be found in a typical "yard" setting or nature trail. Caution must be taken if students are allowed to perform this scavenger hunt in "wild" settings because of allergies to plants such as poison ivy.

Materials: (per group of 30)

15 Plastic zippered bags (or similar container)
200 Index cards (or plain white paper)
Several rolls of transparent tape
15 Pinto bean seed (beans soaked overnight)

Suggestions for implementation:

- Once you have selected an area where students will collect the samples, you may need to edit the scavenger hunt list.
- Clearly mark the boundaries of the area in which students will be allowed to collect.
- If there are young, sapling trees in the collection area, discourage over-sampling of these specimens.
- In pre-lab remarks, encourage students to take samples that are small, yet large enough to demonstrate the specific trait.
- Tell students whether or not you will allow a single sample to be used for more than one scavenger hunt item. For example, a small piece of Bermuda grass exhibits parallel veins, a monocot, and a vascular plant.

Student Page: Botanical Scavenger Hunt

Purpose: Students will collect plant specimen or components that meet a specific set of criteria.

Materials: (per group of 2)

Plastic zippered baggies
13 Index cards
Transparent tape
Soaked pinto bean seed

Procedure:

1. Working with a partner, remove the plant embryo from a soaked pinto bean seed. Tape the embryo onto one of the index cards. Label the radicle (root) and the epicotyl (shoot) of the taped specimen.
2. Move to the outdoor collection site according to the teacher's instructions.
3. Work with a partner to find the remaining items on scavenger hunt list. Once you find each item place it in your bag. Students will have 20 minutes to collect their items!
4. Upon returning to the classroom, tape each collected item to an index card and label the card with the characteristic(s) that are being represented (ex: fibrous roots). Use your notes or text as needed.
5. Place completed index cards in a plastic zippered bag with the name card visible and turn the plastic bag in when you have finished.

Botanical Scavenger Hunt List

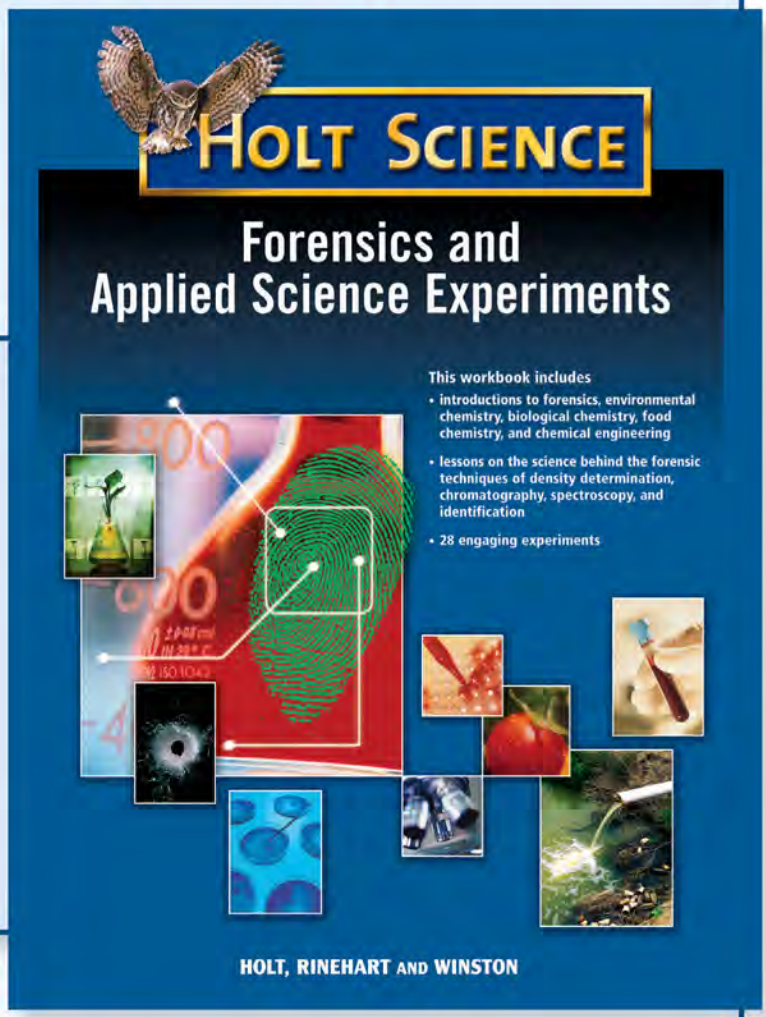
Seed embryo (baby in seed)	Fibrous root	Part of a vascular plant	Part of a nonvascular plant
Part of an Angiosperm	Petal	Part of a Gymnosperm	Part of a monocot
Part of a dicot	Section of stem	Parallel vein leaf	Branched vein leaf

Safety Note: Do not touch plants to which you have known allergies. Do not ingest ***any*** plant parts during this activity.

