The Nucleus

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From the Editor

It seems that the terrible events of late have had an unexpected effect in my classroom: fewer students are asking why they have to learn science or when they will ever use it in the "real world". Instead the world has thrust itself into their comfortable lives and brought fear and uncertainty with it.

As a mother and a teacher, it bothers me that they are frightened. "Avoid the mall on Halloween" (sounds like a good idea for any day to me) ... "put your mail in the microwave" (only if you want to set your house on fire) ..."terrorists are going to target a school in Texas" (the FBI said that?!) ... and on and on.

I want to hold them all and tell them everything will be all right. A knee jerk reaction which might make them feel better for a time. But only one thing is going to empower them to feel better for the long term ... knowledge.

So classes have taken on new meaning for some students. Their math and physics relate to materials science. Perhaps a new steel to resist superheating is on the way. Or a mine detection system that wouldn't cost the limbs of military men. Techniques for effectively sterilizing buildings and equipment after anthrax exposure are needed. Measures to prevent bioterrorism can stimulate active imaginations.

The problem-solvers of tomorrow are in our classrooms today.

Now more than ever, we are faced with the task of preparing students to take their place in society. To see each day as an opportunity to add to their mental "tool box", never knowing when that addition will come in handy.

Many of us are not trained microbiologists and our college days become more distant each year. So, I have asked Dr. C. O. "Pat" Patterson of the Biology Department at Texas A&M University in College Station to write about anthrax for this issue of The Nucleus. Turn the page to see his contribution. Perhaps we, too, can add to our "tool box".

Stay in touch ...

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Inside this issue:

Guest Editorial:

By Dr. C. O. "Pat" Patterson
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In today's world, people with technical knowledge and expertise have special ethical and social responsibilities. Those of us who are charged to convey such knowledge to students carry even heavier burdens. In a time when wild rumors and sometimes poorly-informed news reports contribute to fear and even panic, we must serve as calm, careful sources of information. This responsibility has been specially clear as the anthrax scare has played out over the past few weeks.

It is not a new idea to disrupt societies by spreading infectious pathogens. In medieval times, attackers besieging a city or a castle often used catapults to throw dead animals into the enemy's camp, hoping to start an epidemic. More recently, biological weapons were extensively investigated and some development was carried out by various European nations (including Germany and England) beginning in the 1920's. As the potential menace of biological weapons became apparent, many nations including the United States pursued such studies beginning in the 1950's. The focus by then was on developing preventive measures.

However, a great deal of medical and molecular biological research during the past 25 years has given almost any trained biologist the information needed to produce biological weapons with the capacity to frighten and disrupt everyday society. It is rather surprising to non-biologists to learn how easy it is to produce the sort of "weapons" which were used to attack the postal service, various Washington D.C. offices and other locations. The trick is the recognition that in biological weapons, the microbes do the work for you.

Bacillus anthracis, the causative agent of anthrax is a naturally occurring soil organism, widespread throughout most of the world. Almost its only unusual feature is the ability to form resistant spores (also called endospores) which can survive almost indefinitely without nutrients, even under extremely harsh conditions. There are good data indicating that spores can survive in soil for at least 1000 years; sone published reports indicate that spores might be capable of survival for tens of thousands of years. Most bacterial species, depreived of moisture and nutrients, or stored in harsh temperatures or pH conditions, can survive for only a few hours or a few days at most. So a terrorist wishing to prepare large amounts of infectious material to be delivered later, is obviously attracted to a sporulating organism.

Another species, *Bacillus thuringiensis*, is harmless to humans and other vertebrates, but forms a toxin which is deadly to grasshoppers, crickets, caterpillars and other grazing insects. This toxin is protein in composition, is formed at the time of sporulation, and is stored inside the spore as a crystalline structure called the parasporal body. Spores containing the toxin are harvested, milled to a fine powder and sold commercially as insecticide. Next time you visit a plant nursery or garden-supply store, read the label on insecticide packages, especially those sold as organic insecticides. You will probably find list3ed the ingredient "Bt". This refers to *Bacillus thuringiensis* spores. So virtually every insecticide manufacturer has the technical capacity to produce, handle, and mix large quantities of finely powdered *Bacillus* spores. Only minor changes are needed to produce *B. anthracis* spores using the same equipment and facilities.

