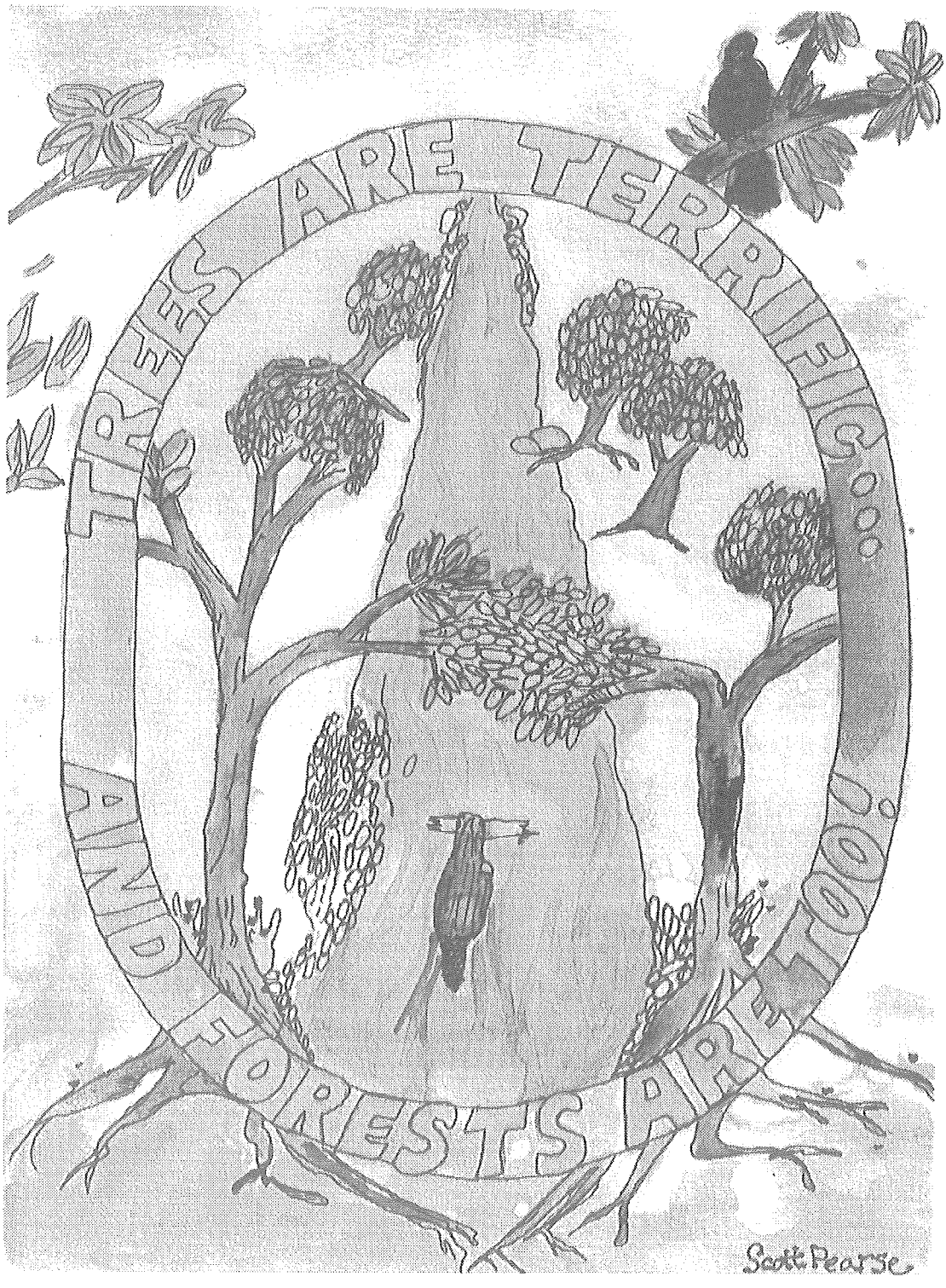
SPECTRUM

THE JOURNAL OF THE ILLINOIS SCIENCE TEACHERS ASSOCIATION



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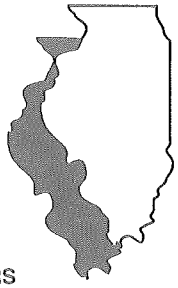

SPECTRUM

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ISTA NEWS

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PRESIDENT'S SPRING LETTER

As the doldrums of another Winter end and the promise of new Spring beckons, I want to bring to your attention a few matters that will impact our professional lives.

First on the agenda is the NSTA National Convention in St. Louis, March 28-31. NSTA expects more than 15,000 science educators will attend the convention. NSTA reports that more than 1,000 hands-on workshops will be offered and that more than 400 companies will be exhibiting the latest and most innovative science materials on the market. Special programs that focus on the recently published National Science Education Standards will be presented at the convention. ISTA and the Science Teachers of Missouri have been designated by NSTA as co-hosts of the convention. As a result, ISTA will benefit financially in response to the number of ISTA members who attend the convention. I strongly urge you to make the necessary arrangements to attend this professionally rewarding event.

The first draft of the Illinois Academic Science Standards is scheduled to be distributed to every school in the state during the month of March. Many ISTA Board members will be attending a training session in Springfield in early March to enable them to conduct Science Standards focus sessions across the state. There will be a three month period for Illinois science educators to comment on the draft. The Illinois Academic Standards will chart the future direction of K-12 science education in this state. Please take the time to examine the draft and contribute to the publication of a document that all science educators can embrace and employ to achieve the goal of producing a scientifically literate citizenry.

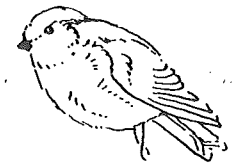
Kudos to Suzanne Asaturian, Region VI Director, for her efforts to organize an ISTA conference in her region of the state. Suzanne has held preliminary meetings with university representatives and received an enthusiastic response to her initiative. I will be traveling downstate in March to meet with Suzanne and the university representatives to firm up details on the conference. This is another effort to provide additional services to ISTA members across the state. As plans for the Southern Illinois Conference crystallize, you will be kept informed.

The ISTA Home Page will be up and running very soon. If you have World Wide Web access, look for your home page at http://nethomes.com/il.sci.tchrs.assoc

The ISTA Home Page will be the conduit for timely information for ISTA members. As Internet access opens up to more and more teachers, ISTA will search for ways to expand the electronic resources for its members.

The ISTA Convention scheduled for October 10 - 12 at the Merchandise Mart Plaza in Chicago is going to be a very exciting event. The focus of the convention will be the role of standards in science education. Call for Papers applications have been rolling in so use the Call for Papers form in this issue of the Spectrum to register your presentation. Remember, registration materials for the October Convention are going to be mailed to ISTA members in May to provide members with ample time to complete the paperwork required by their school districts.

I look forward to seeing you in St. Louis in late March. A combined social event for ISTA, WSST and Iowa Science Teachers Association members has been scheduled in conjunction with NSTA District XII. Plan to attend! Carol Van De Walle will be introducing our new NSTA District Director and it will be a great chance to meet new people. The reception will be held Friday March 29th, 1996 from 6:00 to 7:00 PM in Jefferson E, Regal Riverfront Hotel, St. Louis.



Bernie Bradley

JOIN US AT A RECEPTION FOR ILLINOIS, IOWA, AND WISCONSIN SCIENCE TEACHERS AT THE NSTA CONVENTION IN ST. LOUIS FRIDAY MARCH 29TH, 1996 6:00 TO 7:00 PM JEFFERSON E REGAL RIVERFRONT HOTEL IT WILL BE A GREAT OPPORTUNITY TO MEET SCIENCE TEACHERS!

Kevin D. Finson
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Western Illinois University
Macomb, IL 61455-1396
finsonk@ccmail.wiu.bgu.edu

LETTER FROM THE EDITOR

In today's world of education, we seem to be constantly bombarded with "new" trends and terminology. Often, these "new" things are simply good "old" things that have been repackaged, and sometimes renamed, and presented again to us. At other times, the "new" things that confront us consist of elements of good old tried and true ideas mixed with some new ideas, or are those tried and true ideas presented with some new twist. More rare are those "new" things that are genuinely new.

One interesting facet of all this is that some of the "old" ideas a number of us have dealt with for many years are "new" to colleagues. I am constantly amazed at the number of teachers my university colleagues and I encounter throughout the state who only recently discovered hands-on science through publications such as the AIMS or GEMS. I am even more amazed at finding teachers who never heard of such curricula, particularly considering the number of years they've been in print. I remember relating to you similar experiences in a previous column about presentations I've seen at NSTA conferences—presentations about things some of us consider quite old, but which nevertheless are thrilling new discoveries for many attendees.

While mulling over such a state of affairs, one may not be surprised at the difficulty we (science educators) have in spreading "new" ideas and getting teachers at all levels to make use of the best of them. This difficulty is only magnified when the ideas are genuinely new. Fortunately, we have at our disposal media such as science education journals which can disseminate information about new developments and ideas in science teaching.

We are now attempting to begin an intermittent series of invited papers for *The Spectrum.* The intent is to help each other better understand and see how to use "new" concepts, ideas, issues, etc. in our science teaching. In three statewide surveys conducted in 1991, 1993 and 1994 in Illinois, we found many teachers knew the buzz words but lacked a clear understanding of what those terms encompassed. One of those terms was "constructivism." I've found many colleagues at national professional meetings who are still seeking an operational definition for constructivism and some guide as to how to implement it in their own classrooms as well. So the fuzziness surrounding such terms and concepts is certainly not limited to elementary and secondary teachers. Hopefully, we can all benefit from what the authors of our invited papers have to say about their topics.

Hence we are kicking off our series of invited papers with one on "constructivism" written by Dr. Robert Yager of the University of Iowa. We will attempt to identify other such concepts for future issues of *The Spectrum.* And, as always, we are certainly interested in hearing from you about your needs and interests. Please don't hesitate to let me know if there is a topic you'd like to hear more about in *The Spectrum.*

REGION 4 REPORT

I have been talking with Kevin Seymour (science consultant working with Champaign, Vermillion, and Ford Counties) about the possibility of organizing an informal group of teachers interested in science education. My intention is to model this on CESI which is active in the Bloomington-Peoria area.

We will be looking for teachers who want to talk/share and explore areas of mutual interest This is a slow process, and if any teachers out there in the region are interested in pitching in hosting a meeting, they should contact me and I will pass the information on to Kevin.

Sincerely,
Keith Hanson

Region 2 meeting at the Rockford Discovery Center Big Bug Exhibit

LETTER TO THE EDITOR

I have always been extremely concerned about the way in which the IGAP assesses students in science. To add to my concern is the new revision of the Illinois School Improvement Process making the IGAP a "high stakes" student-centered assessment.

As we all know, assessment drives instruction. Therefore, schools are now going to model closely the type of assessment being presented on the IGAP. I can gather much research to support students actively doing science, but the bottom line will be: "Will it improve our IGAP scores?" Because inquiry-based instruction is a more challenging and costly method, many schools and educators will look to past practices to produce high IGAP results. At this time, schools placing in the 'Exceeds Standards" or the top 15% of the "Meets Standards" categories have little incentive to improve past poor practices. Several other problems have arisen:

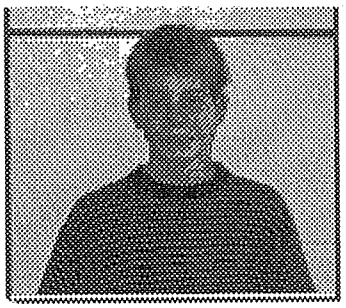
- Schools state that they cannot focus on a hands-on science program that teaches depth over breadth because it will not address the wide range of content covered by the IGAP.
- School and teachers find that they can do just as well, and sometimes better on the IGAP by concentrating on the sample items and cramming for the test.
- As the IGAP stands now, schools who have a high socioeconomic population score high regardless of their type of instruction

I am sure that you are aware that the IGAP, as it stands, will not suffice as a measure of student learning in science. It will not drive the type of instruction promoted by the National Science Education Standards. Though I question whether any state assessment can truly measure learning in a valid, reliable, and fair manner, I would like to see an IGAP that drives hands-on inquiry-based instruction.

Changes are supposed to occur and ISTA must take an active role in convincing the Illinois State Board of Education to overhaul the IGAP and add the appropriate assessments as quickly as humanly possible.

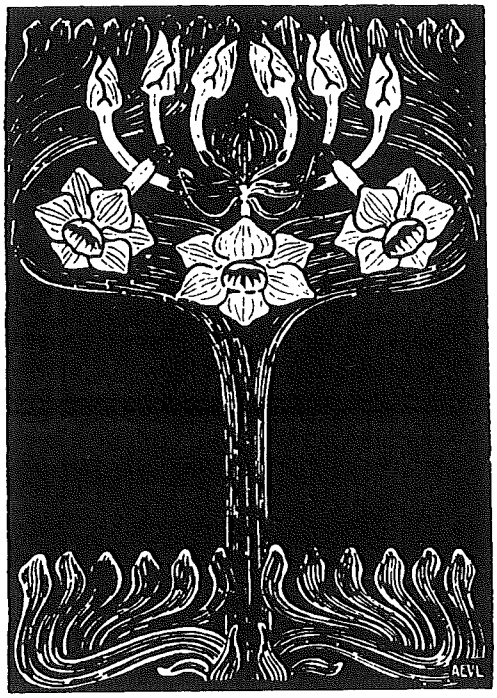
Michael A. Schneider
Director of Scientific Literacy
Regional Office of Education
St. Clair County

SCOTT PEARSE WINS ARBOR DAY POSTER CONTEST!



ABOUT THE COVER

Scott Pearse, a fifth grader at Hutsonville Elementary School has won the Arbor Day Poster Contest for 1994-95.
Scott's Entry was awarded first place from among 1500 entries. Scott enjoys working with animals and hopes to enter the field of marine biology. His other interests include 4-H, band, tennis, track events, and water skiing. Congratulations Scott for a terrific entry!



1996 ILLINOIS SCIENCE TEACHERS ASSOCIATION CONVENTION
OCTOBER 10-12, 1996
MERCHANDISE MART, CHICAGO
CALL FOR PAPERS
DEADLINE FOR SUBMISSION: APRIL 15, 1996

PLEASE COMPLETE A FORM FOR EACH PARTICIPANT (You may duplicate this form). I can be available for
o Friday's program o Saturday's program o either day

Please print or type:

Name _____ Day phone _____

Affiliation (School or Organization) _____ Home phone _____

Address of above organization _____ Home address _____

City, State, Zip Code _____ City, State, Zip Code _____

Title of presentation (10 word maximum)_____

Program description as you wish to appear in the program book (25 word maximum)

Due to limited space, presentations must be limited to 50 minutes.

I. Type of Session
o hands-on workshop
o demonstration
o contributed paper
o panel
o other

II. Intended Audience
o preschool
o elementary
o middle/jr.high
o high school
o college
o supervislon
o general
o teacher preparation
o other

III. SubjectArea
o astronomy
o biology
o chemistry
o earth science
o physics
o ecology/environment
o science/tech/society
o other

IV. Equipment Required
o overhead projector
o slide proiector

Note: Convention will furnish only overhead, screen, and 35mm slide projector. All other equipment, including computers, will be furnished by presenters. If you need special equipment, contact Diana Dummitt for information.

V. How many participants can vou accommodate at your session? o 30-50 o 51-80

As a professional, nonprofit organization, the Association is unable to reimburse participants for travel or other conference expenses. ALL PARTICIPANTS INCLUDING PRESENTERS, ARE REQUIRED TO REGISTER FOR THE CONFERENCE This form is not for commercial or non-commercial exhibits. It is only for educators!

Signature _____ Date _____

Send to: Bernie Bradley, 88 W. Schiller #2806, Chicago, IL 60610

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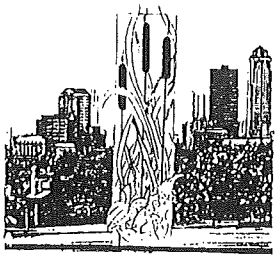

REQUIREMENTS:
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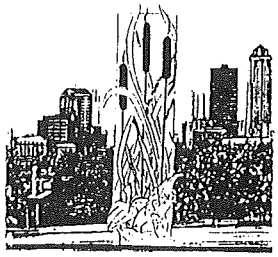
INSTRUCTIONAL APPLICATION
EVALUATION AND REPORT



DATES:
APRIL 12 (evening), 13, and 14, 1996
AND
MAY 10 (evening) and 11, 1996
Both sessions required

LOCATION:
DES MOINES, IOWA SCIENCE CENTER AND WALNUT CREEK INN

INSTRUCTORS: C. BOLLWINKEL, B. BONNETT, R. COCHRAN

CONTACT: CONTINUING EDUCATION at UNI, 800-772-1746

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__Send information __Reservation deposit check attached ($35.00)
__Credit Card No._____ MC Visa Exp. Date____($35.00 dep.)
Signature_____ (Balance of $100 due at workshop)
Send to: UNI, Continuing Education, Cedar Falls, IA 50614-0223

Gary Cooper, Delta Jct., Alaska
Linda Lloyd Maier, Columbus, OH
Reprinted from *MNLSTA Newsletter*

MAKING CONNECTIONS INTERNET PROJECTS AND LISTSERVS

If you have access to email on the internet, one way to broaden your horizons and get in touch with others is through a listserv. Listservs are similar to electronic bulletin boards where people can post messages on any particular topic or thread that the listserv is discussing. They can also be a great source of information on where to find other sites on the internet or about projects.

One problem you may encounter is how to find a listserv on a topic that you may be interested in. In order to find the possible listservs you can send a message to Listserv@vmd.cso.uiuc.edu and in the message type "list global" (without the quote marks). The listing you get back will include all the listservs that can be accessed along with information on how to subscribe. If one of them sounds interesting, you can try it for awhile and if you don't like it you can always sign off later. When you sign up for a list be sure to keep the initial information you receive back because it will also have the information on how to get off the list.

Tips for first time subscribers:

- When you first sign on a list it is a good idea to listen awhile (known as lurking) to get the tone of the list before becoming a part of the discussion.
- Some lists generate a lot of messages, so it is usually wise to set the list to digest the message each day. You can do this by sending a message to the listserv (not the group) and in the body of the message type "set 'name of list' digest" (without the quote marks).
- If you do subscribe to a list, it is also a good idea to check your mailbox regularly to keep it from getting too full.

Listserv are good ways of learning and getting into discussions about a wide variety of topics. Recently the middle level list* has had many posts about the "real world," detention, and including a student's attitude as part of their grade. The topics change but it is interesting to listen in on the variety of opinions and the different ways of dealing with the issues that we all face.

***The middle level list can be subscribed to by sending a message to Listerv@vmd.cso.uiuc.edu in the message type subscribe middle-1**

ZERO POPULATION GROWTH FIND US IN CYBERSPACE

ZPG is happy to introduce its new "homepage," designed to provide ready access to population information on the World Wide Web. It is a work-in progress, but already provides a variety of useful ways to learn abut ZPG and the impacts of population growth on our planet and our lives.

The homepage makes available demographic and census data for the United States and the world, as well as pointers on how to reach major population research centers and libraries. You can get current legislative information, curriculum materials, ordering information for publications and T-shirts, and much more. There's even a population quiz to test your "Pop I.Q." In the future, we will also provide news and activist tips.