New from Holt!

Forensics and Applied Science Experiments

For use with Holt biology and chemistry programs, and for one-semester forensics courses.



Topics covered

- Density
- Chromatography
- Spectroscopy
- DNA and Blood-Type Identification
- Environmental Chemistry
- Biological Chemistry
- Food Chemistry
- Chemical Engineering

Introduce students to the exciting world of forensics in our new workbook and then guide them through several case-oriented labs for each topic. Every aspect of this program is situational and realistic, motivating students by presenting the lesson as a *real-life scenario with a mystery they have to solve.* Both inquiry labs and computer-based labs are included.

This resource includes assessment at the topical introduction level, as well as laboratory student worksheets. The ***Teacher's Edition*** has sample answers for all student entries on assessment and lab worksheets, as well as a ***Teacher Resource Page*** which gives detailed information about each lab.

www.hrw.com | **HOLT, RINEHART AND WINSTON** | **800.HRW.9799**

Elephant Toothpaste, A Catalyst Demonstration

Materials:

Hydrogen peroxide (H_2O_2) 30%
Manganese dioxide (MnO_2) powder
Dawn dish soap
2 glow sticks (one green & one yellow)
500 ml or 1000 ml graduated cylinder (clear glass)
250 Erlenmeyer flask
Large demo tray or garbage bag (spread out)

Discussion:

Begin by discussing peroxisomes and their role in the cell. This includes breaking down hydrogen peroxide with the help of the enzyme catalase. This leads into a discussion on enzymes/biological catalysts.

Explain the function of a catalyst within chemical reactions. Be sure to stress that a catalyst is not used in a chemical reaction; it creates an alternate pathway by lowering the activation energy of the reaction. Since the catalyst is not used, it can be recovered when the reaction is complete.

Without the catalyst, the decomposition of hydrogen peroxide will occur, but the reaction time is on the order of years for completion. By using the MnO_2 (the catalyst), the rate of the reaction is significantly increased.

$$\mathbf{2H_2O_2 \xrightarrow{MnO_2} O_2 + 2H_2O}$$

<u>Procedure:</u>

1. Add an even amount of soap and MnO_2 (the catalyst) to the bottom of the graduated cylinder ahead of time. Alternate adding small even amounts until a volume of 100 ml Soap/MnO_2 solution is reached. The better the soap is mixed with the MnO_2, the better the reaction will run. Place graduated cylinder in the middle of a large tray or spread out a very large garbage bag underneath (such as a tablecloth) to catch everything. ***Avoid inhalation of MnO_2 powder!***
2. In the Erlenmeyer flask, poor 75-100 ml of 30% H_2O_2. ***Use caution!*** 30% H_2O_2 will burn if it comes in contact with the skin. Remember, cells contain the enzyme catalase that will cause the spontaneous decomposition of H_2O_2. ***This is an exothermic reaction.***
3. Activate the glow sticks using utility scissors to cut tops off of the activated glow sticks. ***Turn off the lights.***
4. Pour the contents of the 2 glow stick into the Erlenmeyer flask with 30% H_2O_2. Immediately pour the Erlenmeyer contents into the graduated cylinder. ***Make sure all equipment is removed from the tray area.***
5. The reaction that occurs is the decomposition of H_2O_2 with the help of the catalyst (MnO_2). Students will be able to see water given off in the form of steam. The other product, oxygen, will be trapped in the growing column of soap bubbles. A burning splint can be inserted into the foam. The splint will continue to burn. When the lights are turned back on all the black color in the soap is the catalyst, MnO_2. Notice the catalyst changed the rate of the reaction without being consumed by the reaction. This is how catalase in the peroxisomes of cells work. The catalase is a catalytic protein. These enzymes work by lowering the activation energy of the reaction.
6. Upon adding the glow stick contents to the H_2O_2, the glow stick solution will quickly lose its luminosity. It breaks down from the ensuing reaction, but not before it adds a cool glowing streak effect to the demo. Yes, this is the only reason for adding the glow sticks. However, if you've not figured it out, this is the best part. The column of soap bubbles that emerges from the graduated cylinder looks like a huge column of toothpaste. The glow stick solution adds streaks that make it look like Aquafresh™ or some other striped toothpaste. Seeing that the column is so large, you can tell students, "It's big enough for an elephant!"