The next level of skill would be required to genetically modify a strain of *B. anthracis* to make it resistant to antibiotics. The same molecular biological techniques which aid our understanding of toxicity and treatment methods could also be used to make the organism far more dangerous as a medical threat.

In other words, information and technology can be used for human benefit or for harm. We as teachers carry responsibilities not only to provide information and understanding for our students and our communities, but also to call constantly for ethical commitments in the use of such knowledge. It is our task not merely to convey information, but to guide our students and the public in developing understanding of our social responsibilities. A generation ago, nuclear physicists confronted new responsibilities as even the survival of human civilization seemed threatened by technologies they had developed. Biotechnology opens tremendous prospects for beneficial applications in the future, so long as we assure that the information is used in ethical ways. It will be our role in the months and years ahead to insist loudly that knowledge and ethics must go hand in hand.

Because new informaiton is constantly becoming available, we must all be on the alert for current news. I have found the websites listed below to be especially useful in keeping up with this fast-changing situation:

http://www.nature.com/nature/anthrax

http://www.carolina.com

http://www.ericse.org/anthrax.html

http://www.accessexcellence.org
Click on What's News: Anthrax

http://www.nhm.nih.gov/medlineplus/biologicalandchemicalweapons.html

http://www.bt.cdc.gov

Scenes from CAST 2001

The Austin Convention Center was the scene for the latest Conference for the Advancement of Science Teaching (CAST). Held October 31 - November 4, 2001, a variety of workshops and short courses geared to improve science instruction were offered. Here are a few scenes from around the convention.

Betty Ann Wonderly passes the TABT gavel, a cow vertebrae, to Keith Watson who will assume the presidency in January.

Alton Biggs was elected an Honorary Member of the Science Teachers Association of Texas. The award was presented by Roger Stryker.

The TABT Luncheon was a success! Every attendee received door prizes in addition to a CD-ROM and a laser pointer. Our speaker presented an interesting discussion of fire ant behavior.

Flinn Offers Student Teacher Survival Kit

A free gift is available from Flinn which is ideal for secondary science teachers beginning their career. Included in the kit are demonstration ideas, safety contract and posters, a Flinn catalog and money-saving coupons.
Teachers only may request the kit using catalog number AP4564.

Loretta Loykasek was presented this year's Texas Outstanding Biology Teacher Award. The national award is given by NABT, with Prentice Hall and Leica as major sponsors. Loretta received a pair of binoculars and a microscope in addition to the plaque awarded by OBTA and the monetary gift awarded by TABT.

Maybe you should apply this year! If you are interested, or know a colleague who fits the bill, see the application process posted on the TABT website
www.tc.cc.tx.us/%7Emstorey/TABT/
You can also link to the TABT site through www.statweb.org.

A snail-mail application may also be submitted via

Robert Dennison
10406 Jockey Club Drive
Houston, TX 77065
School Fax # 713-896-3438

The Nucleus would like to hear from you. Please send your comments, concerns, ideas, etc. to Ginger at gintor@yahoo.com

Nadine Dickson won this year's TABT Outstanding Biology Teacher Award.

TABT thanks our generous sponsors!

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Texas Building a Presence for Science

Being one of the most influential networks for science education in the great state of Texas, the Building a Presence for Science (BaP) project has been having a productive year in regards to providing professional development for Key Leaders and Points of Contact, updating the national online database, and increasing the number of Points of Contact to the network. At the beginning of the 2000-2001 fiscal year, the BaP network moved into an advance stage. Not only has the BaP network disseminated the National Science Education Standards (NSES) to practitioners in the field, but it also has provided a medium for informational updates, an appraisal of views on issues regarding science education, and dissemination of various events that focus on professional development for educators in the network.

