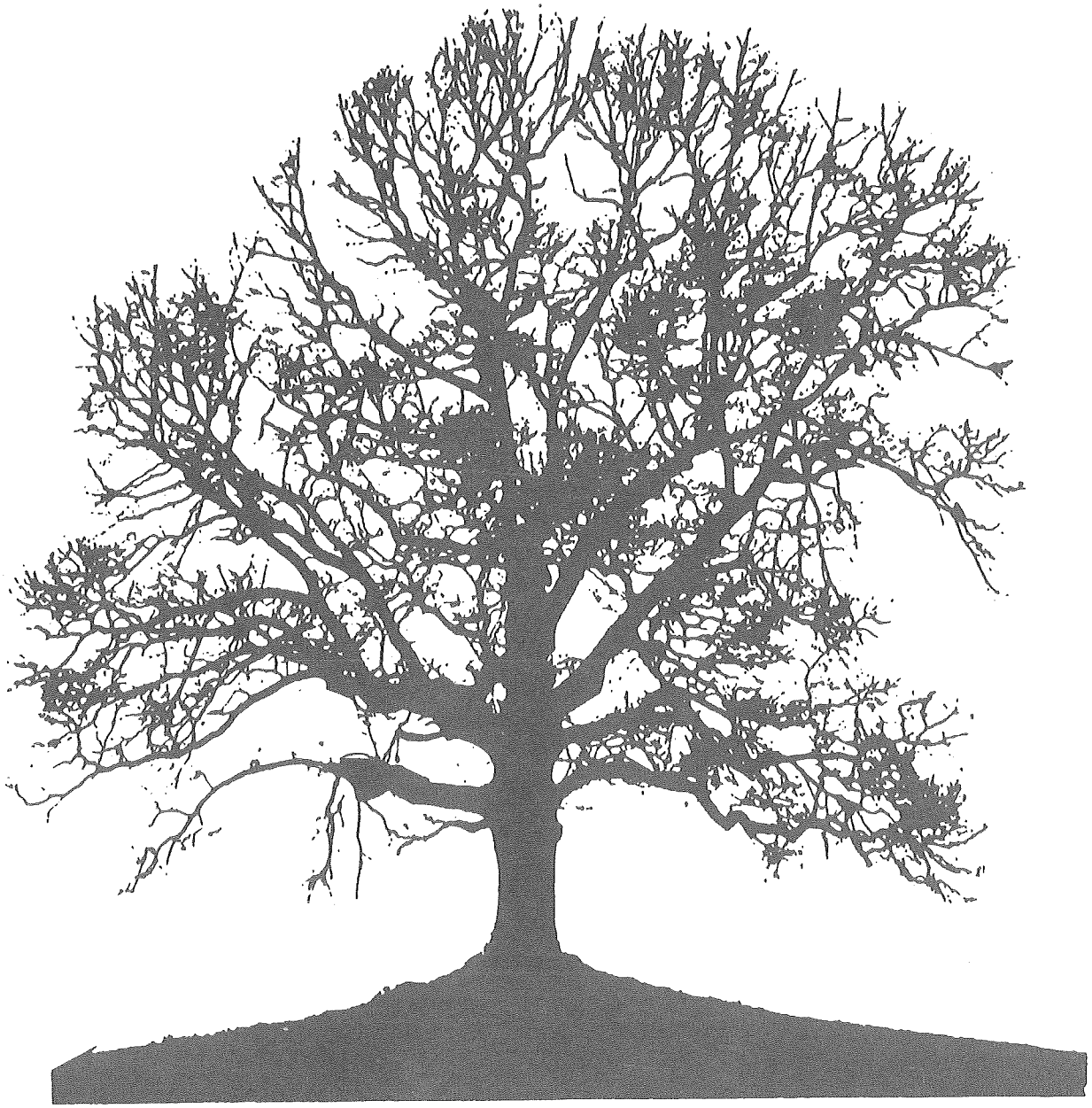
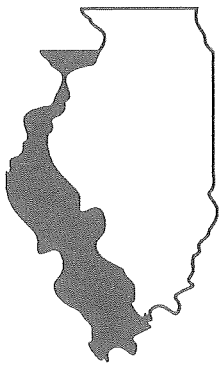
SPECTRUM