Feedback and suggestions about ZPG's homepage are welcome. Because the homepage provides instant response e-mail, you can speak your mind with just the click of a mouse. hook into the ZPG homepage at the following location:

http://www.zpg.org/zpg

If you re not on the World Wide Web but have access to e-mail, you can reach us at:

zpg@igc.org

To reach a particular person or department at ZPG, just add the name in <brackets> after the address.

Correction: In the last issue of the *Spectrum* the online address for the Eisenhower National Clearinghouse for Mathematics and Science Education was inadvertently omitted. The address is <enc.org> Sorry!

THE WEATHER CHANNEL ON THE WEB

Check out national maps, aviation maps, current conditions and five-day forecasts for hundreds of U.S. cities. And look for our new Atlantic tropical storm and hurricane maps.

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Science AnyTime is aligned with ***Illinois State Goals and Objectives*** and follows many recommendations contained in ***Science for All Americans***, ***Benchmarks for Science Literacy***, and ***Project 2061***.

HARCOURT BRACE

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CONSTRUCTIVISM AND WHAT IT MEANS AS REFORMS ARE SOUGHT IN SCIENCE TEACHING

Constructivism is a term that has enjoyed a long history as a broad explanation of how human learning occurs. An Italian philosopher published a paper in 1719 where he posited that "to know means knowing how to make." He argued that a person knows something only when he/she can explain it. Constructivism is defined by one of the leading constructivists in the U.S. simply as "a way of knowing" (von Glasersfeld, 1987). The exact mechanisms or how one knows is surely not well understood today—and yet it is apparent that knowing is something that individuals must accomplish for themselves. Knowing is not something that one human being can simply transmit to another.

Teaching techniques that help students formulate meaning for themselves have now been proposed and tested. Such teaching strategies are now called constructivist teaching even though that term is usually reserved for a way of describing human learning.

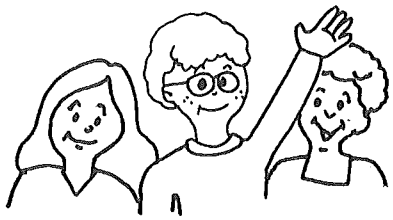
Constructivism became popular in education circles during the past decade because of the work of cognitive scientists. When the U.S. government decided once again in 1983 that science and mathematics learning was in crisis and probably the cause of our failures in the economic arena (poor learning in science and mathematics was seen as the reason that nearly all other industrial nations were able to compete better!), psychologists (later called cognitive scientists) were awarded grants to study human learning. Initially they sought pathways that resulted in really knowing and understanding mathematics and science.

University students who majored in physics, engineering, and other sciences were used as study subjects. They were given difficult—even tricky—problems where they would have to apply the concepts and skills they had seemed to learn so well. Instead of finding out such steps to learning, the researchers found that 85 to 90 to of these very able and interested students could not solve the problems. In fact, there were indications that these very best students had not really learned. They could not use the concepts and skills in the real world setting. It became clear that traditional teaching which was designed to give students understanding and skills was not effective. In fact, the very best students were found to be little more than actors and actresses learning the words, language, skills, and performing often flawlessly—until they were asked or expected to use the concepts and skills in a new situation There was apparently little or no transfer of information or skills to life outside the classroom or laboratory.

In most educational settings students are expected only to excel in the three R's, albeit not the traditional readin', 'riting, 'rithmatic—instead repeat, recall, and regurgitate. The best students were expected to remember and to repeat definitions and ideas and to replicate certain skills practiced and demonstrated. Memory and attentiveness to detail were the primary determiners in finding the best science students.

As cognitive scientists sought to discern the cause for the observed failure on the part of these best students (probably the upper 1% of high school graduating classes), they found that the problems that could not be solved arose from conceptions that had been developed individually by the students usually long before they encountered the concepts and/or skills in a science classroom or laboratory. These early conceptions that were in the minds of students remained in spite of the teaching and apparent learning. The science known and encountered in real life was not the science learned in the traditional educational setting.

The recent research work on learning and the reexamination and extension of constructivism have created a revolution in schools, teacher education, and current attempts at reform. The work has resulted in new looks at student-centered instruction and new concerns for direct teaching. Some of the most conscientious teachers find themselves in the midst of a revolution. After years of traditional teaching, the very best students do not like a new set of ground rules. They like being told what they need to know for recall tests, skills they need to perform, interpretations they need to repeat. They often dislike having to think, analyze, synthesize, and evaluate. They find these higher order thinking skills to be fuzzy, difficult, unrewarding. However, not to change seems unprofessional and unethical. Science depends on such higher order thinking and has little to do with recalling, repeating, remembering, or regurgitating information given by teachers or textbooks for use in measuring the degree of learning.



Reinsmith (1993) has captured the essence of constructivism and constructivist teaching with his ten points of real learning: These are:

1. Learning first takes place by a process much like *osmosis.*
2. Authentic learning comes through trial and error.
3. Students will learn only what they have some proclivity for or interest in.
4. No one will formally learn something unless she believes she can learn it.
5. Learning cannot take place outside an appropriate context.
6. Real learning connotes use.
7. No one knows how a learner moves from imitation to intrinsic ownership, from external modeling to internalization and competence.
8. The more learning is like play, the more absorbing it will be.
9. For authentic learning to happen, time should occasionally be wasted, tangents pursued, side-shoots followed up.
10. Traditional tests are very poor indicators of whether an individual has really learned something.

Apparently learning is something that each person must do for him or herself. Teachers can only encourage and work for such intellectual engagement. When it occurs, learning occurs automatically. Some procedures for gaining such intellectual engagement include:

1. encouraging students to identify questions and problems that they see as important (instead of dealing with questions and problems posed by teachers and textbooks);
2. encouraging students to wonder about phenomena and problems around them, especially Lose believed to be based in science and technology (as opposed to following the district course of study or a textbook topic by topic);
3. planning investigations designed to test the validity of student explanations (rather than performing contrived "laboratories" where the real activity is to verify what teacher and textbook have proclaimed);
4. taking advantage of strange questions that are designed to provoke further questions (rather than to attack the next chapter or topic because it is in the book or district plan);
5. valuing different forms of student expression, respecting student views, encouraging discussion and action on them (rather than following the predetermined set of units, chapters, and activities);
6. encouraging students to invent or plan activities (rather than following directions from predetermined investigations(?) and doing worksheets);
7. encouraging student products resulting from the learning activities that can illustrate student "expertness" as a result of the lessons (rather than giving a test of memory as a closure activity to lessons and instructional units);
8. encouraging actions and displays outside of school to create a feeling of importance of the study, e.g., political action, reports to school boards or community groups, a community improvement project; and
9. casting student study in ways that suggest that all was not predetermined by the teacher—or that the results were all known in advance of the activities (rather than encouraging the notion that all class sections and past students had experienced the same things).

Some ways to characterize teaching as more or less constructivist can be seen by assessing where a given teacher (or the students enrolled) see the following:

	Constructivist	Typical Instruction
1. Identify the organizing questions/issues	Student	Teacher
2. Asks the most questions	Student	Teacher
3. Questions most used to determine class activities	Student	Teacher
4. Locates written materials for considering questions/issues	Student	Teacher
5. Identifies and contacts human resources (experts)	Student	Teacher
6. Plans and organizes activities to test ideas	Student	Teacher
7. Determines ways to access and determine learning	Student	Teacher
8. Identifies new applications for learning that occurs	Student	Teacher
9. Initiates actions as a result of study	Student	Teacher
10. Finds basic concepts of science/technology to deal with questions	Student	Teacher
11. Suggestions for use of learning outside school in the wider community	Student	Teacher
12. Suggests new directions as a given question/issue is pursued	Student	Teacher

What we now know about learning is causing a revolution in science teaching. The new NSES *Standards* (1994) illustrate constructivist teaching and new views of assessment that are required Most important of all, the new *Standards* broaden the definition of science content. Science is conceived as more than what discipline-based scientists see and know as biology, chemistry, earth science, and physics. And interestingly, science research is becoming less discipline bound. For example, biology is becoming richer because of its base in chemistry and physics. At the research level science is becoming more integrated and interdisciplinary. As we consider reforms we need to be aware of what is happening in science—and perhaps as educators we need to understand learning better and learn to use teaching strategies designed to assist students to achieve real learning. It is time to move beyond the traditional (basic) indicators of learning, namely recalling, repeating, remembering, or regurgitating information and skills that teachers and textbooks try to transmit directly. That is the revolution that constructivism brings to our profession. And, it applies across the curriculum!

References

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AN ENVIRONMENTAL TEMPLATE

A Remedial Action Plan is a format for describing contamination to the water resource throughout the Great Lakes Basin. The plan's format can be used in classroom assignments to help describe local water problems.

The Remedial Action Plan is a product of the International Joint Commission, which is a combinational organization to advise Canada and the United States in preventing or resolving problems along their common borders.

The Remedial Action Plan is called a RAP for short. The coincidence with the term in pop culture is a fortunate one because both the cultural rap and the environmental RAP have become powerful communication tools. The RAP model is in place for 43 major problem areas in the Great Lakes Basin. Areas of concern include the major municipal and industrial centers on the Great Lakes, harbors, and connection channels. Remedial Action Plans were to be drawn up by Citizen Advisory Groups for these areas.

One such area was located in Waukegan, Illinois, where I teach. The specific area was the Waukegan Harbor. It was for this harbor area and an expanded study area, which included most of the industrial lakefront, that the Waukegan Remedial Action plan was written.

As recommended by the Great Lakes Water Quality Board in 1985 and reinforced in the Governments' 1987 and Protocol to the Agreement, all Remedial Action Plans must address certain points. It is these points, which when used as is or simplified, become the "environmental template."

- **Define** the environmental problem, including geographic extent to the area affected, using detailed maps and surveillance information.
- **Identify** beneficial uses that are impaired. The International Joint Commission enumerates the following:
  - Restrictions on fish and wildlife consumption
  - Training of fish and wildlife flavor
  - Degradation of fish and wildlife populations
  - Fish tumors or other deformities
  - Bird or animal deformities & reproductive problems
  - Degradation of benthos
  - Restrictions on dredging activities
  - Eutrophication of undesirable algae
  - Restriction on drinking water consumption
  - Beach closing
  - Degradation of aesthetics
  - Added cost to agriculture or industry
  - Degradation or phytoplankton or zooplankton populations
  - Loss of fish and wildlife habitat
- **Describe** the causes of the problems, identify all known sources of pollutants, and evaluate other possible sources.
- **Evaluate** remedial measures already in place and identify additional measures to resolve the problems and restore beneficial uses.
- **Provide** a schedule for implementing for implementing remedial measures.
- **Identify** persons and agencies responsible for implementing remedial measures.
- **Describe** surveillance and monitoring activities that will be used to track the effectiveness of the program and eventual confirmation that uses have been restored

For my middle school science classes, I have omitted some of the points and simplified others.

I. Define the environmental problem.

II Tell harm to water resource.
- Fish or wildlife cannot be eaten
- Quality and numbers of fish and wildlife have gone down
- Quality of water bottom has gone down
- Dredging cannot occur
- Water is unfit for drinking
- Beaches have been closed
- Beauty of the environment has been lost
- Costs have increased to agriculture or industry
- Quality and numbers of phytoplankton and zooplankton have gone down
- Habitat has been lost

III. Describe the cause(s).

IV. Identify ways to solve the problem and choose if possible.

V. Provide a schedule for clean-up

VI. Identify persons and agencies that can help.

VII. Describe monitoring activities

I have been a member of the Citizen Advisory Board for the Waukegan Area of concern for five years and have many slides from the Waukegan Harbor on the PCB clean-up which I began taking in the mid-1980's. The segments of the slide show can be organized, according to the template, from the definition of the problem: The PCB contaminated sediments to the solution to the problem: The use of the Taciuk processor and containment cells to monitoring: Fish and sediment sampling. The template helps to organize. Students have also watched about plastic pollution along the Texas coast and used the template to reorganize the information from an ABC News report on the environment. The following RAP was done on contamination due to lead. Information from the Waukegan **News-Sun** and the Lake County Health Department helped students to organize their thinking.

A RAP For Lead In Water

- **Define** problem: Lead can be found in the drinking water in some older homes.
- **Tell** harm: Water is unfit for drinking. Lead builds up in the body over many years and causes damage to the brain, red blood cells, and kidneys.
- **Describe** causes: Lead pipe (service line) coming into house from water main. Lead solder connecting cooper pipes.

Identify was to solve the problem:

1. Check solder yourself to see if it's lead by scratching with a key. Lead will be shiny.
2. Have lab test water. (Above 15 ppb or .015 mg/L is a problem)
3. Call a plumber
4. See the city's engineering department for records.
5. Purchase a device for the faucets as a carbon filter may reduce lead.

Provide a schedule:

Check system immediately, but in meantime use only cold water for cooking and drinking and let water run until it gets colder. Update system

Identify persons and agencies that can help: North Shore Sanitary District, Russell Road, P.O. Box 750, Gurnee, IL 60031 for lab. Various plumbers in Waukegan

Monitor activities:

Sample water within 14 days of correcting problem.

A RAP document can be many pages long. The RAP documents for the Grat Lakes' areas of concern are volumes long. For students, it can be a report of one to one and a half pages. Cooperative teams can work on different sections. Formatted writing is also helpful in classes where instruction needs to be more sheltered as in ESL classes.

The RAP document shows a beginning and an end to an environmental problem. The end occurs when beneficial uses are no longer being impaired or in simpler language when no more harm is being caused.

The students of the nineties are concerned about the environment. There is little apathy. The RAP template gives them a way to speak with a clearer and more defined voice.

Brian Poelker
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Manito, IL 61546

THE MACKINAW RIVER PROJECT

Introduction

Field work is essential to learning at the Junior High School level. Students make connections between class work and the real world. Many students at this age are concrete learners. These students learn best when they are able to manipulate the equipment and collect their own data. Time in the field is a premium at the junior high school level. Midwest Central Junior High School operates on an eight-block schedule. Even with eighty minute periods, much collaboration is needed for a successful field trip. At Midwest Central Junior High School students collect data on a meander bend of the Mackinaw River during open class period. Student groups measure the physical and chemical characteristics of the stream at five sites of the meander bend.

Stream bank erosion is a major problem along the Mackinaw River. Cornfields are planted up to the river bank. Each spring erosion increased the size of the meander bend. Students explore the physical causes of the erosion by measuring the stream velocity and depth. Students also measure the water temperature, dissolved oxygen, pH, and alkalinity. Students analyze the data from the five sites and look for trends.

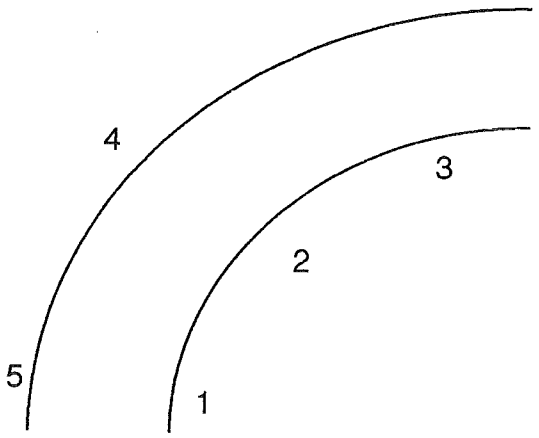
Prefield Trip Activities

Midwest Central Junior High School operates on an eight block schedule. Students meet on alternate days for 80 minutes. This provides ample time for students to be bussed to the river, make the requisite measurements, and return to school for the next class period. Data gathering is facilitated by collaboration among teams. Students work in teams of three. Each team measures specific river characteristics are one of five assigned sites at the meander bend.

Students are divided into 8 teams. The size of the team depends upon class size. A teacher may wish to have more sites and more teams with a larger class to keep the team size at 3. The teams must work cooperatively to complete the tasks at the river. The class must work together and rely on each other because each team measures only small part of the meander bend. The data is shared to produce a complete picture of this section of the river. Teams are generally assigned based on previous course work grades. A team consists of a class member from the upper one-third, middle-one third and lower one-third of the class.

Team number	Field Trip Responsibility
1	Measure velocity and depth at site 1
2	Measure velocity and depth at site 2
3	Measure velocity and depth at site 3
4	Measure the temperature and collect water samples at sites 1, 2, and 3
5	Measure the velocity at site 4
6	Measure the velocity at site 5
7	Measure the depth at sites 4 and 5
8	Measure the temperature and collect water samples at sites 4 and 5

Students are provided with handouts that explain how to complete the tasks and data collection sheets. Students review the tasks and are permitted to implement alternative methods of measurement. The field activities are modeled and practiced before the trip so all students know what they are expected to accomplish in the field. A slide presentation before the trip shows aerial and ground views of the meander bend to acquaint teams with the terrain.



Field Work

All measurements are made one meter from the shoreline. This control allows data from all classes to be averaged. On the inside of the meander bend a meter stick is sufficient to measure the depth. On the outside of the curve students measure the depth by attaching a weight to a rope and dropping it in the water. Students measure the temperature by attaching a thermometer to the end of a meter stick. The surface temperature is recorded at 1 minute intervals until the same temperature is recorded three time in a row. (Poelker, 1990)

Students measure velocity by placing orange parking lot cones 3 meters apart along the river bank. Students place a slice of an apple upstream, one meter from the shore. Students begin timing with a stopwatch as the apple passes the upstream cone.

The students stop timing as the apple passes the downstream cone. Students perform three trials and average the results. (Poelker, 1990) Water samples are collected at each site. Students collect and cap their jars underwater. Students use LaMotte water test kits in the lab to analyze the amount of dissolved oxygen. The samples are fixed in the field and the analysis is completed in the classroom. (Amos, 1969)

Classroom Activity Stations:

The work in the field provides students with a framework for understanding streams and the data associated with a meander bend. After data is collected in the field the information is analyzed in the classroom and at home. Classrooms stations provide connections to other water related problems. Class work is divided into four stations. Students spend one double period, eight minutes, at each activity station. Students are provided with the necessary handouts for all stations before the activities begin to maximize the use of class time. Students are assigned to begin at one of the stations and rote to the next higher number station in subsequent classes.

Station 1. Computer Tutorial

Students use the "Surface Water" tutorial from IBM's Eduquest Series to answer a series of questions on the handout (IBM, 1990). The tutorial provides general information about streams and rivers. Topics include stream flow, lakes, drainage patterns, stream gradients, velocity and discharge, channel characteristics, erosion and deposition. There is also a section about human impact on surface water.

Station 2. Video

The video "The Price of Bounty," produced by the University of Illinois, presents information relating to the water quality problems cause by erosion of farmland (University of Illinois, 1991). Students watch the video. The team reaches consensus on a theme for the video and several key ideas that support the theme. Three of these ideas are chosen by the team and recorded as topic sentences. Students use the information in the video to compose a three to five paragraph report. Each paragraph of the body of the report must relate to one of the topic sentences.

Students measure river characteristics at sites 2 and 3.