The Building a Presence for Science program is creating a communications and professional development network of science education advocates and connecting science teachers with standards-based classroom resources. Last January, Building a Presence for Science debuted a new online system designed to be the primary administration and communication tool for the program. While many of the program's participants have welcomed the new system, many have yet to realize its potential. An email address is needed for connection to the system. A free email address can be obtained by signing up with yahoo (http://mail.yahoo.com) or hotmail (http://www.hotmail.com).

With an email address in hand, go to the NSTA BaP website (http://ecommerce.nsta.org/bap) and set yourself up on the system. Key Leaders are on the system, but may need to complete the geographic section of their profile. Points of Contact can access their profiles on the online system and complete the profile including an email address. Questions or comments should be addressed to Vanessa Westbrook at vwestbrook@mail.utexas.edu.

Online Features for the Building a Presence Participants

Features for Key Leaders:

•Edit your contact information
•Email other Key Leaders
•Email your Points of Contact
•View and edit your Points of Contact
•Add and delete Points of Contact
•Print mailing labels
•View and post to the state message board
•Receive bi-monthly email blasts from the state coordinator, Vanessa Westbrook, about program events and updates concerning science education in Texas.
•Receive NSTA's monthly email blasts with targeted messages from National Partners and timely notice of special events and opportunities.

Features for Points of Contact (PoC):

•Edit your contact information
•Email your Key Leader
•Email other Points of Contact
•View and post to the state message board
•Receive bi-monthly email blasts from the state coordinator, Vanessa Westbrook, about program events and updates concerning science education in Texas.
•Receive NSTA's monthly email blasts with targeted messages from National Partners and timely notice of special events and opportunities.

A Peek into a College Biotechnology Lab Course

The University of Texas Master Teacher Institute hosts a four-week program in the summer for teachers in several disciplines, including Biology. Participants work with various university personnel to update their skills and knowledge. In June of 2001, Dr. Julie Palmer addressed the Biology Institute with a review of the changing needs of college freshmen.

All teachers ultimately prepare their students for the rigors of college academics. Below is a tentative schedule of laboratories which Dr. Palmer suggested for the education majors at UT.

Week 1:
Introduction, safety, measurement/pipetting
Weighing reagents, calculating molarity

Week 2:
Sterile technique, measuring cell density with a spectrophotometer
Statistical analysis: linear regression, growth kinetics

Week 3:
Practical (basic skills)
Selection of gene frgment, ligation into a selected expression vector

Week 4:
Transformation of competent cells, plating on selected media
Selection of colonies, analysis to determine transformation efficiency

Week 5:
Mini-prep isolation of plasmid DNA, restriction digestion, agarose gels

Week 6:
PCR of cloned DNA, purification using spin column for sequencing

Week 7:
Use computer programs to identify homologies to known genes

Week 8:
Practical 2

Week 9:
Prepare protein extract from expression clones, pour polyacrylamide gels.

Week 10:
Electroblot gels to PVDF transfer membranes, Western blot

Week 11:
Column chromatography

Week 12:
Enzyme assays

Week 13:
Chloroplast extraction, thin-layer chromatography, spectrophotometry of purified bands

Week 14:
Methods of microscopy: bright field, dark field, phase contrast, fluorescence

Week 15:
Immunofluorescence of corn roots; visualizaiton of mitosis, final Practical

Free Homework Service offered by University of Texas

C. Fred Moore of the University of Texas in Austin has announced a new on-line homework and exam service available to teachers.

"The Homework Service replaces your reliance on problems at the end of chapters in textbooks. At present, the Homework Service handles over 250,000 homework questions per week assigned to students by their instructor,.

Problem banks in Chemistry, Mathematics, Physical Science, and Physics are provided with algorithmic questions and their solutions.

The Homework Serice may change your teaching prerogative from grading homework to helping students how to solve problems."

Visit http://hw.utexas.edu/hw.html click on the "OK" button and fill out a form for each class you teach. Books of problems are at http://hw.utexas.edu/bur/hwbooks.html.