THE JOURNAL OF THE ILLINOIS SCIENCE TEACHERS ASSOCIATION



WINTER 1993



ILLINOIS SCIENCE TEACHERS ASSOCIATION

SPECTRUM

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ISTA NEWS

WINTER 1993 PRESIDENT'S LETTER

How about that 1993 ISTA convention? Was that great or what? I would like to officially recognize the hard work and outstanding product produced by the convention committee directed by Virginia Bryan (SIUE) and Rion Turley (O'Fallon High School) co-chairpersons for the 1993 convention.

I also want to express my sincere thank you to John and Monica Kent as I hope you are all aware the Kents have been largely responsible for the phenomenal success of our convention's commercial exhibits. I asked John to help us put the southern convention together, and when I did John told me he was not familiar with the area but would do his best and did he ever. John and Monica will be turning the commercial exhibit responsibilities over to someone else this year and we will truly miss them.

Over the last several years I have had the opportunity to present at numerous state science conventions from all areas of the United States and I am pleased to inform you that an ISTA convention stands among the country's best. When you look at the high quality of programs presented for the unbelievably low price of $20.00 for members it has to be a great bargin in staff development.

Next year the state convention moves back north to the **Pheasant Run Convention Center in St. Charles, Illinois, Nov. 3 - 5.** Mark your calendars now because convention chairperson Steve Pieritz (Bourbonnais Elementary) promises a challenging and educational convention for 1994.

ISTA is currently publishing the Desk Top Organizer developed by a talented group of ISTA teachers. We passed out single copies to each convention participant, but if you would like additional copies please contact Wayne Green at (309) 343-0112 ext 341.

Our organization is also bringing to completion the development of a handbook for preparing teachers to use authentic forms of assessment in their science classrooms. The handbook includes specific procedures for developing instruments and numerous examples of authentic measures at the elementary, middle, and high school level.

If you are interested in more information regarding these performance assessment tools, contact your local Educational Service Center or me directly at (618) 692- 3065.

If you attended the general membership meeting at the convention; you know the organization is currently accepting applications for an Executive Secretary. The new position will largely be responsible for many of the organization's activities currently being performed by volunteer and hourly paid individuals. Applicants are being reviewed based on their relevant skills and familiarity with the organization's primary functions.

Finally, as I am sure you are all aware many of our fellow state science teachers were severely impacted by the "great " flood of 1993. If you can help provide assistance or if you have been affected by the flood and have a specific need or request please drop me a note at Box 1122, SIUE, Edwardsville, IL 62026 and I'll try to match up needs with supply.

I have a real good feeling about 1994. This is going to be a productive year for science education in Illinois. Be a part of it.

Sincerely,

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Illinois Science Teachers Association

November 3-5, 1994
Pheasant Run Convention Center
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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
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II. Intended Audience
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IV. Equipment Required
- o overhead projector
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Note: Convention will furnish only overhead, screen, VCR/monitor, and 35mm slide projector. All other equipment, including computers, will be furnished by presenters.

V. How many participants can you accommodate at your session? _____30-50 _____51-80

- Please attach a less than one page abstract of your proposed presentation.
- 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.
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Signature _____ Date _____

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ISTA would like to encourage its members to support the commercial and non-commercial vendors listed above. They contribute to our organization by exhibiting and by advertising in the SPECTRUM.

Sincerely,
John A. Kent
Coordinator-Commercial Contracts/SPECTRUM

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ARTICLES

William C. Beckman
East Peoria Comm. H.S.
East Peoria, IL 61611

YOU CAN MAKE THE DIFFERENCE

In everyday conversation the phrase "you can make the difference" is used so often it is almost becoming trite. The truth of the matter is that we really do make a difference in the environment. Our choices with regards to the environment may vary between taking the very best action to taking the very worst course of action. You and I, and our decisions, result in the condition of our planet Earth.