Station 3: Water Chemistry

Students do a serial dilution using red dye to better understand the concept of parts per million. Students begin with 10% solution of red food coloring. This is 100,000 ppm. Each dilution reduces the concentration in the next test tub by 90%. After 5 dilution's the concentration is 1ppm. The food coloring is now invisible but the mathematics shows students that a small amount is left in solution. Students express the concentration in fractions, decimals, percentage, exponents and parts per million in a cooperative lesson with the mathematics staff.

Just like the low concentration of red dye, students cannot see the traces of chemicals dissolved in the river water. Following the dilution activity, students use LaMotte water test kits to analyze Their samples. Students determine the amount of dissolved oxygen, pH and alkalinity of the water. (See data table.)

After completing station three teams record their data of the chemical and physical stream characteristics on a wall chart. This data is used by the entire class to determine the river characteristics. Students collect data from the chart and average the information as homework.

Station 4.

Station four is divided into two activities. Students locate the major rivers in Illinois on a state map and find the Illinois Department of Conservation Rating fro each river. Data from an atlas provides students with elevations of the Mississippi and Colorado Rivers at various locations. Students graph the elevation of the rivers versus the distance from the source for both rivers. The gradient of both rivers is calculated. Students compare the characteristics of the river stream beds to the gradients.

Data:

Students share the data they collected in the field and at Station 3 with their classmates. Information taken from the inside and outside of the meander bend is averaged by students.

Average data compiled by classes.

Characteristic	Inside Meander Bend	Outside Meander Bend
depth	16cm	78cm
velocity	3cm/s	9cm/s
temperature	16C	14C
Dissolved oxygen	8.3ppm	11.8ppm
pH	8.2	8.2
Alkalinity	250ppm	270ppm

From the table students can easily see direct relationships between many characteristics of the inside and outside of the meander bend. Percentages differences can easily be calculated. In viewing the river students observe that the outside of the curve has eroded and the inside of the meander bend shows deposition. The data collected provides evidence of the physical changes occurring in the river system.

Evaluation:

Students are evaluated by multiple methods. The students complete a laboratory report describing their work at the river and the comparisons of the river characteristics. Students produce a product from each of the class activity stations. A short quiz is given to check knowledge of Stations 1 and 4. Students write a theme based on the information gathered at Station 2. The results of the lab work at Station 3 are recorded in a table and on the wall chart. Finally information from the entire unit is included in a written test.

Conclusions:

The Mackinaw River Project uses local geology, which is familiar to students. Students measure certain river characteristics in the field. The project is both bands-on and interdisciplinary. Students study geology, chemistry, and agricultural problems related to rivers. Students work cooperatively in groups and collaboratively with classmates to measure the river. Data collected provides evidence of geological change. When faced with data from other localities, students have a frame of reference on which to base their work.

A related project for high school students is the Rivers Project of SIU-Edwardsville. The project collects data from high schools primarily along the Mississippi and Illinois Rivers and associated tributaries. The information is shared via the internet to participating schools. For more information about the Rivers Project contact Dr. Robert Williams at SIU-E.

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Williams, Bob. The Rivers Project, SIU-Edwardsville, Box 2222, Edwardsville, IL 62026.

Internet: rivers@eville.uiuc.fred.org

The Staff Journal Register
John O'Connor, Staff Writer
Springfield, IL

WILLIAMSON DONS FURRY DISGUISE: CHEMISTRY CLUB INDUCTS SHERIFF INTO ROYAL ORDER OF THE MOLE

Now, if only Sheriff Neil Williamson could get the Sangamon County Board to think like the Lanphier Chemistry Club. Williamson needs a number like 602,000,000,000,000,000,000,000, not the mere $6,536,145 ($7000,000 less than this year) that the board suggested he get for next year's budget.

"They can't think that high," Williamson joked Monday, while dressed like a blind, furry little animal. "They think, 10% cut, 10% cut." On Monday, all Williamson had to do was dress like a mole, and he could reveal all he wanted in 6.02 times 10 to the 23rd power (the reason Mole Day is Oct. 23). Williamson became the eighth local luminary to be inducted into The Royal Order of the Mole.

The sheriff told the chemistry club he's had a lot of honors in his two decades in law enforcement. He won a Big Brother/Big Sister pig-kissing contest. He auctioned himself off for charity, and that's how he met his wife. "But the Royal Order of the Mole, how can you top that?" he said after removing the mole mask that had mussed his TV-perfect hair.

Chemistry brains need the mole — the number — to measure atoms. To convert tiny atoms to a relatively huge unit like a gram, you've got to use the mole — or, to quote the "Mole Song," which the students sang lustily, "Much too big a number to comprehend."

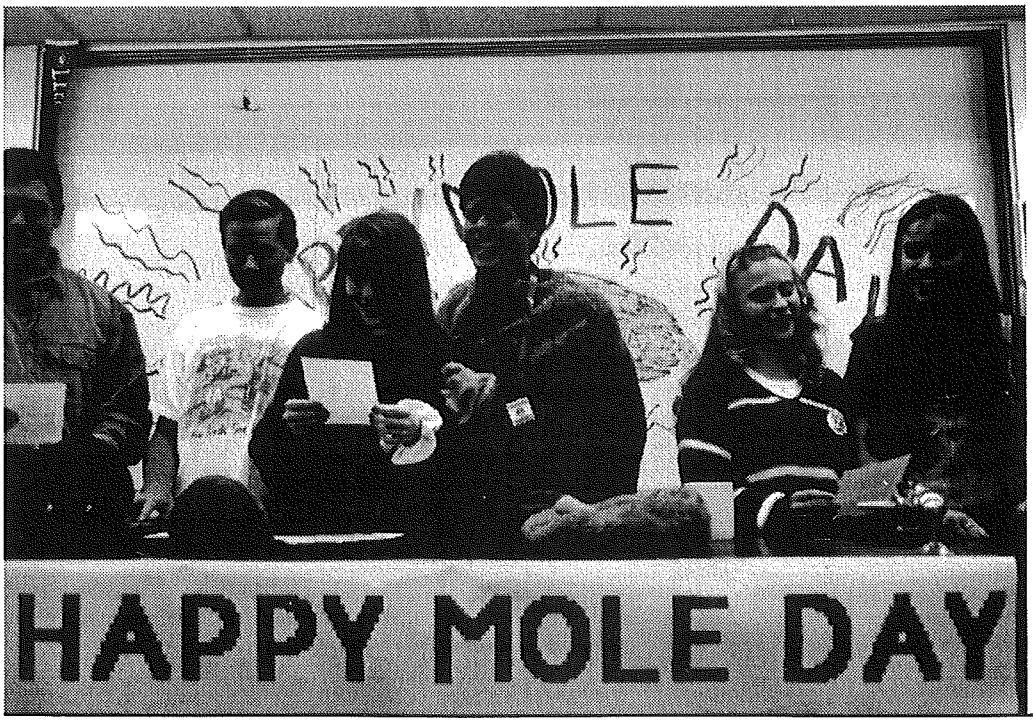
For instance:

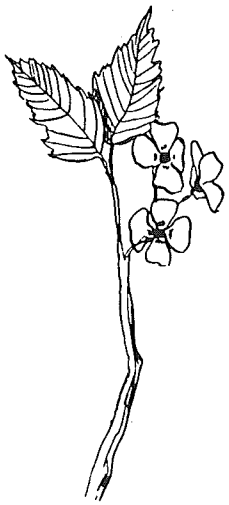
- A mole of pennies would give everyone in the world $1 trillion, according to the song.
- A mole of stacked paper would stretch to the moon and back 80 billion times.
- A mole of marshmallows would weigh five million trillion tons and take everyone on Earth 40 million years to eat.

The chemistry club celebrates the mole every year. "It's something that should make you feel very good," science teacher Ray Bruzan said, showing Williamson the royal order's plaque as Williamson stood in front of drawings depicting the Mole-a-Lisa and a De-moleition Derby.

There's a mole prince and princess too — this year, seniors Nathan Dash and Kathy Evans. It must be a great honor."Oh, it is," Evans said with a straight face. The chemistry Club , president Alicia Redfield said, is the school's largest, with 130 members who vote on mole royalty. It apparently needs better press, though. Evans was late getting down to the principal's office to escort Williamson to classes taught by Bruzan and colleague Don Golff. The teacher didn't believe Evans was mole princess, she explained as she hastily put on her sash, which on the back has the mole — 602 with 21 zeros after it."She said, 'Where's your pass?'" Evans related, "I said: 'I'm the mole princess! I don't need a pass.'"

Stuffed moles made by students including one dressed like superman with a big "I" — for incredi-mole, of course — were lined up for judging. Then came the Mole Olympics, winners of which were determined by who could answer chemistry questions most quickly and accurately. They produced gold medalist Bryan Kennedy, silver medalist Josh Ratz and bronze medalist Rachael Smith. "Can I write this on a college application? "Silver medal in the Mole Olympics?" "Ratz asked as Bruzan lit the Olympic torch — a Bunsen burner — and the class started singing the Olympics theme for the three to receive their medals.





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EXPLAINING THE MOON ILLUSION

As science teachers we are often called upon to answer all sorts of questions relating to the natural world. One of those things we are sometimes called upon to explain is the Moon Illusion. The question goes something like this, "Why is it that the moon looks so much bigger when rising or setting as compared to those times when it is higher up in the sky?"

Some answers to this question in the past have relied upon such diverse things as atmospheric effects, the orientation of the eye in its socket, the comparison of the moon with foreground objects, and so on. None of these explanations will survive careful analysis.

So what is the answer to this question that has succeeded in eluding many a scientist for generations? I offer an answer that over the years seems to have satisfied my questioners, be they school pupils, parents, planetarium directors, and even physicists and astronomers.

It is my assertion that the Moon Illusion is caused by the differing apparent background of the sky "against" which we view the moon. This may seem to be a curious way to approach the question, but it is one that seems to explain the phenomenon to the satisfaction of the most severe critics.

That a background can affect how one perceives a foreground object has been well established. For instance, an examination of figures 1 and 2 will show this to be the case. In the first figure, the two lines truly are straight and parallel; in the second figure the triangle is created from three straight lines. (If you doubt that these lines are straight, turn the page on edge and look down the lines.) As you can readily see, the background affects in no small way the way one perceives the foreground objects.

The moon has essentially the same angular size when observed near the horizon as compared to overhead (neglecting atmospheric refraction that compresses the moon in the vertical direction and the changing observer-moon distance that results from earth's rotation that actually enlarges the angular diameter of the moon minutely with increasing elevation). This can be shown clearly by measurement. That the moon appears larger when near the horizon as compared to higher up in the sky is the basis of the illusion.

The solution of the Moon Illusion question connects two seemingly divergent points: 1) the Ponzo or Railroad Track Illusion, and 2) one's perception of the shape of the sky.

The Ponzo Illusion (shown in figure 3) is nothing more than a set of "parallel" lines that appear to converge at the distant horizon due to perspective — just like a set of railroad tracks. Two blocks of identical size stand in the foreground. The "nearer" of the two blocks appears smaller than its "more distant" counterpart. Clearly, the background influences our perception of the blocks' relative sizes.

What does the Ponzo Illusion have to do with the Moon Illusion? The connection may seem quite tenuous until one considers how humans perceive the sky. Have you ever noticed how the

fig. 1

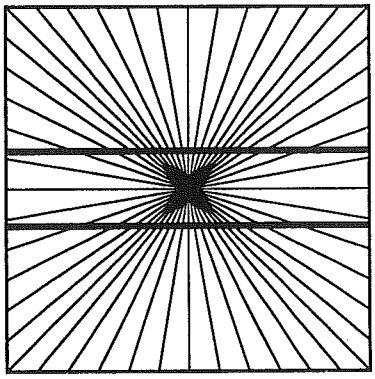
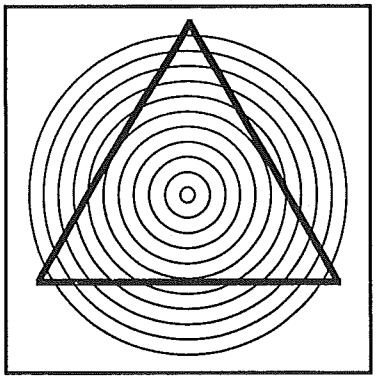
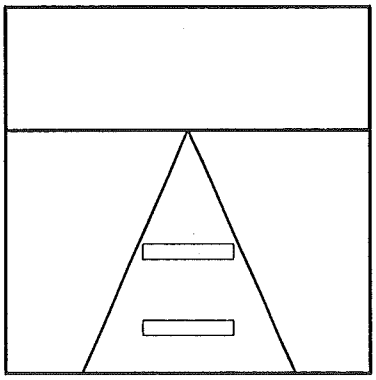


fig. 2





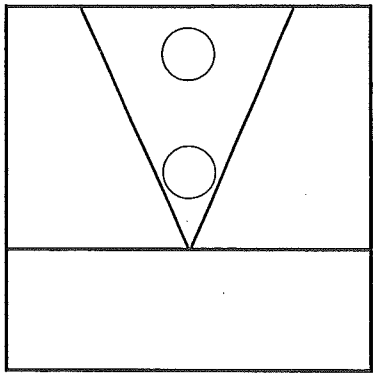


fig. 3

sky near the horizon seems much more distant than the overhead point? Why one perceives the sky as such is unknown, but it probably has something to do with the way clouds appear in the sky. Clouds, when passing overhead, actually are much nearer than those lower down in the sky. These clouds near the horizon truly are more distant. This perception — high = near, low = far —seems to be carried over into the cloudless sky of day or night.

The moon, much more distant than the atmospheric blue haze that we call the sky, appears to be embedded in the sky. Since it is "against" the sky that we observe the moon, the sky has the potential of perceivably affecting the appearance of the moon. When one sees the moon against the "more distant" sky near the horizon, the moon appears large. When the moon is observed higher up "against" the nearer sky, it appears small. The explanation of the Moon Illusion is that it is nothing more than the Ponzo Illusion turned up-side down!

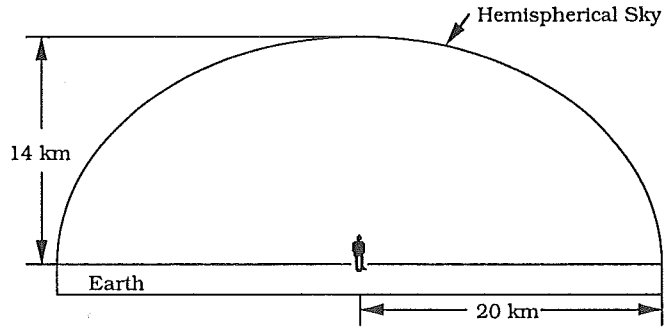
In addition to explaining why the Moon Illusion occurs, this reasoning also appears to explain why the sun and constellations also appear so much larger upon rising and setting.

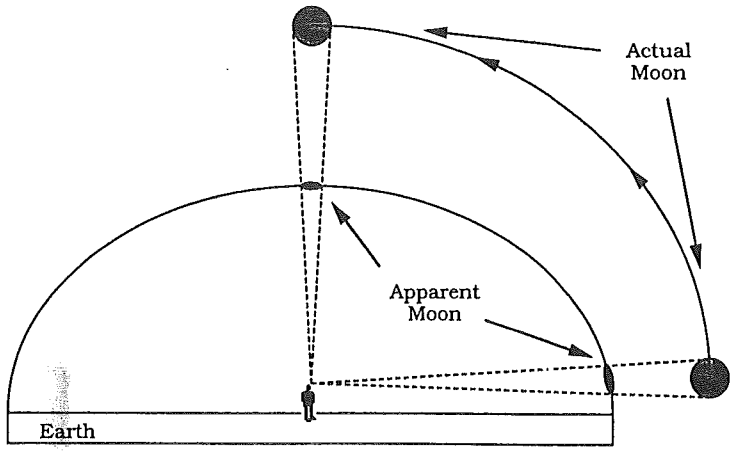
Now the critic might ask, "Is there any way one might verify this explanation?" Consider the following arguments: If the sky is causing the Moon Illusion then any observation made of the moon without the interfering sky should show the moon to appear the same size when near the horizon as compared to higher up. Additionally, varying the "background" should be able to induce the illusion in other ways. Let's examine both of these cases.

The moon illusion can be made to disappear if the rising moon is viewed near the horizon through a screen that blocks out the sky. Peering at the rising moon through sheer curtains from a lit room makes the effect disappear altogether. When only the moon is seen through the sheer curtains the illusion disappears.

There is a way to recreate the effects of Moon Illusion that also lends credibility to the explanation. Enter a dimly-lit room and peer into an unshielded light bulb for about 30 seconds. Turn off the light and you will see an after-image of the bulb's filament. Now "project" the after-image "onto" a piece of paper held close up and note its apparent size. Next, "project" the after-image onto the same piece of paper held at arm's length. The after-image will appear much larger.

Clearly, the size of the after-image in the eye has to be the same size in each case. The background against one views the after-image affects the perceived size of the after-image. So it is with the Moon Illusion.





SPECIAL INTERESTS

Water Resources Center
University of Illinois
Institute for Environmental Studies
1101 W. Peabody Dr.
Urbana, IL 61801

AQUATIC NUISANCE SPECIES NEWSLETTER INAUGURATED

The first issue of the *Aquatic Nuisance Species Digest* was published in July, 1995. The Freshwater Foundation, in cooperation with the Great Lakes Commission and the Great Lakes Panel on Aquatic Nuisance Species has developed this newsletter that will cover many aspects of the ANS problem.

The July issue contained articles on nonindigenous aquatic weeds, costs of zebra mussel monitoring and control, the problem of edible brown mussels in Texas coastal waters, and the results of a survey on the knowledge and attitudes of boaters in Minnesota and Wisconsin about exotic species.

For a subscription to ANS Digest contact the Freshwater Foundation, 725 County Road Six, Wayzata, MN 55392, Phone (612)449-0092.

NIWR RELEASES NEW DATABASE

The National Institutes for Water Resources has released the NIWR Publication Database containing nearly 10,000 citations. The new database features citations of journal articles, books and book chapters, dissertations, water resources research institute reports, conference proceedings, and other publications resulting from research activities over the last ten years at the nation's 54 water resources research institutes.

The NIWR Publication Database is available on computer disk with a powerful and quick search utility developed by the U.S. Geological Survey. The only requirements for its use are a DOS-compatible computer with at least 10 megabytes of free hard disk space. The database is scheduled to be updated in 1997. The database cost is $10 to cover the cost of distribution. Please specify disk size (3.5" or 5.25") and format (double density or high density).

To request the database, write: National Institutes for Water Resources, Massachusetts Water Resources Research Center, Blaisdell House, University of Massachusetts, Amherst, MA 01003-0820. Other information about NIWR and the Institutes may be accessed through the World Wide Web (on the Internet at URL address): http://wrri.eng.clemson.edu/.

CALENDAR OF UPCOMING EVENTS

March 18, 1996, Third Annual Clean Water Celebration, Peoria Civic Center. Over 4,000 students will learn about water from about 100 exhibitors and workshops. For more information, contact the Sun Foundation (309)246-8403.