<u>Safety Precautions</u>: 30% H_2O_2 is severely corrosive to human tissue; such as the eyes, skin and respiratory tract. It is also a very strong oxidant and a dangerous fire and explosion risk. The graduated cylinder will get very hot – use only Pyrex® glassware if performed in a glass vessel. Always wear chemical splash goggles, chemical-resistant-gloves, and chemical-resistant apron.

Joe Stanaland adapted this demonstration for biology from one he received from George Hague (Captain Chemistry) about a year before he passed away.

Science Kit & Boreal Laboratories

A

B

C

SKopes

Cat. No.	Viewing Head	Nosepiece	Objectives	Stage	Illumination	Condenser	Price
A FN55841-21	Single	3	4X, 10X, 40X	Plain	Tungsten	N.A. 0.65	$189.00
FN57452-00	Single	3	4X, 10X, 40X	Plain	LED	N.A. 0.65	$195.00
B FN57450-00	Dual	3	4X, 10X, 40X	Plain	LED	N.A. 0.65	$245.00
FN55841-35	Single	4	4X, 10X, 40X	Mechanical	LED	N.A. 1.25 Abbe	$265.00
C FN55845-00	Single	4	4X, 10X, 40X, 100X	Mechanical	LED	N.A. 1.25 Abbe	$330.00
FN55844-00	Dual	4	4X, 10X, 40X, 100X	Mechanical	LED	N.A. 1.25 Abbe	$375.00

Cordless SKopes

- *Completely portable – no longer dependent on electrical outlet proximity*
- *Just plug-in to charge – no additional charging station needed*
- *50-70 hours of use from an 8-hour charge*

D

E

F

Cat. No.	Viewing Head	Nosepiece	Objectives	Stage	Illumination	Condenser	Price
D FN57904-00	Single	3	4X, 10X, 40X	Plain	LED	N.A. 0.65	$225.00
FN57905-00	Dual	3	4X, 10X, 40X	Plain	LED	N.A. 0.65	$265.00
E FN57446-00	Single	Zoom	5X-30X Zoom	Plain	LED	N.A. 0.65	$275.00
FN57911-02	Single	4	4X, 10X, 40X, 100X	Mechanical	LED	N.A. 1.25 Abbe	$350.00
F FN55849-00	Dual	4	4X, 10X, 40X, 100X	Mechanical	LED	N.A. 1.25 Abbe	$420.00

Science Kit & Boreal Laboratories

Helping Teachers Make a World of Difference

P.O. BOX 5003 • TONAWANDA, NEW YORK 14151-5003
TOLL FREE (800)828-7777 • FAX (800)828-3299 • www.sciencekit.com

Texas Association of Biology Teachers
c/o Alton Biggs, Computer Records Clerk
1002 Madera Court
Allen, Texas 75013-3639

Texas Association of Biology Teachers

Membership Application (Please Print All Information)

Name:_____ Telephone: (_____)_____

Home Street Address, City, State, Zip:_____

E-mail address (***very important***): _____

Type of membership: _____Active ($10) _____Student ($5) _____Retired ($5) _____Life ($250)

Please complete the following to assure balanced representation in planning TABT activities

1. Professional Class (**Check one only**)

_____Biology Teacher _____Department Chairman _____ Curator/Interpreter
_____Supervisor/Administrator _____Teacher Training _____Student
_____Other_____

2. _____Male _____Female (**OPTIONAL**)

3. Have you ever received the OBTA? ___ No ___ Yes If yes, what year? _____

4. Number of years teaching?_____

5. Organizational Class (**Check one only**)

_____Elementary _____Middle/Junior High _____Secondary _____College/University _____Zoo/Aquarium
_____Business/Institution _____Other_____

6. Special Interests (**Check no more than 2**)

___Cellular/Molecular ___Botany/Plant Science ___Laboratory Science ___Reproduction/Evolution ___Zoology
___Computer Instruction ___Environmental Biology ___Teaching Materials ___Other_____

7. I am also a member of (**Check all that apply**): ___National Association of Biology Teachers (NABT)

___National Science Teachers Association (NSTA) ___Science Teacher Association of Texas (STAT)

Please send membership application and dues to: Alton L. Biggs, TABT Records Clerk
1002 Madera Court, Allen,TX 75013-3639

Make all checks payable to: Texas Association of Biology Teachers