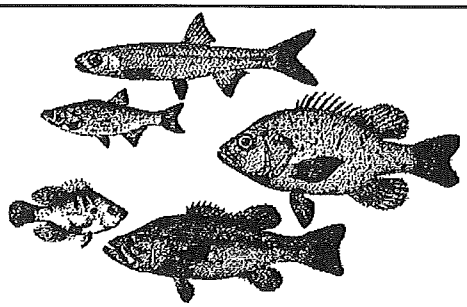
During the 1990-91 school year, East Peoria Community High School (E.P.C.H.S.) started an environmental science class. It was just one class of 21 students led by one teacher. Two years later environmental education at the school changed so dramatically that even the international environmental community was recognizing E.P.C.H.S for its Environmental Education Program. Now let us look into these remarkable changes and learn how the program evolved.

Before we start, we need to briefly define the following three terms; education, environment, and science:

1. Education means change. Hopefully this outcome will be positive change. No one expects students to stay the same after twelve years of schooling.
2. Environment is the total of all the living and the non-living parts of the biosphere.
3. Science is the systematic collection of knowledge; of course the system used internationally is called the Scientific Method.

The East Peoria students initially studied environmental science in a traditional way. This may have changed the students and their families or friends' way of thinking in a more positive way about the environment. Of course this was a good beginning, although probably less than a hundred people, at best, were affected.

The environmental education program is considerably different in many ways. First of all, consider that it is not only students and other people changing in a positive way, it is also the environment which is changing. Consider also that the word program means multiple groups rather than a small class like twenty-one students and one teacher. It implies large numbers of people and a broader range of influence. The program now includes twenty-two teachers spread across twelve subject areas: math, biology, chemistry, earth science, foods, computers, industrial tech., government, English, environmental science, geography and art classes. Seven hundred and five students participated from E.P.C.H.S. alone during the 1992-93 school year. This figure does not reflect the school administration, park district employees, and the citizens who also participated.



All of these changes in the East Peoria environmental education program are initially due to one person's vision. This person is Robert A. Williams, a professor of science education at Southern Illinois University Edwardsville. He founded the program named "The Illinois' Rivers Project" and now serves as the director for over two hundred "river project" schools in a six state region. He has made a remarkable difference in the way students, teachers, administrators, and citizens at large think about education. It is hoped that the scientific community will continue to observe positive changes in the environment. Tens of thousands of citizens will continue to monitor a major portion of the Mississippi River basin, and every river and major stream in the state of Illinois.

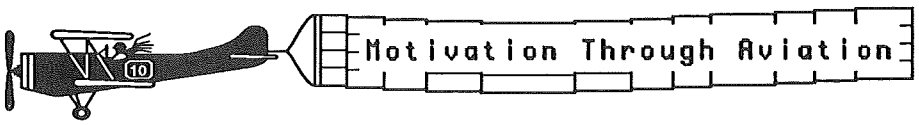
I recently returned from Washington, D.C. where I presnted The Illinois' River Project at an international conference, Environmental Education 2000. The general feeling there among the participants was that now a very good time for all of us to follow the initiative taken by Dr. Robert Williams, and all the "river project schools". These school-communities are being openly encouraged to build partnerships between businesses, private organizations, government agencies and universities to make this world a better place. Yes, you really can make a difference!

If you have an environmental concern in your community, and you have an idea or plan of how it can be fixed, get in touch with others who may be able to help you take remedial action. If you want to fix up a stream or some land, you don't really know where to start, send me a stamped, self addressed envelope, along with the location and a description of the problem area. I will make every attempt to make connections and provide you with a list of people who may be able to evaluate the location you are concerned about.

Teachers and students will continue to collect more data about our world. All of us should learn more and benefit from this learning about mother nature's great cycles. Critical thinking should enable humans to gain a better understanding of the concept that everything is related. We play a significant role in the future of this planet.

Remember this starts at home in our own backyards. Our river project students are cleaning and monitoring our own stretches of Illinois River. We are focusing on local problems with a global perspective. "You can make the difference", just by sharing this story with a friend.