April 13, 1996, Beardstown. The Illinois State Geological Survey (ISGS) will conduct a field trip in the counties of Cass, Schuyler, and Brown. The Beardstown area offers a variety of geological features. Thick layers of loess cover some of the ancient Mississippi River Valley, now occupied by the Illinois River. **Meet before 8:15 a.m. at Beardstown High School, two blocks north of IL 125 on 15th Street.**

May 18, 1996, Hoopeston. The ISGS will be leading a field trip in the Vermillion County area in the northeastern part of central Illinois. The Pleistocene glacial deposits are the subject of the day - moraines, intraglacial deposits, and gravels left by glacial meltwaters and sand dunes. Join the ISGS and see Glacial Lake Watseka. **Meet before 8:15 a.m. at Hoopeston High School, 615 East Orange Street, east side of town south of IL 9.**

***For more information about the ISGS, or the field trips, call: (217)244-2427 or 333-4747.**

AVAILABLE RESOURCES

Resources Available Virtually — The following World Wide Web addresses are related to groundwater

Groundwater Home Page
http://wtrwww.env.gov.ca/gwis.html

Internet Accessible Software for Groundwater Modeling and Analysis
http://gwrp.cciw.ca/interent/software/non-commercial.html

Water Organizations
http://www.siu.edu/orgs/index.html

***Editors Note:** If you have access to the World Wide Web, you can gather an enormous number of addresses for sites by using your search utilities (Web Crawler, Lycos...) to search for groundwater related words: groundwater, water, aquifer, hydrogeologic. These freely available utilities can jump start your research and allow you to spend more time using the information instead of sifting through the virtual universe. In addition, if you have Internet access, but not World Wide Web access, use your commercial server's "Gopher Search" capabilities. This will list not only Gopher Sites but file transfer protocol (ftp) sites as well.

The ZPG Reporter
Zero Population Growth, Inc.
November/December 1995

POP WATCH

Risk Factors

The majority of the 1.3 million women who die from causes related to reproduction each year are from countries with very restrictive family planning and abortion policies, according to a Population Action International study, "Reproductive Risk: A Worldwide Assessment of Women's Sexual and maternal Health." The "very high risk" category to dominated by sub-Saharan African countries and characterized by very low contraceptive use, very high fertility and maternal death rates, high infertility due to sexually-transmitted disease, and restrictive abortion policies. In the "very low risk" category, Italy ranked first and the United States ranked 19th among 23 countries with very low rates of fertility, maternal mortality and HIV/AIDS prevalence and high levels of contraceptive use and access to maternal health and abortion services.

Trashing Computers

By the year 2005, more than 150 million computers, or about half the world's computers, will be in landfills, according to estimates by Carnegie Mellon University. Due to rapidly advancing technology and planned obsolescence, the average replacement rate for computers in Western countries is once every three years. While many trashed computers can no longer support the latest software, they would be welcomed by businesses in developing countries that can't afford the latest models. Sensing a new market, some companies in Europe and the U.S. have started repairing and rebuilding computers, creating working systems or salvaging components for export and recycling.

Vanishing Forests

Tropical rainforests in the Pacific Islands are being destroyed faster than those in Brazil or Southeast Asia, warns a new World Bank report on the region's economic development. Without logging and farming reforms, large forests in the Solomon Islands, Fiji, Vanuatu and Western Samoa may disappear completely in 15 to 20 years, the study predicts. The rate of population growth in these nations ranges between 2.0 and 3.7 percent, and most Pacific Island nations lack written forest management plans. The study also found that natural regeneration is almost nonexistent in these tropical forests.

Abortion On the Decline

Although the public debate over abortion has grown even louder, the percentage of women having abortions and the percentage of pregnancies ending in abortion have been steadily dropping since the early 1980s, according to a study by The Alan Guttmacher Institute. In 1992, the abortion rate was 25.9 per 1,000 women of childbearing age, the lowest rate since 1976. This decrease may reflect the shrinking number of abortion providers, a growing acceptance of single motherhood, and the fact that a smaller proportion of women are in the prime childbearing ages of 20-29. But fewer abortions don't necessarily indicate a higher rate of contraceptive use; the percentage of women aged 15 to 44 using contraceptives declined from 60 percent to 59 percent between 1988 and 1990.

ZPG has a new 800 number. Feel free to use it to order publications and products and for information on our activist programs. We want to hear from you Call: 1-800-POP-1956

Reprinted from *Washington Science Teachers Association* journal

SOME MISCONCEPTIONS OF STUDENTS

Supposedly, a teacher complied this list of comments from test papers, essays, etc. submitted to science and health teachers by students. The teacher noted "It is truly astonishing what weird science our young scholars are create under the pressures of time and grades". This list came from Fred Spilhaus and it is not stated where he obtained it.

- H_2O is hot water and CO_2 is cold water.
- To collect fumes of sulphur, held a deacon over a flame in a test tube.
- When you smell an odorless gas, it is probably carbon monoxide.
- Water is composed to two gins, Oxygin and Hydrogin. Oxygin is pure gin. Hydrogin is gin and water.
- Three kinds of blood vessels are arteries, vanes and caterpillars.
- Respiration is composed of two acts; first inspiration and then expectoration.
- The moon is a planet just like the earth, only is even deader.
- Artificial insemination is when the farmer does it to the cow instead of the bull.
- Dew is formed on leaves when the sun shines down on them and makes them perspire.
- Mushrooms always grow in damp places and so they look like umbrellas.
- The pistol of a flower is its only protection against insects.
- The skeleton is what is left after the insides have been taken out and the outside have been taken off. The purpose of the skeleton is something to hitch meat to.
- A permanent set of teeth consists of eight canines, eight cuspids, two molars and eight cuspidors.
- Blood flows down one leg and up the other.

2061 TODAY
Fall 1995, Vol. 5, no. 2
Science Literacy for a Changing Future

PROJECT 2061 DEVELOPS RESOURCES FOR SCIENCE LITERACY

"I know that science literacy is important for my students. But how can I be sure that what I teach, how I teach it, and the materials I use will help them reach that goal?"

Questions like this one are heard frequently by Project 2061, and it's not surprising. Although there has been widespread acceptance of science literacy and learning goals for students—such as those proposed in Project 2061's *Science for All Americans* and *Benchmarks for Science Literacy* and in the National Research Council's *National Science Education Standards*—much remains to be done before teachers and students can address those goals in classrooms throughout the country.

According to Dr. Norman Lederman, professor of science and mathematics education at Oregon State University, implementation issues have been a major obstacle to reform in the past."Many reform pronouncements have been made with the assumption that everyone involved should be prepared to put the reforms into practice immediately," he says. In fact, the adoption of science literacy goals for all students is going to require change at many levels of the education system. And one of the most far-reaching changes has to do with the way teachers prepare for their work in the classroom.

What Should Teachers Know?

Project 2061's report *Science for All Americans* (1989) describes science literacy goals for all high school graduates. In doing so it defines science literacy broadly to include knowledge of the natural and social sciences, mathematics, technology, and the connections among them. It reaches even further to cover the nature of the scientific enterprise itself, historical events of significance to the development of science, and themes that cut across science, mathematics, and technology.

Few teachers can be expected to understand all of these topics. What is more, the sheer volume of scientific knowledge grows rapidly every day. At the same time, science and technology play an increasingly important role in the daily lives of most of us, making science literacy for all more important than ever. Is it any wonder that teachers need help?

What kind of help and how to provide it has been a major focus of Project 2061's blueprint report on teacher education. Prepared by a panel of experts on teacher education and professional development, the draft blueprint report puts it this way:

"To achieve the ambitious instructional goals in *Science for All Americans*, teachers will need to pursue their study of content, learning, curriculum, and pedagogy in greater depth than any initial preparation program could allow. Moreover, teachers must continue to learn so that they can keep pace with some of the advantages in science and about science teaching."

A similar concern is expressed in the most recent draft of the NRC's *National Science Education Standards*: "The view of science and how it is learned (as described by the *Standards*) are difficult to convey to students in school if teachers have never experienced it themselves."

New Tools for Teachers

To respond to concerns like these, Project 2061 is creating *Resources for Science Literacy*, a new two-part CD-ROM/print tool for teachers, teacher educators, curriculum developers, and others. *Resources* will provide users with access to a broad array of information that will help them to expand their knowledge of science, mathematics, and technology; increase their understanding of science literacy goals for K-12 education; and improve their ability to make better decisions about curriculum materials, classroom instruction, and assessment.

Professional Development

Part 1 of *Resources for Science Literacy*, to be released in Spring 1996,

Resources for Science Literacy: Professional Development will offer a carefully selected collection of references, workshop activities, research, analyses, and course plans that teachers can use to explore many aspects of science literacy and its implications for K-12 science education. Hypertext links will allow users to search for resources that relate to specific topics presented in *Science for All Americans*. The CD-ROM will contain:

Science for All Americans. The book's full text is accessible and linked to all of the other components (except the *Workshop Leader's Guide*) on the disk.

Workshop Leader's Guide. Developed and field-tested by Project 2061 staff, teachers from the Project's School-District Centers, and education consultants, the *Guide* includes a variety of presentations, activities, and supplementary materials that can be used to design and conduct workshops on *Science for All Americans* and *Benchmarks*.

Comparisons of Benchmarks to National Standards. Included here are analyses of how Benchmarks for Science Literacy relates to national content standards developed by the National Research Council, the National Council of Teachers of Mathematics, and the National Council for the Social Studies.

College Courses. Descriptions of 15 undergraduate college courses provide some guidelines for designing syllabi and supplementary materials to teach college students particular concepts from *Science for All Americans*.

Cognitive Research. The full text of Benchmarks Chapter 15: The Research Base plus a survey of cognitive research literature shed light on what is known—and not known—about the ability of students of various ages to learn many of the topics in *Science for All Americans* and *Benchmarks for Science Literacy*.

will offer a variety of professional development aids that can be used by teachers for self-guided study or as the basis for preservice or inservice education programs. It will offer a variety of materials and information that will help educators who want to know more about using and understanding *Science for All Americans* and *Benchmarks for Science Literacy*."*Resources* has grown out of our earlier work on *Science for All Americans* and *Benchmarks*" says Dr. Jo Ellen Roseman, Project 2061's curriculum director. "But a great deal of the impetus for *Resources* comes from what we've learned from the teachers who have been attending our workshops over the past two years."

According to Marilyn Cook, a science teacher in Port Aransas, Texas, this is the right tool at the right time. "My district is beginning to collaborate with Texas A&M-Corpus Christi on a master's degree in curriculum and instruction. *Resources for Science Literacy* will be an excellent tool for such a program. It will also be useful for district-level staff development programs, especially in rural districts like mine, where distance or individual learning is important."

But Dr. Lederman at Oregon State has a different perspective on how *Resources* will be used. "Those of us in higher education might not want to admit it, but we need just as much help dealing with the whole notion of science literacy as K-12 teachers do. College folk can be quite isolated within their own specialty or even sub-specialty. *Resources* can help us break down those barriers."

Curriculum Materials

Scheduled for publication by the end of 1996, Part 2, *Curriculum Materials*, is being created to help educators design curriculum and plan instruction with science literacy goals in mind. Along with a tutorial explaining how to analyze curriculum materials for their relevance to science literacy goals, this component will include descriptions of books, films, computerized resources, museum exhibits, and other exceptional materials and activities recommended for their quality and their match to learning goals in *Benchmarks for Science Literacy*.

Benchmarks a Model for State Frameworks

According to a recent report by the Council of Chief State School Officers (CCSSO), a majority of states have begun to develop, revise, and implement state curriculum frameworks in science and mathematics. Traditionally, state curriculum guidelines in science and mathematics have been lists of topics to be covered at each grade level. This approach often tended to encourage the teaching of disconnected low-level facts. More recent frameworks have centered on a coherent set of content standards for all students, reflecting similar approaches by other national and state reform initiatives.

The CCSSO study, *State Curriculum Frameworks in Mathematics and Science: How Are They Changing Across the States?* reviewed 60 frameworks in science and mathematics—40 from 1990 to 1994, and 20 completed in 1990 or earlier. CCSSO found that 16 states had completed frameworks in science, and 16 had completed frameworks in mathematics. In addition, 10 of the 16 states with completed frameworks in science claimed to match recommendations from model documents such as Project 2061's *Science for All Americans* and *Benchmarks for Science Literacy* and the NRC's *National Science Education Standards*.

Benchmarks for Science Literacy
Table of Contents

1 **Nature of Science**
2 **The Nature of Mathematics**
3 **The Nature of Technology**
4 **The Physical Setting**
5 **The Living Environment**
6 **The Human Organism**
7 **Human Society**
8 **The Designed World**
9 **The Mathematical World**
10 **Historical Perspectives**
11 **Common Themes**
12 **Habits of Mind**

Kansas

Program Outcomes
- Nature of science
- Meaning of science
- Integration of science
- Relationship of social, technological and scientific issues

Cross-cutting
- Matter and energy
- Patterns of change
- Systems and interactions
- Stability
- Models

California

Content Areas
- Physical sciences
- Earth sciences
- Life sciences

Cross-cutting
- Energy
- Evolution
- Patterns of change
- Scale and structure
- Stability
- Systems and interactions

Ohio

Goals
- Nature of science
- Physical setting
- Living environment
- Societal perspectives
- Thematic ideas

Cross-cutting
- Scientific inquiry
- Scientific knowledge
- Conditions for learning science
- Applications for science learning

Examples of state frameworks and their general content match to Benchmarks.

Matching Content

CCSSO's preliminary analysis of state frameworks and model documents focused primarily on a general content match—the consistency of main categories of the mathematics and science frameworks with national standards. Because the majority of science frameworks were written prior to the publication of Project 2061's *Benchmarks* or the National Research Council's draft *Standards*, some states left out or gave more emphasis to key content areas that Project 2061 and the National Research Council (NRC) eventually included in their documents. Examples of these include the nature of science, history of science, science as inquiry, science and society, and science applications.

The CCSSO expert panel found that the main headings and categories of most of the recent science frameworks reviewed were generally consistent with the broad content categories in Project 2061's *Benchmarks* and the NRC's draft *Standards*. For example, the illustration below shows the general content match of Project 2061's *Benchmarks* with the frameworks of three states. In the next phase of its analysis, the CCSSO panel is planning to work with Project 2061 staff to conduct a much closer comparison of state frameworks to *Benchmarks*.

The new CCSSO report provides summary tables and figures showing patterns across the states in the content and organization of frameworks, along with selected examples of how states write and design framework documents. The report was written by Rolf K. Blank, CCSSO Study Director, and Ellen M. Pechman, a senior associate at Policy Studies Associates. To order a copy contact: CCSSO Publications, One Massachusetts Ave., NW, Suite 700, Washington, DC, 20001.

AAAS Science Sourcebook Available

More than 1,000 organizations and 10,000 resources and programs are described in the latest edition of *IDEAAAS: Sourcebook for Science, Mathematics, and Technology Education*. Listings include contact names and addresses for professional societies, academies, museums, zoos, planetaria, government programs and offices, and more. Available for $24.95 from The Learning Team, Inc., 914/273-2226.

2061 Today is published by Project 2061. We welcome your comments. For additional information, contact: Project 2061, AAAS, 1113 H Street, N.W., Washington, D.C. 20005. 202/326-6666; e-mail: project2061@aaas.org. Internet: gopher.aaas.org; World Wide Web: http://www.aaas.org.

UPDATE ON THE THIRD DOE-FUNDED GENOME MODULE: NONTRADITIONAL INHERITANCE: GENETICS AND THE NATURE OF SCIENCE

Overview BSCS is developing a third curriculum module associated with the Human Genome Project. The new module, tentatively titled Nontraditional Inheritance: Genetics and the Nature of Science, will be a print product, as was the first BSCS genome module.[1]

Initiation of the project This twenty-month curriculum-development project is funded by the Department of Energy through the Ethical, Legal, and Social Implications (ELSI) component of the Human Genome Project. The goals are to produce a print module for high school biology that will address recent discoveries in genetics that require nontraditional explanations, and to use these examples to convey the nature of scientific explanations and processes. Scientific research and medical histories have produced considerable evidence for a variety of genetic phenomena that are not adequately explained by classical, Mendelian patterns of transmission or by standard views of gene structure and behavior. Recent discoveries provide evidence of the mechanisms underlying these genetic phenomena; as a result, the body of genetics knowledge and explanations is changing. Genetic phenomena that require nontraditional explanations include genomic imprinting, expansion of trinucleotide repeats associated with genetic anticipation, the mobility of certain genetic elements, uniparental disomy, and RNA editing.

First meeting of the advisory committee: 17-18 March 1995 An advisory committee composed of experts in high school teaching, genetics, the philosophy and history of science, and ethics met with BSCS curriculum developers to consider the project goals, to build a conceptual framework and to suggest the structure for classroom activities. The committee recommended that the module focus on the nature of science, using examples of nontraditional inheritance as a vehicle to let students experience the process of change in scientific explanations. Background materials for teachers

Table 1. New Concepts Require New Explanations of Inheritance

Traditional Concepts of Inheritance	
Genotype gives rise to phenotype.	Non-alleles assort independently (Mendel's law of independent assortment).
Genes are the units of inheritance and are the source of biological variation.	Genes occur at fixed locations (loci) distributed along chromosomes.
Inheritance is nuclear and vertical (from parent to offspring).	During meiosis, chromosomes can exchange genetic material. This recombination process is called crossing-over.
The genetic contribution from each parent is equal (in sexually reproducing species).	Genes on the same chromosome are "linked." The closer they are, the lower is their chance to separate during crossing over.
The laws of probability help to explain patterns of inheritance.	Chromosomes are composed of DNA and associated proteins; DNA is an informational molecule. Rare events (mutations) can change this information.
Traits can show a dominant or recessive pattern of inheritance.	
Alleles segregate (Mendel's law of segregation).	
Nontraditional Concepts of Inheritance	
Genomic imprinting can alter the expression of genetic information and distinguish its parental origin.	Some heritable traits are extranuclear (mitochondrial inheritance; cytoplasmic inheritance).
Genetic anticipation (increased severity of a genetic disorder in later generations) correlates with expansion of trinucleotide repeats.	Many traits result from phenotypic expression of more than one gene (polygenic inheritance).
Some genes are mobile and can insert themselves in new chromosomal locations.	Genetic information specified by genomic sequence may be altered during RNA editing.
	Genes may (in rare cases) undergo horizontal transfer between individuals or species.

will include a survey of the new genetics discoveries in addition to those nontraditional examples of inheritance that are used in the classroom activities.

Review of the conceptual framework and committee recommendations: April June 1995 The project staff at BSCS has prepared a report to summarize the outcome of the first advisory committee meeting. This report has been reviewed favorably by individual experts in genetics and the philosophy of science, and a revised draft was reviewed by the education committees of three national genetics organizations: the American Society of Human Genetics, the National Society of Genetic Counselors, and the Council of Regional Networks for Genetic Services. The report describes the conceptual framework for the module and outlines topics to be covered in the teacher's background materials. Table 1 is an excerpt from the report showing genetics concepts traditionally taught in high school biology (upper, shaded portion) and new concepts, some of which wilt be the focus of classroom activities.

Information is available electronically through the World-Wide Web address (http://wvNw.ornl.gov/TechResources/Human_Genome/ftp.html). In June 1995, high school and college biology teachers participating in the Human Genome Teacher Networking Project Workshop in Kansas City received an overview of the project and a short questionnaire. Their responses support the advisory committee's recommendation that the module will be most useful as a tool for teaching the nature of science and the connections between evidence and explanation. They also stressed the need for students to learn how to ask good questions.