Don Nelson, Assistant Professor
Science Education Center
49A Horrabin Hall
Western Illinois University
Macomb, IL 61455
(309) 298-1411



AVIATION EDUCATION FOR ELEMENTARY TEACHERS

It was with great interest that I read Jack Bennett's article in Spectrum (Summer 1993, page 37) announcing two programs designed to help teachers use aviation to get their students excited about science. Bennett's title "Using Aviation to Motivate Science Study" is an apt description of the course, Motivation Through Aviation, Western Illinois University has offered to elementary school teachers during the past two summers.

As with the Aircraft Owners and Pilots Association and Experimental Aircraft Association programs discussed by Bennett, Motivation Through Aviation, is based on the conviction that students (and their teachers!) find the topic of aviation both interesting and exciting. The key premise of all of these programs is the belief that interested and excited teachers will provide active and involving learning experiences for their students.

While Bennett suggests that aviation has great potential as a means of involving the various science emphases, Motivation Through Aviation takes an even broader perspective. The activities and learning experiences included in this course demonstrate to elementary teachers how their many curricular responsibilities; math, language arts, reading, social studies, and, of course, science can be integrated and coordinated through the use of the topic of aviation. In addition, the course illustrates how the concepts and skills related to aviation education can help elementary teachers meet their local and state goals for learning.

Motivation Through Aviation offers a two-pronged approach to enhancing elementary teachers' awareness of aviation and their appreciation of its educational possibilities. The first goal of the course is to provide the participants with a variety of aviation experiences. Such activities as building and flying kits, gliders, airplanes, helicopters, and rockets provide an opportunity to get the teachers "flying" and to enhance their background knowledge concerning flight and various types of aircraft.

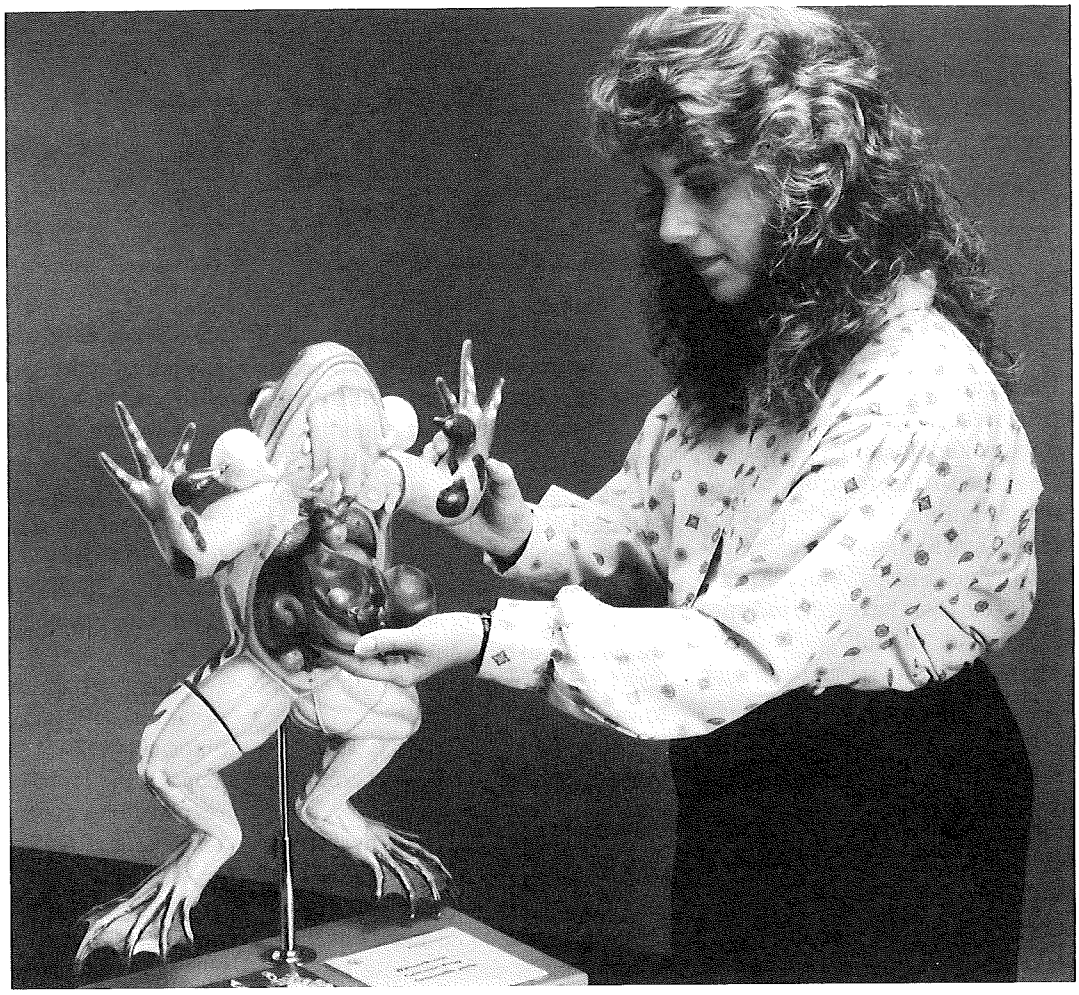
In addition to working with models, participating teachers learned about full-sized aircraft through visits to private and commercial airfields, Illinois National Guard helicopter and fighter bases, aircraft maintenance facilities, and private "airplane factories" where aviators lovingly build their own airplanes. The experiences with models and full-sized aircraft culminated with the teachers, themselves, flying in airplanes and helicopters piloted by volunteer aviators.

Getting teachers personally excited about aviation through high interest experiences, however, does not necessarily translate into exciting learning activities for their students. The second aspect of the course, therefore, was to offer practical teaching ideas, across the curriculum, to help them develop lessons appropriate for their teaching situations. Topics included aviation history, aviation careers, meteorology, communication, and navigation, along with suggestions for presenting such aviation concepts to elementary students.

A major aspect of helping teachers integrate aviation into their classrooms is to make them aware of the many instructional resources available to educators. Motivation Through Aviation participants were provided a wealth of educator resources from such agencies and organizations as Illinois Department of Transportation Division of Aeronautics, National Aeronautics and Space Administration, Federal Aviation Administration, and Civil Air Patrol. In addition, teachers were able to meet with educational specialists representing these various agencies and organizations.

Motivation Through Aviation was originally developed by Dr. Gary Eiff of Purdue University and presented to interested teachers from Springfield's Harvard Park School. Since then the course has been offered at Macomb's Municipal Airport in 1992 and Springfield's Capitol Airport in 1993. Since its inception the course has been sponsored by Aerospace Illinois through funds made available by the NASA. Funds for this year's edition of Motivation Through Aviation were also provided by a grant through the Dwight D. Eisenhower Math and Science Program. The course's sponsorship has made it possible to offer the participating teachers free graduate credit, materials and equipment.

Plans are being made to offer Motivation Through Aviation again during the summer of 1994. For additional information on Motivation Through Aviation '94 contact Don Nelson at the above address.



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GREAT FLOOD ATTRIBUTED TO RECORD RAINS IN THE FALL OF 1992

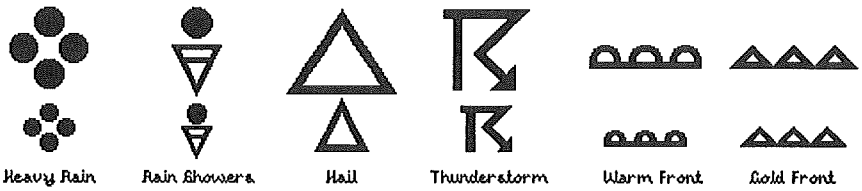
Unprecedented rainfall has produced the wettest spring and early summer of the century for the Upper Mississippi River basin (upstream of Quincy), according to rainfall data gathered by the Midwestern Regional Climate Center at the Water Survey. Since April 1 portions of the basin have received up to twice the normal rainfall.