Also in June, a group of community college biology faculty who were meeting at BSCS in relation to another curriculum project pilot tested a sample activity on genomic imprinting. Their enthusiastic comments and criticisms, along with the responses of the Kansas City workshop participants, helped guide the production of full-scale field-test materials.
Writing conference at BSCS: 7 - 18 August 1995 For two weeks in August, a team of six writers worked with curriculum developers and other BSCS staff to design five classroom activities for the module. These activities will require five class periods (of approximately 50 minutes each) to teach. The team produced a rough draft of these activities with accompanying teacher material that describes strategies for teaching each activity. In addition, the writing team drafted a relatively comprehensive survey of the nature and methods of science and of many examples of nontraditional inheritance, including those used in the activities, and of ELSI topics (Ethical, Legal, and Social Implications of the Human Genome Project). This material will provide teachers with an in-depth background of the content of the module. Tentatively, the activities will consist of:

Activity 1 a review of major concepts traditionally taught in genetics, in the context of the history and nature of science;

Activity 2 an introduction to new discoveries in genetics that require a expansion of existing explanations, particularly beyond those commonly taught in introductory classes; mitochondrial inheritance will be used as an example;

Activity 3 a more extensive experience with using new evidence to adjust explanations in science; Huntington disease and myotonic dystrophy are used as examples of genetic anticipation, and the molecular mechanisms underlying this phenomenon (unstable trinucleotide repeats in genes associated with these diseases) are presented;

Activity 4 a focus on ELSI issues; this activity builds on the prior activity, exploring issues related to genetic testing for Huntington disease, particularly to the restrictions on the testing of minors.

Activity 5 a final focus on the nature and methods of science; it includes a summary of the examples of nontraditional inheritance used in the module, along with the scientific criteria through which they have entered our understanding of genetics. Students will have an opportunity to apply these criteria to new situations.

Sept-Nov 1995 Selection of field-test participants; preparation of materials for field testing
28 Oct 1995 A workshop titled "Genetics and the Nature of Science" was presented at the NABT Annual Convention in Phoenix. The workshop will explore issues related to the module and use material from the experimental drafts.
8-9 Dec 1995 Orientation for field-test teachers at BSCS
A report on this project will be presented at the Department of Energy Human Genome Program Contractor-Grantee Workshop (Santa Fe, NM).
Jan-Feb 1996 Field test of experimental materials; collection of evaluation data
Mar-April 1996 Second meeting of the advisory committee
We plan to have the completed module ready for distribution in the fall of 1996.

[1]Please note that this third module covers new material; it is not a revision Of update of the previous two modules. The first BSCS genome module was Mapping and Sequencing The Human Genome: Science, Ethics, and Public Policy (a print module, 1992). The second module, awaiting distribution, is The Human Genome Project: Biology Computers, and Privacy (a software and print module).

ChemWest: Upcoming Chemistry Events

CICI, Chemical Industry Council of Illinois, Presents its 22nd Annual Chemistry Career Conference for High School Students at the Museum of Science and Industry, March 21-22. For more information and registration contact: Mike Moss, Chemical Industry Council, 9801 W. Higgins RD., Suite 515, Rosemont, IL 60018, 708-823-4020.

The first round for the Chemistry Olympiad is temporarily scheduled for March 23, at Roosevelt Univ. The second round will be held on April 19 at Roosevelt and will have a lab practical. For further info on times, how to sign up your students, and directions call the ACS office 708-647-8405.

201th ACS National Meeting in New Orleans March 24-29. You might be able to combine your Spring Break with the meeting [there is an education day which is cheap to attend and has some good tax consequences!] Contact ACS, 1155 16th St., N.W., Washington, D.C. 20036-4899 or 202-872-4396.

AP EXAM MAY 13 or so I am told. Bit early this year so watch it! Last years test was too easy so look for a killer this year?

The local ACS scholarship will be held on May 18 at Univ. of Illinois in CHICAGO. Each student will get a certificate this year. There will be a short program for students on the opportunities in chemistry after the exam. For further info call the ACS office 708-647-8405.

ACS Great Lakes Regional Meeting in late May 20-22 at Illinois State University. A chemical education program is planned for in conjunction with the program. For into on program contact Doris Kolb 309-691-4874 or visit the home page http://www.che.ilstu.edu.girm/

ICE (Institute for Chemical Education) is running Chemistry and Materials Science program this coming summer [June 17 - July 12] at the Univ. of WI. For more info on this opportunity contact Dept of Chemistry, University of Wisconsin - Madison, 1101 University Ave, Madison, WI 53706-1396 [or phone 608-262-3033]

Dreyfus Outreach Programs, July 8-12, funded by Woodrow Wilson National Fellowship Education and hosted by the University of Illinois at Chicago. This institute is for high school teachers and combines demos, labs, computers, and lectures. Four hours of graduate credit in chemistry is available. Contact Wade Freeman, Dept. of Chem., Univ. of IL. at Chicago, Box 4348, Chicago, IL 60680 (312)996-3161 for more information and dates.

14th BCCE [Biennial Conferences on Chemical Education] at Clemson University, S.C. August 4-8 immediately following the Olympic games in Atlanta (only 2 hours away). Over 30 workshops are scheduled. Around 1,000 people are expected many college types, BUT THERE IS A BIG PUSH FOR HIGH SCHOOL TEACHERS THIS YEAR. WEIRD SCIENCE WILL BE THERE, DOING SHOWS & WORK SHOPS. WOODROW WILSON INSTITUTES WILL BE DOING MINI TORCH PROGRAMS. THE PEOPLE FROM SOUTH CAROLINA ARE A GREAT GROUP AND ARE WORKING HARD TO MAKE THIS THE BEST BIENNIAL EVER FOR HIGH SCHOOL TEACHERS. For more information and registration materials write 14th BCCE, DeWitt B. Stone, Jr., 206 Sikes Hall, Clemson Univ., Clemson, SC 29634, call 803-656-2344 or send your name & mailing address via e-mail to [dbstone@clemson.edu].
AP TEACHERS: The AP exam questions from 1970-1995 [Free Response] on disk with answers can be obtained from Harvey Genreau for $14.95 or if you want a print out with the disk $24.95. For more information contact him at Unlimited Potentials, 197 Hemenway Rd., Framingham, MA 01701-2619 OR call 508-788-1561 or e-mail: harveyg@aoi.com.

SOME COOL WEB SITES: http://www-ed.fnal.gov [This is the Fermilab Ed. Home page and will get you into Fermilab's home page] http://www.mcs.net/-bchang/nnhs {Naperville North Home page still Underconstruction if you get a chance look it up & offer suggestions. I am also having kids work on a chemistry home page for our school. e-mail them suggestions} http://astro/uchicago.edu/adler [Adler Planetarium]

The Gene Exchange

USDA GRANTS CONDITIONAL LICENSE FOR RABIES VACCINE—COMPANY MUST PROVE IT WORKS

In late April, the USDA granted a one-year conditional veterinary biological product license to Rhone-Merieux, a French company, to sell a genetically engineered rabies vaccine. Under the terms of the license, only government agencies that administer wildlife rabies control programs can use the product to vaccinate wild raccoons against rabies. USDA granted the commercial license, the first for a genetically engineered wildlife vaccine in the United States, without soliciting public comment on its decision.

The license is conditioned on a showing that the vaccine actually works, a requirement under the Virus-Serum-Toxin Act. Despite several years of field testing, USDA is still not convinced that the vaccine can create a barrier to or otherwise control the spread of rabies among raccoons. During the one-year conditional licensing period, the USDA experts the company to gather data on the efficacy of the vaccine in wild raccoon populations. In the meantime, the license permits use of the vaccine only where the public and local public health authorities are fully informed of the details and are warned against exposure to the baits. The engineered rabies vaccine, packaged in a bait that is attractive to raccoons, is distributed by airplane or by hand to raccoon habitats.

WHERE IS THE FLAVR SAVR TOMATO?

A year after its approval, the first engineered whole food approved for sale by the Food and Drug Administration—the Flavr Savr tomato—is hard to find in the nation's supermarkets. According to the *Wall Street Journal* (4/11/95), Calgene, the biotechnology company that developed the tomato, has been unable to meet its timetable for widespread distribution because the tomatoes do not hold up under the strains of picking, packing, and shipping. Because the tomato is not tough enough to withstand standard picking and packing procedures, the company will change its procedures to rely more heavily on manual labor for picking and processing and to employ technology similar to that used for soft fruit like peaches. The overhaul also required a new processing plan near tomato fields. Other troubles were cited in *Biotechn Reporter* (April, 1995), which blamed heavy rains in Florida and inadequate packing facilities for the lack of Flavr Savr tomatoes in produce markets. The article also noted that the supply of Flavr Savr will be further limited by the company's decision not to grow tomatoes in Mexico this year.

MINI IDEAS

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SERENDIPITY SCIENCE OR THE MEETING OF CANDY IN THE CLASSROOM

Have you ever gone somewhere and gotten a serendipity idea for an activity to be used in your science class? This happened to me this past spring While attending a fund raiser for my husband's alma mater, we toured the Peerless Candy factory in Chicago. While perusing the premises, I came across a Spectrophotometer in the quality control room. As usual, I embarrassed my husband by falling behind the group and interrogating the guide as to the use of this equipment in the manufacturing of candy. I was told that it was used to check the quality of the corn syrup in the making of candy. It took a few months, thinking about an application for this process to be used in my classroom, that led me to the following activities.

The past two summers I had the great pleasure of attending a federally funded teacher enhancement program at Argonne National Laboratory. We were trained on Milton Roy's Spec 20's (which is a simple Spectrophotometer) and binocular lighted microscopes. The hands-on activities were outstanding, and we had the opportunity to bring this equipment to our classroom for our students' use. This brings me to the dichotomous reason for writing these activities. The first being that Judy Whitcomb, my instructor from Argonne, suggested that we present at the ISTA Convention this September on behalf of Argonne Laboratory, and I wanted to present something new. The second reason is that if the federal government, in their infinite wisdom does not cancel the funding of these programs, I would like to teach my children these activities, which has the STS (Science Technology and Society) approach to science, that is, science which ties into real world applications.

During the background research I contacted various candy manufactures from Brach, M&M Mars, Peerless Candy, and Ferrara Pan Candy. Special thanks must be given to Tim Murphy from Ferrara Pan Candy, who guided me through these activities and put up with my incessant questions. Randy Landsberg, from Argonne Laboratory, also needs recognition for translating the "Chemistryese" that Mr. Murphy used into every day English, that I could understand. I personally found it interesting that candy manufacturers used this type of equipment in the quality control of the production of their product. I had always assumed that they would use the traditional chemical approach, that is, using chemicals to determine that the sugars and citric acids are at the proper level. As you can clearly see, I am NOT a chemistry teacher.

	A	B	C	D	E	F	G
1	COLOR	WAVELENGTH	FERRARA	JEWEL	FARLEY	BROCK	BRACH
2	CLEARISH	700	0.16	0.09	0.13	0.06	0.07
3		725	0.2	0.1	0.12	0.05	0.07
4		750	0.25	0.05	0.14	0.05	0.07
5		775	0.19	0.08	0.1	0.05	0.06
6		800	0.24	0.08	0.12	0.06	0.06
7	RED	700	0.2	0.07	0.13	0.07	0.05
8		725	0.16	0.06	0.15	0.07	0.07
9		750	0.16	0.08	0.08	0.07	0.08
10		775	0.18	0.05	0.09	0.06	0.09
11		800	0.16	0.12	0.11	0.1	0.07
12	ORANGE	700	0.26	0.1	0.23	0.09	0.08
13		725	0.19	0.13	0.25	0.12	0.07
14		750	0.18	0.11	0.21	0.06	0.05
15		775	0.24	0.1	0.23	0.07	0.06
16		800	0.19	0.13	0.24	0.1	0.07
17	GREEN	700	0.27	0.11	0.34	0.14	0.11
18		725	0.16	0.08	0.32	0.11	0.07
19		750	0.1	0.06	0.24	0.18	0.08
20		775	0.13	0.1	0.18	0.13	0.07
21		800	0.12	0.07	0.29	0.1	0.07

Appendix A

Note: The data for Brock Morphin Gummi Rangers had no rangers in green so the color blue was substituted for the green. Be aware that the colors differ greatly from one manufacturer to another.

I think these activities will show our students that science is not done by some nerd in a dark and dismal laboratory. You do not have to be a "scientist" in order to do scientific work. The principles learned in the classroom carry over to everyday life. Who has never eaten candy? I bet that there isn't a student out there that answers that question in the negative.

SOMETHING GUMMI

PURPOSE

Candy manufacturers use this technique as a quality control in the production of corn syrup. The corn syrup is the basis of the Gummi Bears and Jujubes. The lower the absorbance level, or the closer to zero, the better the quality of the syrup. The term the industry uses is CLARITY in the production of corn syrup. The wavelength used is approximately 700 nm. (Some companies use between 700 and 800 nm in gauging the clarity of the syrup.)

MATERIALS

5 brands of Gummi Bears/Worms
cuvettes/test tubes
Spec 20's
microwave oven/boiling water
2 sets of cuvette holders/test tube rack

PROCEDURE

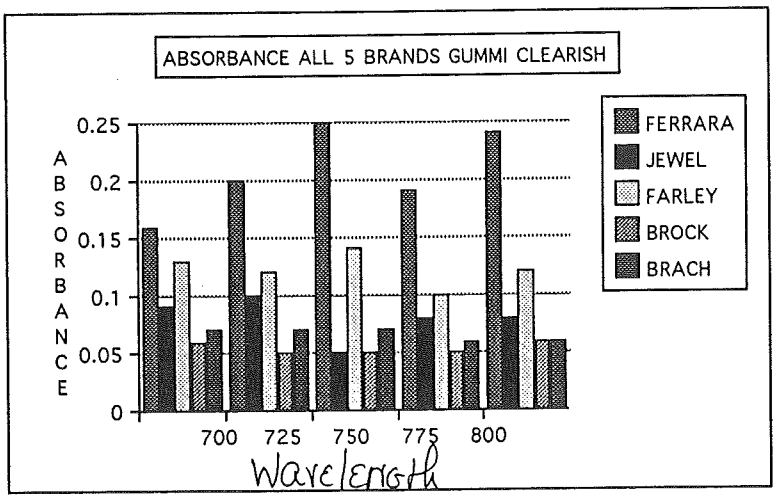
1. Chose any 5 brands of Gummi Bears/Worms.
2. Place approximately 10g. of one color and one brand in a cuvette. (I tried using my microwave oven to melt the Gummi Bears but it turned out to either explode or melt all over making it quiet difficult to clean up.) I found using a large pot with a test tube holder that can with stand the heat of boiling water to be more effective. Place the cuvette in the holder and cover until approximately 10 g. of Gummi have melted. This should only take approximately 30-40 seconds, make sure the Gummi do not burn.
3. Place the melted cuvette in another holder to cool. Continue melting all the Gummi in this manner.
4. When all the Gummi have been melted and cooled, calibrate the Spec 20 and begin with wavelength 700. (We are working in the near infrared range.) Take the absorbance reading and record.
5. Using increments of 25 repeat this until you reach wavelength of 800.
6. When all the data is collected, graph the results.

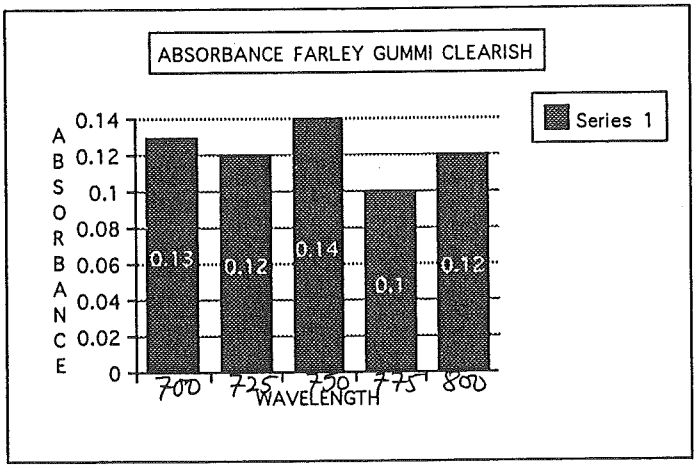
DISCUSSION/NOTES

The optimum level of absorbance for the corn syrup in this activity is 0%. (Industry uses this to check the quality of the corn syrup. If it is either over cooked or under cooked, as in any gelatin made in the home, the candy will not gel properly. The completed product may be too runny or too hard.) The closer to zero for the data, the better the sample is. The infrared spectrum was chosen in order to ferret out any impurities or contamination in the samples. It is used for monitoring the production of candy by the manufacturer for large scale production.

After completing this activity have your students eat the left over samples and see if the taste if affected by the differing reading from one manufacturer to another.

APPENDIX B





The Appendix B shows the various absorbance levels for Ferrara Pan Candy Gummi Bears, Jewel Brand Gummi Bears, Farley Candy Gummi Bears, and Brach Candy Gummi Worms, Brock Mighty Morphin Power Rangers. Appendix A lists the raw data taken.

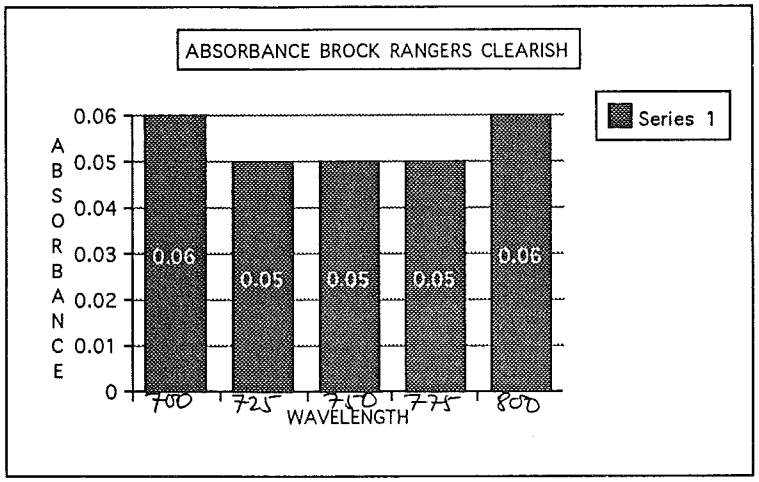
EXTENSION

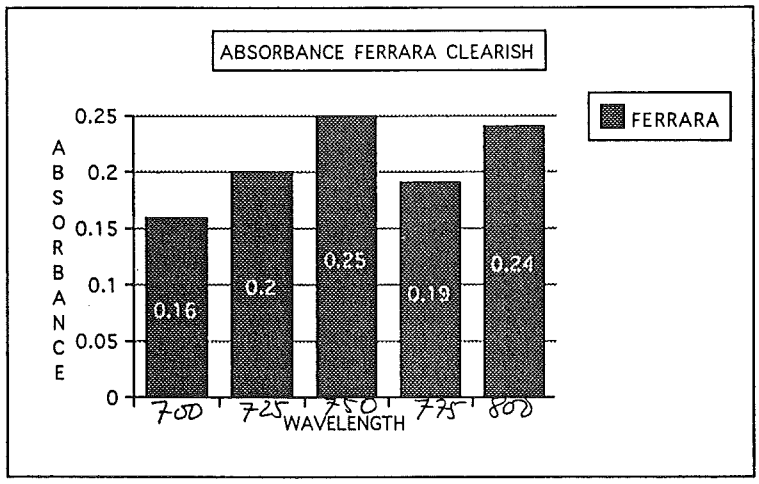
An extension of this activity could be taking transmittance reading on these samples to see how, or if color also affects the candy. (Use from 400-700nm in the transmittance range.) Discuss with students the importance of color in the production of edible consumables. The author can assure the reader that no matter what the absorbance level found, the taste of the Gummi was not affected.