The magnitude of rainfall over such a vast area of the Upper Midwest has resulted in flooding of extraordinary and catastrophic proportions on the Mississippi and many of its tributaries, affecting large portions of Illinois, Iowa, Kansas, Minnesota, Missouri, Nebraska, South Dakota, and Wisconsin.

Soils throughout the Midwest were already saturated from ample rainfall in summer and fall 1992, and soils remained moist as winter began. This pattern continued into spring and summer 1993.

Compared to the long-term average, rainfall in the Upper Mississippi River basin during April and May was 40 percent higher than average, and June rainfall was double the average. As the deluge continued through July, much of the basin received rainfall between two and three times the norm.

A stationary weather pattern over the United States was responsible for the Midwest's persistent, drenching rains. Most of the showers and thunderstorms developed in the boundary area between cooler air over the Northern Plains and warm, very humid air over the South. This front oscillated north and south over the Midwest during much of June and July. Meanwhile a strong high-pressure system (the "Bermuda High") became anchored over the southeastern United States, blocking the progression of weather systems through the eastern half of the nation.



As unusual as the average rainfall amounts over the Midwest may be, some of the individual station reports are nothing short of astounding. In northwestern Missouri, Skidmore reported 25.35 inches of rain in July, and Worth County reported 30.30 inches through July 25. Normal July rainfall for this area is about 4 inches, while the average annual rainfall is 35 inches. Alton (northwestern Iowa) had a July rainfall total of 20.41 inches, and Leon (south-central Iowa) reported 20.68 inches.

July rainfall in Illinois was also much above normal in most areas, but maximum amounts were in the 10- to 15-inch range: 10.65 inches at the Quincy Memorial Bridge, 11.45 inches at Monmouth, 11.83 inches at Galesburg, and 13.88 inches at Flora. Rainfall totals such as these leave no doubt that the recordbreaking flooding on the Mississippi and other rivers in the Midwest is directly related to the exceptional rainfall this past spring and early summer.

A Lesson To Be Learned from the Great Flood

An editorial by Misganaw Demissie, Director, Office of Sediment and Wetland Studies

This disaster ranks as the greatest flood in North America's modern history. But what have we learned from it? As scientists and engineers collect and analyze mounds of data, from flood elevations to satellite images, the general public is force-fed by the news media and selected "experts." But too often, media information is wrong, incomplete, or misleading. Unfortunately, it will have significant impact on government response to the flood.

As the debate heats up on who or what to blame, it becomes clear that the scientific and engineering community has not adequately educated the public and policy makers on how our natural environment and our flood control structures operate. Sadly, people seem more knowledgeable about the odds of a lottery win (let's say one in a million) than about the chances of a 100-year flood (one in 100) or the chances of a flood control levee designed for a 50-year flood being overtopped in any year (two in 100).