TO BE OR, JUJUBE?

PURPOSE

This activity is another method that candy manufacturers use to check the quality of the corn syrup in the production of candy. Microscopes are used with polarized lenses in order to see whether or not the starch (corn) has been over or under cooked. The optimum field of view should be (see Figure 2) lighted circles with a black cross within, braking the circle into four quadrants. If this does not appear in the sample then the starch is either over cooked, and nothing can be seen, or the starch is under cooked, and black halos appear, as in Figure 1, which is slightly off polar (the lenses are not totally polarized.)





MATERIALS

light microscope 2 polarized lenses
microscope slide w/ cover slip
razor or sharp knife

PROCEDURE

1. Slice the Jujube in half.
2. Take a thin sample from the center half of the Jujube and smear thinly onto the microscope slide.
3. Place a cover slip onto the sample.
4. Using the lowest objective of the microscope, set the field. Gradually increasing the objective to 40X.
5. Once the field has been found, place the polarized lenses on the microscope.

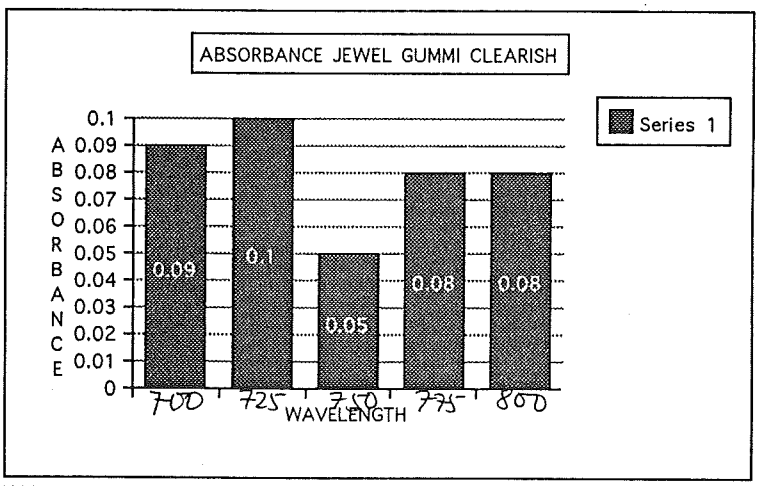
DISCUSSION / NOTES

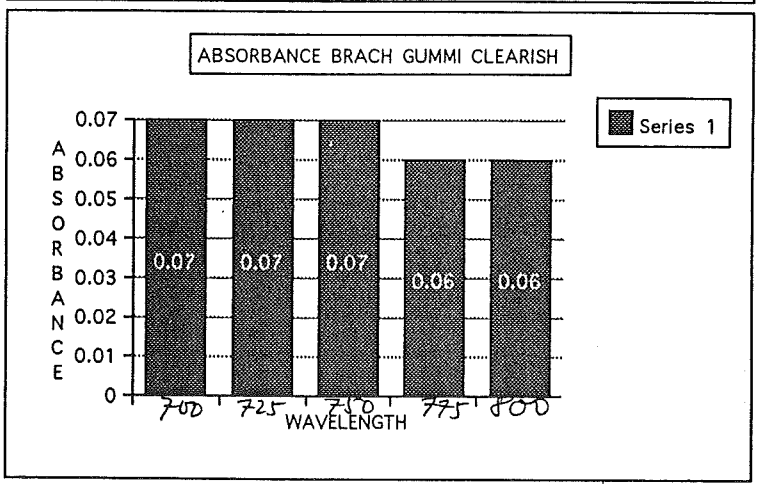
Figure 1 shows an orange Jujube at 40X slightly off polar. Notice the circles with the crosses and the halo around other circles within the field. Figure 2 is the same Jujube at cross polarized, all the halos have disappeared into circles and crosses. The halo around the circles are the swelled granule of starch. Starch by nature has an internal structure which makes it visible under polar lenses. As the starch cooks, it looses this property. The more a sample is cooked the more gradation of polarization is lost because the starch granule takes on too much water and this may affect the sample (or the sample becomes less distinct).

As the figures clearly show, the Jujube sample is birefringent (breaking into 2 rays, because light travels at different speeds and in different directions when these lenses are used), a circle with a cross appears and the quadrants appear white. Fully cooked corn starch, or gelatinizes starch, would approach the refractive index of the medium, therefore birefingence will not occur. (In real life terms the starch is over cooked, the starch granules have virtually dissolved and the sample will not gel. If no crosses and circles are seen under high, 40X magnification, the sample is amorphous.) Depending upon the candy manufacturer, and the type of candy produced, microscopy or spectroscopy will be used for the quality control of the corn syrup.

EXTENSION

1) Starch granules, uncooked, can be observed under the microscope, various stages of cooked samples can also be observed under the microscope. Discussion of the reasons why these samples differ from one another. 2) An everyday application can be using plain gelatin, follow the cooking instructions, and observe a sample at differing stages in the cooking process. One minute, two minutes etc. 3) A variation can be the addition of pineapple to the gelatin. Discussions on why the gelatin will not gel with the addition of pineapple, what enzyme reaction or cause affect or interferes with this process. How many, if any pineapple Gummi, Jujubes are on the market?





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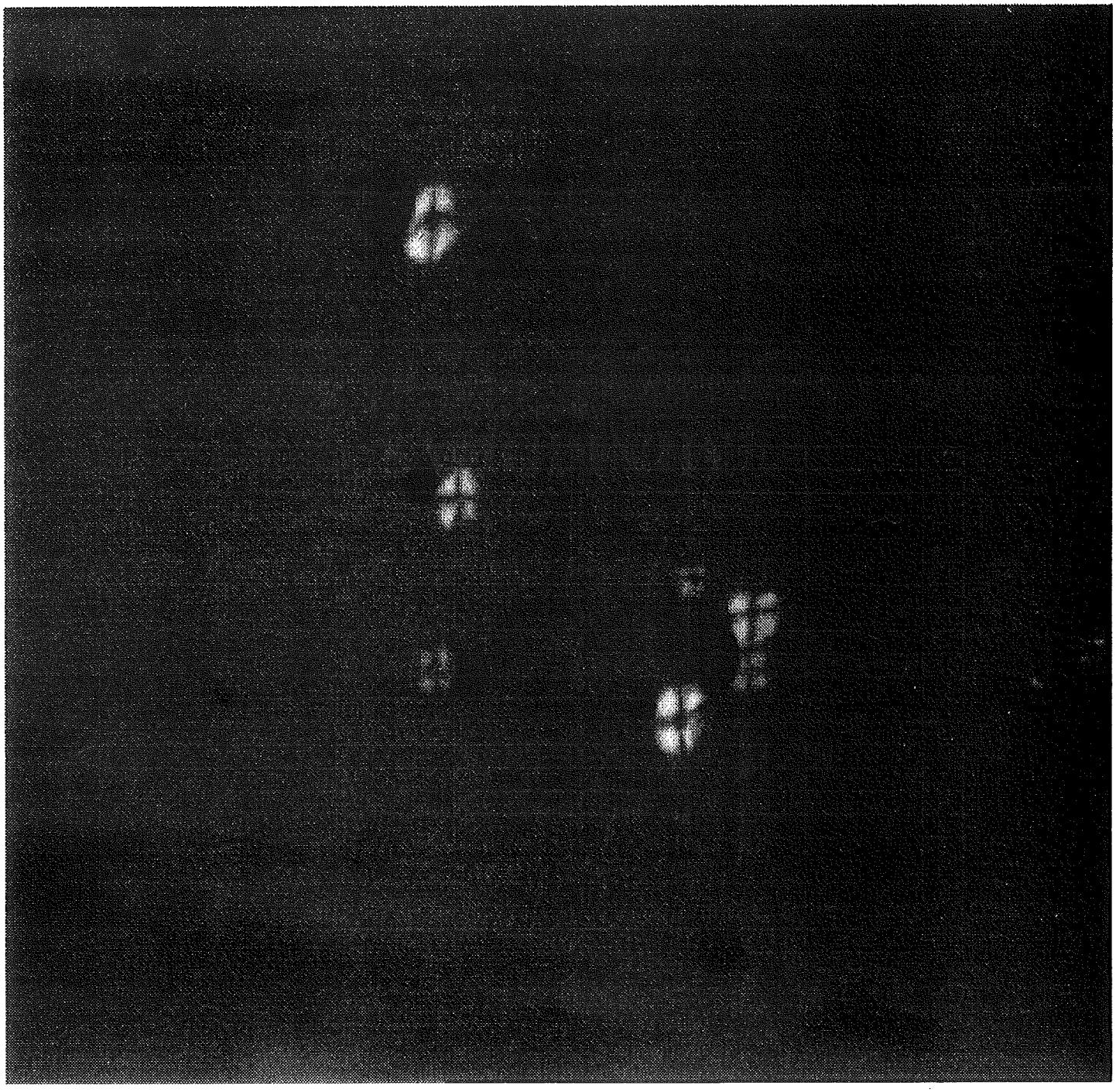


FIGURE 1

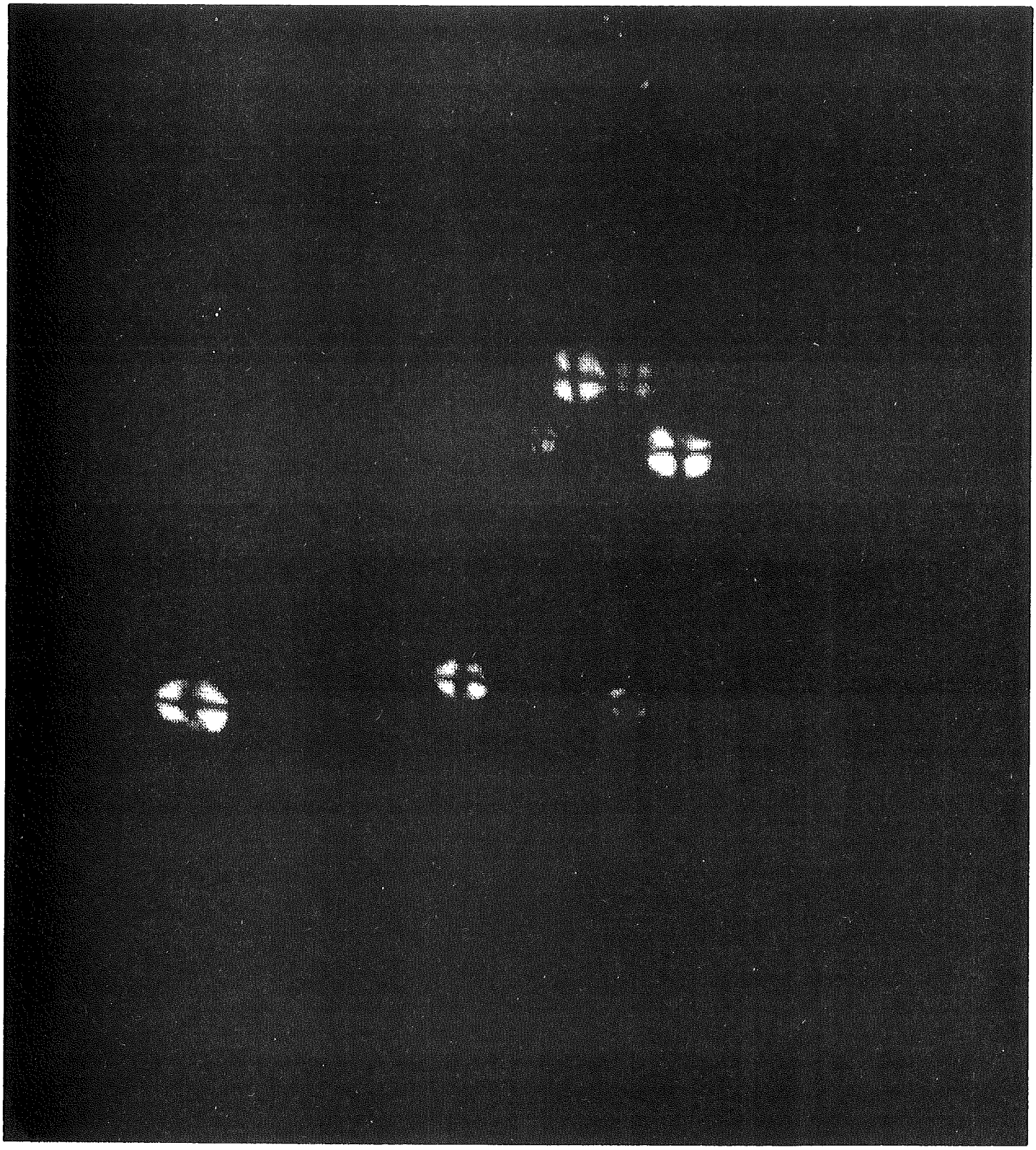


FIGURE 2

MEETINGS AND WORKSHOPS

1996 CAPE CODE SUMMER SEMINARS
American Institute for Creative Education
23 University Drive, Augusta, Maine 04330
Phone - 1-800-448-5343 or (207) 622-5662
Fax - (207) 626-3276 (24 hours, 7 days a week)

EDUCATOR SEMINAR SERIES
JULY 21-26, 1996

Enrollment: Contact us at the above address to receive a registration form. Register early. Spaces are limited.
Cost: $725 - Cost includes tuition for 45 clock hours, lodging (double occupancy), and all meals at the Massachusetts Maritime Academy.

Topics

- **THE OCEAN AND CHILDREN'S LITERATURE (K-8)**
- **SCIENCE IN THE ELEMENTARY CLASSROOM (K-8)**
- **INSTRUCTIONAL STRATEGIES IN MATHEMATICS EDUCATION (K-8)**
- **MEETING STUDENT NEEDS THROUGH MULTIPLE INTELLIGENCES (K-8)**
- **MANAGING STRESS CREATIVELY (K-12)**

WIU SCIENCE EDUCATION CENTER
TENTH ANNUAL K-8 SCIENCE UPDATE CONFERENCE
Horrabin Hall, Western Illinois University
Friday, April 19
1996 8 am to 3 pm

Sponsoring Agencies:
WIU Elementary Education & Reading Dept.
Illinois Science Teachers Association
Regional Offices of Education

Selected presenters (Mostly classroom teachers) with enthusiasm and experience for teaching elementary science have been invited to make presentations. The focus will include new science curriculum programs such as
Activities to Integrate Math & Science (AIMS), Great Explorations in Math & Science (GEMS), Science Technology and Children (STC), Full Option Science Systems (FOSS), Windows on Beginning Science (K-3), and more. A presentation of the proposed Frameworks for Science in Illinois will also be included.

Registration Information:

Registration fee = $20. This includes a light lunch.
You may register by calling the WIU Science Education Center from 8 am - 12 noon at 309/ 298-1777 or 298-2065. You may also contact:

John B. Beaver
47 Horrabin Hall
Western Illinois University
Macomb, IL 61455
email: jbeaver@ccmail.wiu.bgu.edu

Warren Bjork
Glenbrook South High School
4000 West Lake Ave
Glenview, IL 60025
tel. 847-486-4631
wbjork@gbsfs02.glenbrook.k12.il.us

GLENBROOK SUMMER SCIENCE WORKSHOP
STS BIOLOGY

JUNE 24—JUNE 28, 1996

The Glenbrook Summer Science Workshop will offer midd school and high school biology teachers and science admi istrators an exploration of biology teaching from the perspe tive of science-technologysociety. This workshop feature

- Problem Solving through Computer Simulations
- Computer interfaced laboratory sessions
- STS Topics with culminating exercises
- Authentic Assessment activities
- Videodisc presentations
- Staff Development ideas
- Graduate Credit available
- Classroom Observations of STS Biology
- Roundtable discussions with colleagues
- Developmental Research, Reading, and Writing
- Instructional TV for teacher & student presentations

For additional information contact;
Warren Bjork, Science Supervisor
Glenbrook South High School
4000 West Lake Avenue
Glenview, Illinois 60025
708-486-463 1

MaTR INSTITUTE SUMMER WORKSHOP FOR SCIENCE TEACHERS —GRADES 6-9
University of Wisconsin-Stevens Point
Sponsored by
the National Science Foundation

WHAT IS IT?
The MaTR Institute* ("matter") is a special collaboration between teachers, the National Science Foundation, the Intersociety Polymer Education Council, and the University of Wisconsin-Stevens Point. The purpose of the Institute is to assist teachers in linking classroom science with the "real" world by helping them become more familiar with polymer (macromolecule) topics.

WHO IS IT FOR?
The Institute is for K-12 teachers. Newsletters, year-round networking, and summer training workshops will be offered.

WHEN ARE THE WORKSHOPS?
The 1996 summer training workshop will be for middle level (grades 6-9) teachers. It will be held July 14 to August 2, 1996 with a weekend follow-up session in the Spring of 1997. A workshop for elementary teachers will be offered in the summer of 1997. A workshop for high school teachers was offered in Summer, 1995.

CAN I RECEIVE GRADUATE CREDIT?
Participants in the workshops will receive three graduate credits from UWSP.

WHAT DOES IT COST?
Workshop participants will be expected to pay part of their travel costs and any personal expenses. The Institute's sponsors will pay fees, room and board, will provide participants with a daily stipend, and will assist with travel expenses. Participants also will receive materials for use in their classrooms and a special budget for classroom supplies and in-service offerings.

WHO WILL LEAD THE WORKSHOPS?
Teams of grade-level teachers and faculty from UWSP's chemistry department will lead the workshops. The workshops will feature Polymer Ambassadors and other national award-winning teachers recognized for their use of polymer topics in the classroom. Industry representatives also will share their expertise with the participants.

POLYMER EDUCATION AT UWSP
UWSP has a long tradition of polymer education and is a leader in the development of polymer-related curricular materials. The POLYED National Information Center for Polymer Education, which opened in 1989 at UWSP, has processed nearly two thousand inquiries from teachers at all grade levels, K through post-graduate.

MaTR Institute Sponsors
- National Science Foundation
- Intersociety Polymer Education Council
  - American Chemical Society (ACS)
  - ACS Division of Polymer Chemistry
  - ACS Rubber Division
  - Society of Plastics Engineers
- University of Wisconsin-Stevens Point

RESOURCES FOR HIGH SCHOOLS
High school activities, developed during the 1995 workshop, currently are being edited and will be made available through the MaTR Institute. If you are interested in these materials, be sure to contact us at the above address. Your name will be added to our mailing list and you will be kept informed regarding the availability of the materials.

HOW CAN I GET MORE INFORMATION?
MaTR Institute (**Ma**cromolecular **T**eacher **R**esource Institute)
Department of Chemistry
University of Wisconsin-Stevens Point
Stevens Point, WI 54481
(715) 346-3703

The Bronx Zoo/Wildlife Conservation Park
Project W.I.Z.E.: *Survival Strategies*
Summer Seminar
for Teachers
July 8 - 12, 1996.

This NSF supported program is available for teachers of grades 7-10, **nationwide**. Project W.I.Z.E. enables teachers to utilize local zoos and other community resources in combination with an outstanding classroom life science program. There is a $200 registration fee. Accommodations will be provided at no cost to the participants. Each participant will also receive up to $300 for travel reimbursement and a complete set of ***Survival Strategies*** curriculum materials($360 value). Graduate level credit is available at an additional cost. For further information or an application, write to: Rose Baker, Education Department, Bronx Zoo / Wildlife Conservation Park, Bronx, NY 10460, or call **1-800-YES-5131**.

SENSI: SATELLITE EVOLUTION AND NATURE OF SCIENCE INSTITUTE

SENSI: Satellite evolution and Nature of Science Institute at the Chicago Field Museum in conjunction with the Lincoln Park Zoo and Shedd Aquarium meets from July 15-26. Presented for Chicago teachers, but not restricted to them, it is supported by the National Science Foundation with a $600.00 stipend for each of 20 high school biology teacher participants. The application deadline is May 28. Two hours of graduate credit is available through San Jose State University. For more information or applications, contact Steve Randak at FAX: 317-449-3413. E-mail: AESRandak@aol.com. PHONE: 317-477-7127 or 317-449-3400.

OPPORTUNITIES

Jeffrey P. Miller
Specialist, 4-H Youth Development Education
University of Illinois
1901 University Inn
302 E. John St.
Champaign, IL 61820 voice: 217-333-0913 or 0910
fax: 217-333-9287
e-mail: millerj@ces4h.ag.uiuc.edu or
millerj@idea.ag.uiuc.edu

NATIONAL SCIENCE & TECHNOLOGY WEEK
APRIL 21 - 27, 1996

It's that time of year again....National Science & Technology Week (NSTW) is almost upon us. The Illinois 4-H program is partnering with organizations from around the country (including the National Science Foundation) to bring some really cool hands- on science activities to schools, youth groups, and other interested community groups. The actual NSTW is April 21-27. But the info in the packets can be used anytime. This year's theme is: "Design Connections through Science & Technology". Packets are available in both English & Spanish. Each activity in the packet has a recommended age range for its use. This of course can be adapted for use with older or younger kids. The recommended ages range from 6 to 15. OK... so what's in the packets this year?

* 5 different units/activities that deal with how design goes into everyday things....
  "Nice Threads" design of fabrics & fibers
  "Derby Day" design of a wind powered vehicle
  "Mix it Up" packaging design for consumers
  "Shake, Rattle, & Roll" structural design in buildings
  "Not Alone on Ice" community design in Antarctica

* Each activity has an "Assessments" feature which can be used to determine learning & knowledge transfer.

* Other features include a "Home & Community Connection" for ideas on applying what's learned in the real world, and a "Resources" section on where to find additional info on each topic covered. Of particular interest to teachers is that each unit lists the skills to be learned and the subject matter areas covered.

Ok, so how do you get one of these packets to use with your classes? The best way is to contact your local University of Illinois Cooperative Extension Service office. It could be listed in several locations in your local phone book... the government pages, under education listings, or maybe even in the yellow pages. If you still have no luck in finding your local office, call the State 4-H Office at 217-333-0910. They will be happy to give you the local Unit's phone number.

Shedd Aquarium
HIGH SCHOOL MARINE BIOLOGY PROGRAM

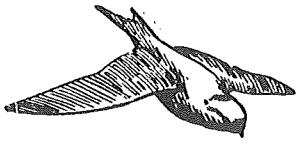
Section 1
Classroom session: June 26-28, July 1-3
Trip: July 8-14
Classroom session: July 25-27

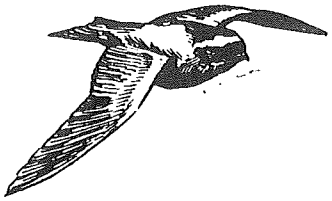
Section 2
Classroom session: June 26-28, July 1-3
Trip: July 16-22
Classroom session: July 25-27
*Please Note: Classroom session dates may be subject to change.

The John G. Shedd Aquarium will be offering a High School Marine Biology Program, open to high school students with at least one year of high school level biology. The program includes one week of a marine biology classroom/ laboratory experience at the Aquarium and one week of field study in the Bimini Islands, Bahamas. Field work takes place on the Shedd Aquarium's 80ft research vessel and focuses on fishes, coral reefs, and island ecology. Following the trip, students spend three days back in the classroom organizing field data and preparing comprehensive reports. Results are presented during a seminar on the last evening.

Ten students will be selected for each session on the basis of interest, overall student performance, and maturity. Financial aid is available and academic credit may be arranged through individual high schools. Applications must be postmarked by **April 5, 1996.**

For more information contact:
Dave Durette
Education Department
John G. Shedd Aquarium
1200 South Lake Shore Drive
Chicago, IL 60605
(312) 939-2426, ext. 3372





PROJECT LAVA
Learning About Volcanic Activity

Would you like to spend six day son one of the most active volcanoes on earth? If so, Project LAVA is for you!

Project LAVA, a course designed for elementary and secondary school teachers, is conducted on Kilauea volcano in Hawaii Volcanoes National park on the island of Hawaii. Two six-day sessions are being offered this summer: June 10-15, 1996 and August 5-10, 1996

Volcanic processes and features, the geologic history of Hawaii's volcanoes, the current eruption of Kilauea volcano, and educational materials using volcanoes to enrich science instruction are presented in classroom sessions, which consist of demonstrations, hands-on activities, and lectures. Field activities and hikes enhance the classroom sessions and provide "real-life" experience on an active volcano, during which teachers can take photographs and collect samples of volcanic rocks. The tentative schedule, which shows the classroom topics and field sites included in both 1996 sessions, is on the back of this page.

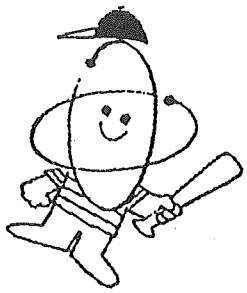
The course instructor is Janet Babb, who holds B.S. and M.S. degrees in education and geology. She is a former elementary school teacher and University of Hawaii at Hilo geology lecturer, and through ongoing volunteer work with scientists at the U.S.G.S. Hawaiian Volcano Observatory, she has extensive experience on Kilauea volcano.

During Project LAVA, participants are housed in rustic cabins at Kilauea Military Camp (KMC) near the summit of Kilauea volcano in Hawaii Volcanoes National Park. Meals are available at the KMC cafeteria and snack bar. Food items are also sold at the KMC general store.

The cost of the six-day course is $535, which includes housing (seven nights), ground transportation from/to the Hilo airport and during Project LAVA field trips, and instructional materials. Optional inservice credit (two hours) from an accredited university is available for an additional fee of approximately $100. Airfare is not included, and participants must make their own travel arrangements to Hawaii. participants are also responsible for their meals.

For registration forms or more information about Project LAVA, contact:

Janet Babb/Project LAVA
Hawaii Volcano GeoVentures
P.O. Box 794
Volcano, HI 96785
TEL: (808) 985-8972



Registration deadlines:
April 20, 1996 for June course.
June 20, 1996 for August course.

EDUCATIONAL MATERIALS

THE WATER SOURCEBOOK GRADES 3-5

This 532 page notebook provides a series of activities using water as the theme to support required classroom curricula. The *Water Sourcebook* supports subject matter in the disciplines of mathematics, science, language arts, social studies, and related arts.

The five chapters consisting of 61 activities are:

Introduction to Water
Drinking Water and Wastewater Treatment
Surface Water Resources
Ground Water Resources
Wetlands and Coastal Waters

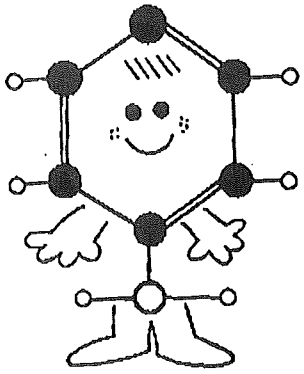
The Water Sourcebook was written and tested by teachers through the Environmental Education Section of the Tennessee Valley Authority. The basic skills of reading, writing, and arithmetic are used throughout the activities.

The purpose of this project is to have students develop an ethic to use the water they need, and not pollute. To receive this publication with binder send a check for $22.90 to:

Georgia Water Wise Council, Inc.
1033 Franklin Road, Suite 9-187
Marietta, Georgia 30067-8004

Quantity discounts available

For info. write/call Fox McCarthy (770)426-8936 Ext 234



BSCS BIOLOGY: A HUMAN APPROACH

The Biological Sciences Curriculum Study (BSCS), a nonprofit science education research group, is developing an innovative high school biology program that is appropriate for all students. The program is designed as a full-year biology curriculum for high school and consists of

- student materials,
- an integrated set of technological materials, including videodiscs,
- microcomputer-based laboratories (MBLs),
- teacher's guide,
- teacher's resource book
- assessment package, and
- an implementation guide.

BSCS Biology: A Human Approach is a curriculum that simultaneously empowers both teachers and students. When fully implemented this program can provide teachers with tools they can use to develop individualized programs that meet their own classroom needs. The activities, essays, and other student materials are accompanied by teacher strategies that support the measured implementation of inquiry, assessment, and other learning tools highlighted by the National Science Education Standards. At the same time, *BSCS Biology: A Human Approach* helps students become more responsible for their own learning. By incorporating hands-on and open-ended activities, authentic assessment, and cooperative learning strategies, this program encourages interdependence among students and independence within students and reduces dependence on the teacher as the primary source and repository of knowledge.

BSCS Biology: A Human Approach is being developed to achieve a number of specific goals for students and teachers.

Program goals for students:

- understand major biological concepts;
- understand the set of characteristics that distinguish *Homo Sapiens* from other living systems and the characteristics that they share with other living systems;
- understand the role, place, and interactions of humans in the biosphere;
- appreciate the diversity of living systems;
- demonstrate mastery of the processes of scientific inquiry;
- use such cognitive skills as critical thinking, problem solving, and ethical analysis;
- understand that science is a way of knowing and that technology is a way of adapting;
- understand the personal, social, and ethical implications of biology and biotechnology; and
- use educational technologies as tools for learning.

Programs goals for teachers:

- decreased dependence on a central text and increased use of a variety of instructional materials and strategies;
- decreased use of lecture and increased use of activities including laboratory and educational courseware;
- decreased perceptions that science is a body of knowledge and that technology is the application of knowledge, and increased understanding that science is a way of knowing and technology is a way of adapting;
- decreased use of structured materials and increased empowerment through the decision-making process for curriculum and instruction; and
- decreased use of traditional tests and increased use of authentic science assessment, such as portfolios and hands-on performance tests.

BioRAP®

A Curriculum Enrichment Resource for Middle School Science and Health Education

BioRAP focuses on the role biological research plays in protecting and improving the health and well-being of humans, animals and the environment.

CLASSROOM TESTED

STUDENTS
- •Quickly interested
- •Challenged to develop hypotheses
- •Intrigued to pursue the inquiry
- •Learning achievement high

CLASSROOM VALIDATED

TEACHERS
- •Find materials unique
- •See BioRAP as addressing real curriculum needs
- •Believe cost is reasonable

Titles available for 1995-96 School year

AIDS: Looking for Answers
What is AIDS?
HIV and the immune system
Laboratory safety
Career Rap: pharmacologist
Research and the fight against AIDS
Tracking AIDS

SUN AND SKIN
All about skin
Safety testing and acne medications
The scientific method
Career Rap: photobiologist
Skin cancer around the world
Pets and skin diseases

THE CHALLENGE OF CANCER
What is Cancer?
Cancer research
Smoking
Genetics
Career Rap: epidemiologist
Pets and cancer
Product safety testing and cell cultures

PRODUCT SAFETY
Product safety testing
Computers in biological research
Protecting pets from poisoning
Career Rap: toxicologist
The human liver; medical transplants

BioRAP is available in classroom packets containing one Teachers Guide and 36 eight-page student foldouts at a price of $11.00 per issue. Additional packets containing 36 student foldouts for the same issue can be purchased at $7.00 a packet.

FOR MORE INFORMATION OR TO ORDER: Call 1-800-BioRAP4 (1-800-246-7274)
or write to: BioRAP, P.O. Box 5048, Wallingford, CT 06492-7548

BioRAP is published by Connecticut United for Research Excellence, Inc., a not-for-profit coalition of more than 60 universities and research institutes, health-related professional societies and corporations, hospitals and voluntary health organizations.

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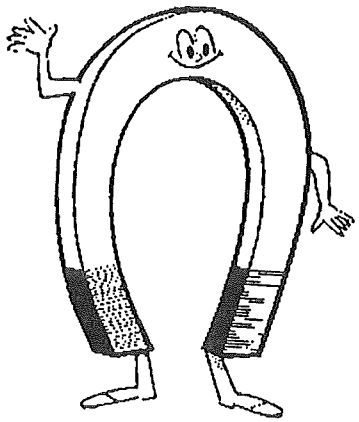

National Science Education Leadership Association (Formerly National Science Supervisors Association)

NEWS FROM NSELA
Energy Kits Available!
"Nuclear Energy: Energy from the Atom"

NSELA in partnership with Northeast Utilities gathered together teachers and supervisors from across the country to develop instructional materials on the role of the atom in energy production. The kit includes a superb video on the atom, fission and radiation as well as classroom activities, questions and references for each unit and a separate teacher's guide.

Hands-on/minds-on activities for both middle school and high school programs.

Key ideas and objectives are highlighted in each unit. Perfect for teaching concepts such as:
- structure of the atom
- causes of fission chain reactions and methods of controlling these reactions
- heat production and electrical generation
- different types of radiation and how to measure radioactive decay
- fuel cycle
- nuclear waste and power

Activities include the making of an alpha ray detector, an electroscope, and cloud chamber. Students are able to compute their annual dose of radiation and model a fission chain reaction.

The accompanying video is designed so that each topic area (the atom, fission, and radiation) can be viewed and discussed as a separate unit. Cost: $18.00 plus $3.00 for postage and handling. Bulk discounts available. Order your kit directly from NSELA by sending a check or purchase order to:

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WILDLIFE HABITAT EVALUATION OPPORTUNITY

Wildlife Habitat Evaluation (WHE) is a program that has been used by 4-H leaders across the United States over the past fifteen years. Now school programs can become involved!

The WHE program can be adapted for youth of all ages using the handbook, teacher's guide, videos, and poster. As an incentive and reward, teachers can earn three college credits for participating in this program. Students participate in five major hands-on, experiential activities:

*identify common wildlife foods
*interpret wildlife habitat from aerial photographs
*prescribe wildlife management practices
*develop a rural wildlife management plan
*develop an urban wildlife management plan

It is our hope that WHE can be easily integrated into teachers' curriculum and lesson plans. Teachers from kindergarten through college have told us that they can apply the basic curriculum to their needs. Once teachers get programs in place, I would like to evaluate their successes as part of my Master's degree project.

If you are interested in participating in this program, contact: Jennifer Barry, Colorado State University, Dept. of Fishery & Wildlife Biology, Fort Collins, CO 80523. Feel free to call or fax me at (970)491-2374 or (970)491-5091 (FAX), or e-mail me at jbarry@cnr.colostate.edu if you have additional questions.

LIBRARIES UNLIMITED / Books & Resources for LIBRARIANS & MEDIA SPECIALISTS

Contact: Jo Anne Ricca, ext. 216

THE INTERNET RESOURCE DIRECTORY FOR K-12 TEACHERS AND LIBRARIANS

1995/96 EDITION

Elizabeth B. Miller

The Internet of today barely resembles that of a year ago. Explosive growth of the World Wide Web and online multimedia, and tremendous turnover in resource offerings and addresses, have rendered any but the most recent information about the Net obsolete. But that's not a problem for educators—with Miller's new directory they can easily find the most current, accurate, and useful information about educational resources on the Internet. More than double its size of last year, the 95/96 edition contains more than 300 new entries in addition to the completely updated entries of the 94/95 edition. There are more than 400 listings for resources on the World Wide Web—a hot spot of activity for education—and many additions and changes to listings for Gopher sites, news and discussion groups, and other resources.

What sets this directory apart is its focus on educational resources. Miller has selected resources that support and enrich the basic K-12 curriculum and supplement the school library media core collection. All are free, current and updated regularly, and specifically designed to help educators develop professionally. The author includes clear directions about how a resource may be accessed, the path name, and any other instructions necessary for login or navigating through multiple Gopher menus. She also discusses basic procedures, tools, and netiquette. All entries have been double-checked for accuracy.

Miller makes a convincing argument for using the internet in schools. Through examples and excerpts from student writings and professional literature, she demonstrates how Internet activities can help students develop language arts skills (e.g., writing and spelling), stimulate their curiosity and eagerness to learn, create interest in a broad range of related topics (such as geography, social studies, and current events), build global awareness, and foster collaboration and partnership among students and educators. Telecommunication via computer can also eliminate many prejudices and allow at-risk students and students with physical or learning disabilities to overcome isolation. In the author's words, "Communicating with students and individuals from around the world is a wonderfully democratic experience."

Any educator who wants to explore the teaching and learning possibilities of the Internet will benefit from this book. Certainly those who have used the first edition will want this greatly expanded and updated version.

Elizabeth B. Miller is a faculty member of the College of Library and Information Science at the University of South Carolina, Columbia.

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Teachers Clearinghouse for Science and Society Education Newsletter
Sponsored by the Association of Teachers of Independent Schools
The Day School
1 West 88th Street
New York, NY 10024

RECOMMENDED SCIENCE AND SOCIETY EDUCATIONAL RESOURCES

1. Bruce Babbitt, "Science: Opening the Next Chapter of Conservation History," *Science*, 267, 1954-1955 (31 March 1995).
The Secretary of the Interior, speaking at the American Association for the Advancement of Science Annual Meeting on 16 February 1995, describes the collaboration of hundreds of scientists to develop land management models for the Pacific Northwest and explains how "the forest plan abandons the old 'protect one, abandon ten' mentality in favor of providing biological diversity and sustainable economic activity across the entire landscape." Adding that "Science is what has made this country work," he cautions about fine print in the Contract with America to eliminate three science agencies in his department: 1) the U.S. Geological Survey, 2) the National Biological Service, and 3) the U.S. Bureau of Mines.
2. Thomas Russell, *The Tangled Web of Bronze*; Beverly Koch, *The Middle Ages*, (Worcester Polytechnic Institute, 100 Institute Road, Worcester, MA 01609-2280). $15 ($25 with field test evaluation included). These are two 20-lesson STS curriculum units for 6th to 9th graders. The first is based in a social studies class but incorporates frequent laboratory visits for demonstrations and experiments to highlight the technologies of ancient societies being studied. The primary technological thrust is on metal working and the transition from stone to bronze and how these changes impacted the socioeconomic structure of society. Some of the lesson titles are "The Sumerians I - Role Playing Game," "The Entomology of Tin," and "7 Alloys - Creating an Alloy." The second curriculum unit presents multifaceted technological approaches to the infusion of physics into the study of society, culture, and technological advances of the Middle Ages. Included are role-playing games, individualized homework assignments, take-home readings, hands-on experiments, and demonstrations. Some lesson titles are "The Outer Bailey," "Hygiene and Plague," "More About Defense," and "Mill Role Play."