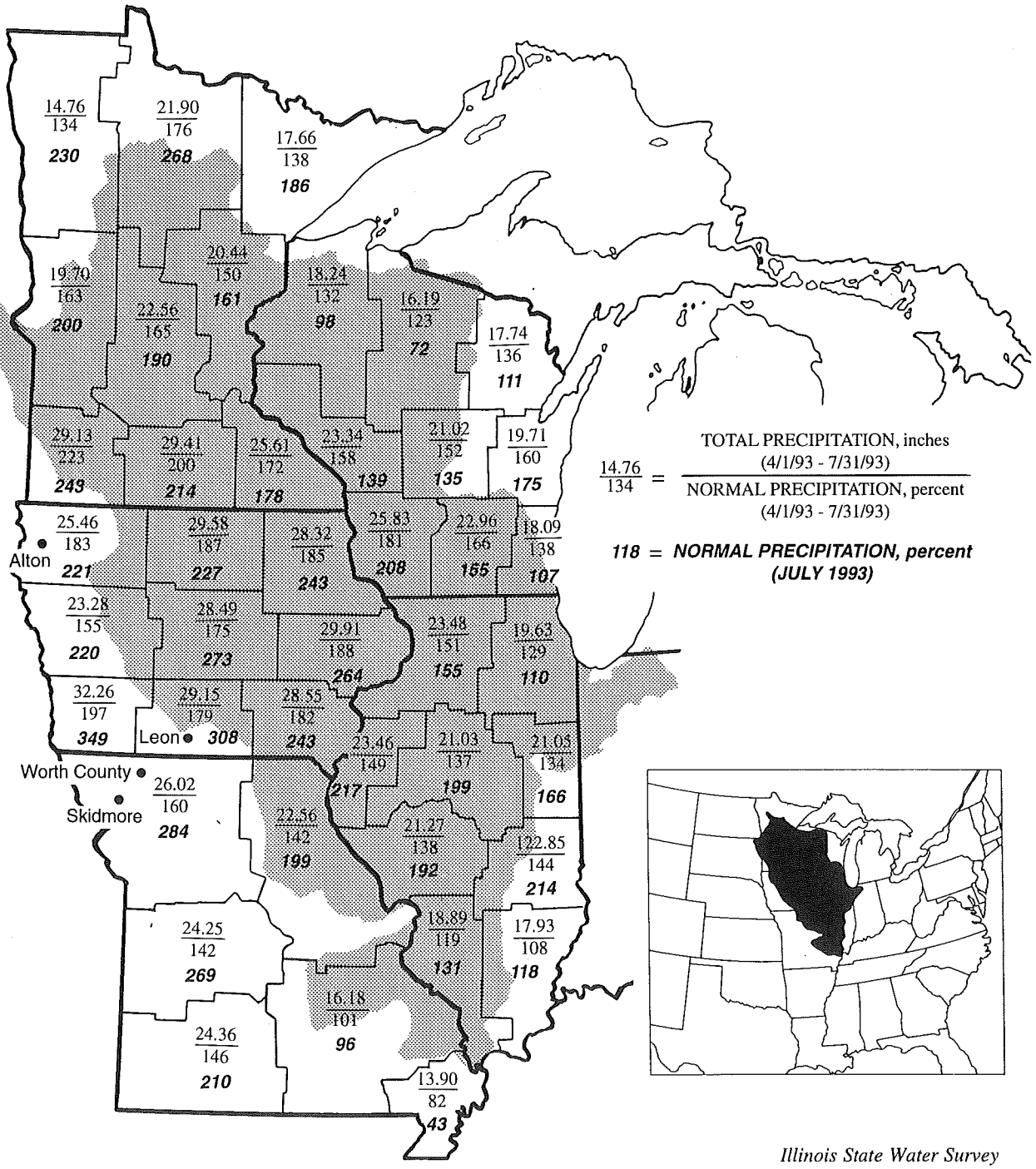
Most people thought they would never see a 100-year flood in their lifetimes, simply because we don't live that long. Or the problem could be that TV "experts" don't understand engineering concepts and deliver the wrong messages, albeit wrapped in confidence and elegance: "A 100-year flood occurs only once in 100 years," or "We'll never see this again." Such misinformation has led to a disregard for the laws of nature when it comes to flooding and flood control.

Often heard along the flood route has been, "After the '73 flood, they said this wouldn't happen again for 100 to 500 years." And when told that the 1993 flood is the greatest on record, "We heard the same thing in '65 and '73." This could have been misinformation or misinterpretation. Either way, it was ineffective communication.

Athletic records are routinely broken, which the public accepts. But when flood records fall, so too does the public's trust in experts. It's a trust that's hard to relinquish. We want to believe in experts. We want to believe we're knowledgeable. We want to believe in flood control and feel secure about flood control structures.

We as scientists must admit that we do not totally understand how our natural environment behaves, and we haven't done an adequate job in communicating that uncertainty. Now is the time to begin promulgating clear and concise

Mississippi River Basin Precipitation, April 1 - July 31, 1993



Illinois State Water Survey

explanations of the major topics of the day: how flood frequency works; how often rivers can be expected to top their banks and reach their flood plains; what a design flood is; the functions and limitations of levees; how bridges, flood walls, and levees affect flood elevations; and how locks and dams control a river and impact flooding. We must respond to questions and concerns such as: Why are we surprised when a major flood occurs? Why are many "experts" saying that a flood of this magnitude will not recur for a long time? Why are we surprised that levees designed for a 50-year flood fail in a flood that surpasses the 100-year level? Why do people risk their lives sandbagging atop levees that were designed to fail weeks earlier? Why do we spend money and emotion protecting cornfields that are expected to be flooded an average of once every 50 years? Why do many feel that the levees caused this flood?