3. *Women's Educational Equity Act: A Review of Program Goals and Strategies Needed. A Report to Congressional Requesters.* prepared by the U.S. General Accounting Office (GAO), available from the GAO at P.O. Box 6015, Gaithersburg, MD 20884-6015, (202)512-6000, FAX: (301)258-4066. first copy free, $2 for each additional copy.
This report contains a history of the Act, results in brief, principal findings of the review, products and dissemination, implications and conclusions, and recommendations; it will be valuable to all concerned with gender equity in education and the workplace.
4. Know Your Environment" bulletins, Academy of Natural Sciences, 1900 Benjamin Franklin Parkway, Philadelphia, PA 19103, (215)299-1108; FAX: (215)299-1028). free.
These bulletins are released every four to six weeks and are produced by the Environmental Associates of the Academy. They are designed to provide unbiased, factual information on issues of environmental concern, and recipients are encouraged to reproduce and redistribute them as well as send in comments and suggestions. Some recent issues supplied by Barry Lewis of the Academy concern the Clean Water Act and the Safe Drinking Water Act. Others discuss wetlands, with definitions and a good discussion of the problems concerned with their maintenance.
5. *Anuario Hispano/1995 Hispanic Yearbook*, available free to teachers in a high school with a large Hispanic population from Angela Zaval, TIYM Publishing company, Inc., 8370 Greensboro Drive, McLean, VA 22101, (703)734-1632/1716; FAX: (703)536-0787. 326 pp.
This handsomely-printed guide is a treasure trove of help for Hispanic students. It includes sections on Career Opportunities for

Hispanics, Minority Business Development Opportunities, The Environment and The International Scene, Health and Education, Student Financial Aid for Hispanics, and Hispanic Organizations and Media. Particularly valuable is a disk included in the Guide containing a "minority Scholarships Reference Database," which requires a 386/SX IBM compatible PC.

6. *Health Highlights* (National Technical Information Service, Springfield, VA 22161, (703)487-4650). free.

This catalog offers descriptions, prices, and ordering information for videos and software on diseases (including AIDS), on The Genome Project, as well as on such studies as the "Youth Risk Behavior Survey." A large section on "Medical Technology" is followed by a listing of National Library of Medicine Products. This includes an interactive videodisc program, "The Suicidal Adolescent - Identification, Risk Assessment and Intervention." Other sections offer kits on "Nutrition," "Public Health," "Substance Abuse," and "Toxicology."

7. *SETI News*, SETI Institute, 2035 Landings Drive, Mountain View, CA 94043, (415)961-6633; FAX: (415)961-7099. free.

The SETI Institute is a nonprofit scientific research corporation founded in 1984 as an institutional home for the externally-sponsored scientific and educational projects related to the search for extraterrestrial intelligent life. The *News* contains articles on new projects underway in the U.S. and foreign countries—e.g., Mopra in Australia. Other articles detail concern about current threats to research efforts, primarily the fund-cutting in Congress. Correspondence from readers is also featured.

8. *The Journey Inside: The Computer*, (Intel Corporation, 2200 Mission College Blvd., P.O. Box 58119, Santa Clara, CA 95052-8119, (800)346-3029, ext. 143). available free to U.S. teachers.

This package is a treasure trove for science, math, and computer teachers of grades 5-9. It includes the following:

1) A handsome white three-ring tabulated binder *Teacher's Guide*, containing background information, lesson plans, student activity sheets, and a glossary.

2) Fourteen black line acetates that support the six units of the guide and four color acetates that, when laid on top of each other, illustrate four of the many layers of a microprocessor.

3) One six-part video that introduces each of the six units.

4) One classroom poster that reinforces the key concepts of the video.

5) One chip unit with silicon wafer, nonfunctioning microprocessor, bag of various computer chips, including one Pentium chip, 9-volt batteries, C batteries, LEDs with wires, switches, transistors, red and black wire, and electrical tape.

6) Student coupon for a free poster, which may be replicated and distributed by the teacher.

9. *Education Network* (NSF Center for Ultrafast Optical Science, IST Building, Room 1006, University of Michigan, Ann Arbor, MI 48109), June 1995 issue.

In the latest issue of this quarterly newsletter (initially listed as resource #16 in our Fall 1994 issue) the Center for Molecular Biotechnology presses for high school students to reach those in the elementary schools, the Center for Clouds, Chemistry, and Climate contributes an article exploring the evidence for global climate change as a teacher training program, and NASA inaugurates 1995-1996 as a "Year to Explore Space and Cyberspace," with a live video from the airborne observatory to schools and science museums. Print materials suggesting hands-on in-class activities are included with the live television broadcasts. Other activities of the 25 NSF-funded Science and Technology Centers are also highlighted.

10. *A Sustainable Development Curriculum Framework for World History and Cultures* (Global Learning, Inc., 1018 Stuyvesant Avenue, Union, NJ 07083, (908)964-1114). ISBN 0-928630-001.

This teachers' manual for world history, which has been piloted in New Jersey high schools, as its title implies, encourages the teaching of world history through a focus on sustainable development. It is extremely detailed in its suggestions. For example, Chapter 3—"Methods for Infusing Sustainable Development in World History and Culture Courses"—identifies twelve methods of infusing this knowledge in the curriculum. These are divided into four levels—the Contributions Approach, the Additive Approach, the Transformation Approach, and the Social Action Approach. Each of these is clearly explained.

In Chapter 5 an analytical framework is offered with sample questions for each of the elements of the framework. These are grouped under geographic, social/cultural, political, and economic. The whole book is not as much a text as it is a resource base for the teacher interested in essaying this approach to world culture. There are details of numerous courses (Chapter 7), resources (Chapter 8), test questions (Chapter 10), and suggested readings (Chapter 11). A great deal of information is available to the interested teacher, who will be able to distill an innovative curriculum using the suggestions presented in this book.

11. Gary Taubes, "Blowup at Yucca Mountain," *Science*, 268, 1836-1840 (30 June 1995).

After extremely careful peer review of a paper written by two Los Alamos researchers asserting that the planned Yucca Mountain nuclear waste repository might erupt in a nuclear explosion led to a complete rejection of the assertion. *The New York Times* got wind of the paper and, despite being cautioned that it was flawed, published a front page story on it. Repercussions in Congress and in the Yucca Mountain area quickly followed and fueled new attacks on the nuclear waste repository project, thereby turning the paper into a self-fulfilling prophecy in that its authors had warned that "the existence of so serious a dispute, so late in the planning process, might cripple the plan, or even kill it."

12. Cathy Mahmud and Douglas Casey, *Smithsonian Resource Guide for Teachers 1995/1996* (Office of Elementary and Secondary Education, Smithsonian Institution, Arts and Industries Building, Room 1163, MRC402, 900 Jefferson Drive, SW, Washington, DC 20560, (202)357-2425). 73 pp. free.

This catalog lists 511 resources available in the arts, language arts, science, and social studies & history. Listings in science include Anthropology/Human Life, Astronomy/Space Sciences, Botany/Plant Life, General Science/Ecology, Geology/Minerals/Palentology, and Zoology/Animal Life. In the Social Studies/History category are entries on African American and Native American studies as well as American political, cultural, and social history and world history and cultures.

Single copies of most of the items listed are free, and they may be obtained directly from the issuing organization. Others range in price from a few dollars to $400 or more for teaching units on a variety of topics. Complete instructions for ordering are provided, and the volume is rounded out with title and subject indices.

13. Frank von Hippel, "Fissile Material Security in the Post-Cold-Car World," *Physics Today* 48(6), 26 (June 1995).

At a time that fissile material has become a burden rather than a threat, the former Assistant Director for National Security in the White House Office of Science and Technology Policy describes what the United States is doing to keep formerly Soviet fissile materials out of the "wrong hands." Von Hippel also relates his own personal experiences in government work on page 51 of the same issue.

14. *Physics Today*, 48(8) (August 1995), entire issue.

The flagship publication of the American Institute of Physics (AIP) commemorates the fiftieth anniversary of the first and only military use of nuclear weapons with three examples of heretofore unpublished material related to the development of these weapons in World War II: 1) a February 1942 lecture on bomb development by Werner Heisenberg; 2) excerpts of taped conversations of the top ten German nuclear scientists interned at Farm Hall after they learned of American development of the atomic bomb (the complete conversations, edited by Jeremy Bernstein, are being published in October 1995 as *Hitler's Uranium Club* by AIP); and 3) an article about General Leslie R. Groves and compartmentalization in the Manhattan Project by his forthcoming biographer, Stanley Goldberg.

15. *Questions and Answers About EMF: Electric and Magnetic Fields Associated with the Use of Electric Power*, (National Institute of Environmental Health Sciences and US Department of Energy, January 1995). 67 pp. free by calling EMF "Hotline": 1-(800)-363-2383.

This booklet contains sections discussing, in a Q & A format, Electric Power Background, Human Health Studies, Biological Studies, Government Actions, Your EMF Environment, and directions For More Information.

16. Daniel M. Kammen, "Cookstoves for the Developing World," *Sci. Am.*, 72-75 (July 1995).

Our Winter 1995 issue reported Kammen's presentation on this topic to the Princeton Chapter of Sigma Xi. This article gives a wider audience the opportunity to learn more about it.

17. Joy P. Gold (ed.), *References on Endangered, Threatened, and Recently Extinct Vertebrates and sources for Additional Information* (National Museum of Natural History, Smithsonian Institution, Washington, DC 20560, 1995). 53 pp.

This valuable reference compilation is divided into General, Regional, Fishes, Amphibians and Reptiles, Birds, and Mammals. There is a list of periodicals and of Sources of Information.

18 Rustum Roy, "The Laws of 'STS' and the Laws of Science," *Bull. Sci. Tech. Soc.*, 15(1), 1-2(1995).

The corporate chair of the National Association for Science, Technology, and Society has enlisted the assistance of four STS colleagues—F. James Rutherford, Jon Harkness, George Bugliarello, and Melvin Kranzberg—to codify their past quarter century of STS teaching into a set of "laws." Roy contributed the first seven, with two more added by Rutherford and the last six coming from Kranzberg (see box on page 43).

19. *ENC Focus*, Eisenhower National Clearinghouse for Mathematics and Science Education, The Ohio State University, 1929 Kenny Road, Columbus, OH 43210-1079.

Two more issues of the Eisenhower National Clearinghouse newsletter have focused on "Equity in the Classroom: Mathematics and Science Materials and Resources for Elementary Teachers" and "Earth Day in the Classroom: Mathematics and Science Materials and Resources for Teachers.

20. Burton Richter, "The Role of Science in Our Society," *Physics Today*, 48(9), 43-47 (Sep 95).

A Nobel Laureate ending his presidency of the American Physical Society gives his own retrospective on the interaction between science and technology in meeting the needs of society. Having been generously funded by the federal government because of the Cold War and the promise of improved quality of life, science is now being examined, Richter points out, from the new criterion of economic security. While "There is a strong temptation in times of economic difficulty to cut back on long-term research to reduce costs," he argues that "This measure can benefit industry and the economy only in the very short run...." Because "competitive pressures have forced industry to shift R&D efforts toward work with shorter time horizons," Richter maintains that "government support for long-term R&D is now more important than ever."

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Phone: 800-537-8703 or 617-547-7724 ★ Fax: 617-547-2686

Contact: Andrea Colby

Carl Zeiss Jena GmbH and Learning Technologies Inc., manufacturer of the STARLAB Portable Planetarium, are pleased to announce a new partnership. Carl Zeiss Jena, well-known for their high performance optics, fine engineering and electronics equipment, as well as precision instruments for astronomy, will be the exclusive European dealer of the STARLAB Portable Planetarium effective immediately.

Since 1925, Zeiss has installed more than 500 permanent planetariums worldwide to institutions including the Hayden Planetarium (New York, USA); the Moscow Planetarium (Moscow, Russia); Planetario de Madrid (Madrid, Spain); Planetarium "Forum der Technik" (Munich, Germany); Edmonton Space Sciences Center (Edmonton, Canada); and Nagoya Planetarium (Nagoya, Japan). Their proven excellence in the field of astronomy and, specifically in the manufacturing and installation of planetariums, in conjunction with the growing popularity and flexibility of the STARLAB Portable Planetarium, make the alliance particularly beneficial to both companies.

Zeiss looks forward to expanding their substantial fixed-planetarium business to include the STARLAB which allows them to offer a wider range of options for institutions with varying budgets and needs. The STARLAB's lower cost and portability make it an ideal option for outreach purposes or for those institutions unable to fund a fixed planetarium.

Learning Technologies, which has concentrated their marketing efforts mainly on the US and Canada, welcomes the widespread representation that Zeiss can provide throughout Europe utilizing their vast sales network and thorough knowledge of the European market.

Illinois
Department of Commerce and Community Affairs

Barbara Antonini
Department of Commerce and Community Affairs
Office of Coal Development and Marketing
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INTEGRATED RESOURCE PUTS COAL INTO SCHOOL CURRICULUM

An integrated reaching resource manual covering the formation, history, and uses of coal as well as clean coal technologies will be available this fall to high school teachers from the Illinois Department of Commerce and Community Affairs, Office of Coal Development and Marketing.

The eight module resource manual includes instructional and assessment activities and is appropriate for such fields as chemistry, biology, physics, geology, government, history, mathematics, and technology. It is the third resource in the Office of Coal Development and Marketing's educational resource series.

The "Coal is Cool Educational Activity Book" is available for kindergarten through fourth grade teachers. It has been expanded to include puzzles, games, and activities suitable for all five grade levels.

The "Illinois Coal Education Teacher's Guide" is available for fifth through eighth grade teachers. It includes lesson plans, student worksheets and a copy of the *Energist*, a newspaper that is all about coal and clean technologies.

Other teaching materials available include actual pieces of coal, the "Words and Pictures About Illinois Coal" calendar, the "What Does Coal Have to Do With You?" poster and the video "Kids, Coal and the Environment."

For more information about ordering, contact Barbara Antonini at the above address.

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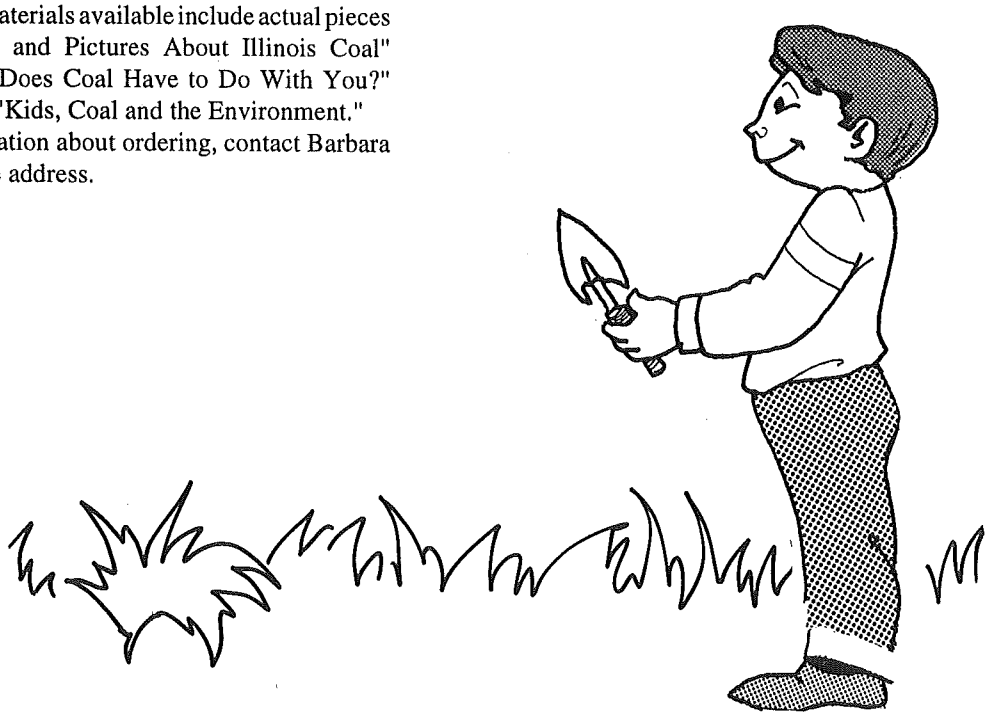

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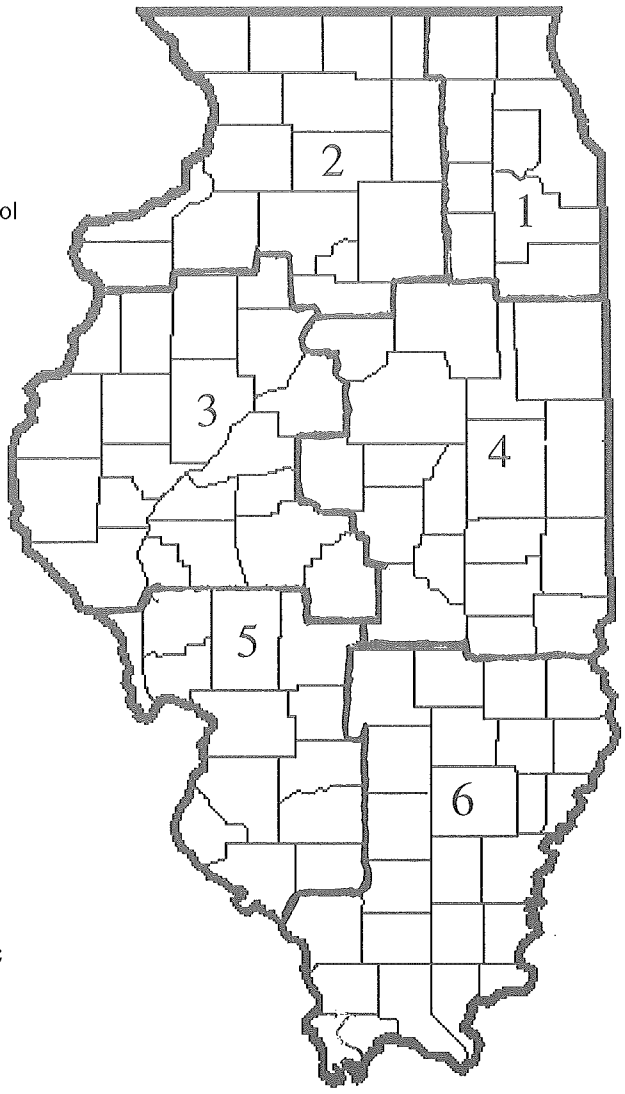

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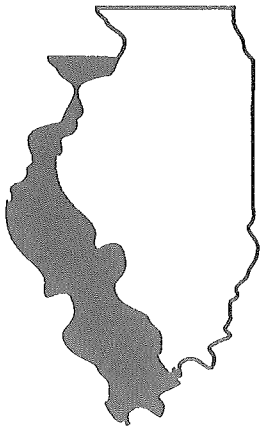

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