The answers touch on social, political, economic, scientific, environmental, and basic survival issues. As scientists, it is our responsibility to communicate effectively—to provide answers, or at least to explain when there are no answers. The key is that we must respond—accurately, directly, and honestly. Some basic concepts about the flood and its aftermath are:

Flood Frequency. This statistical term expresses the chance that a flood of a particular magnitude could occur in any year, or how frequently certain floods are expected to occur on a *long-term basis*. For example, a 100-year flood has a 1 percent chance of occurring in any year, a 500-year flood has a 0.2 percent chance, and so on. The occurrence of the major flood this year does not reduce the chances of another major flood next year. When we say a 100-year flood occurs on the average of once in 10 years, we don't mean that it occurs only once every 100 years. We mean that on a long-term basis, it will average out as once in 100 years. Perhaps the terminology is to blame for the confusion, and "chance of occurrence" might be a more appropriate term.

Flood of Record. The 1993 event is now the flood of record for most of the Mississippi, superseding the 1973 flood, which was identified then as the flood of record for some segments of the river. This does not mean that the 1993 flood will not be exceeded in the future. Records are made to be broken, and the record goes back only about 100 years.

Floodplains. The floodplain is the area adjoining a river or stream that is inundated by floodwaters whenever the capacity of the stream is exceeded and water overflows the streambanks. This is a natural process. The extent of the floodplain is defined to correspond to the magnitude of floods: the 100-year floodplain is inundated by a 100-year flood, and so on. It is important to realize that most of the damage from the current flood is confined *within* the Mississippi's floodplain.

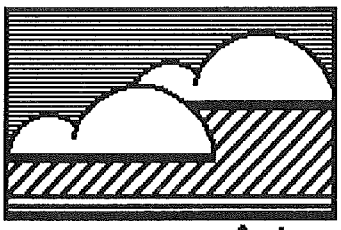
Levees. Levees and flood walls channelize a river, confining the floodway and increasing the water's elevation. But it is very unlikely that levees change the discharge in a river as large as the Mississippi. Most of the agricultural levees along the river were designed only for a 50-year flood, and this level was surpassed a long time ago. Thus, they performed *beyond* what they were designed to do. Have we "oversold" the levees? Probably. Have we encouraged an unwarranted sense of security among those who rely on them? Very likely. We must learn to accept the risk that extreme floods will overcome levees designed to withstand lesser floods of greater frequency. It is economically infeasible, if not technically impossible, to design levees that will never fail.

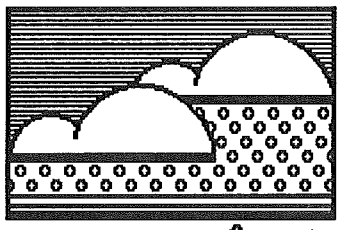
Most Illinois Rivers Feel Effects of Rains

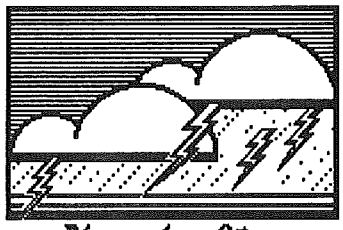
Few of Illinois' major rivers have escaped the effects of increased precipitation. Many experienced peaks surpassing flood stage during July's Great Flood, and most of them have exceeded flood stage for several months. In northern Illinois, portions of the Kishwaukee and Rock Rivers have exceeded flood stage for four to six months, and the Vermilion River near Leonore for four months. The Kankakee River near Wilmington has exceeded flood stage for six months, while at Momence it has experienced above-normal flows for the last ten months.

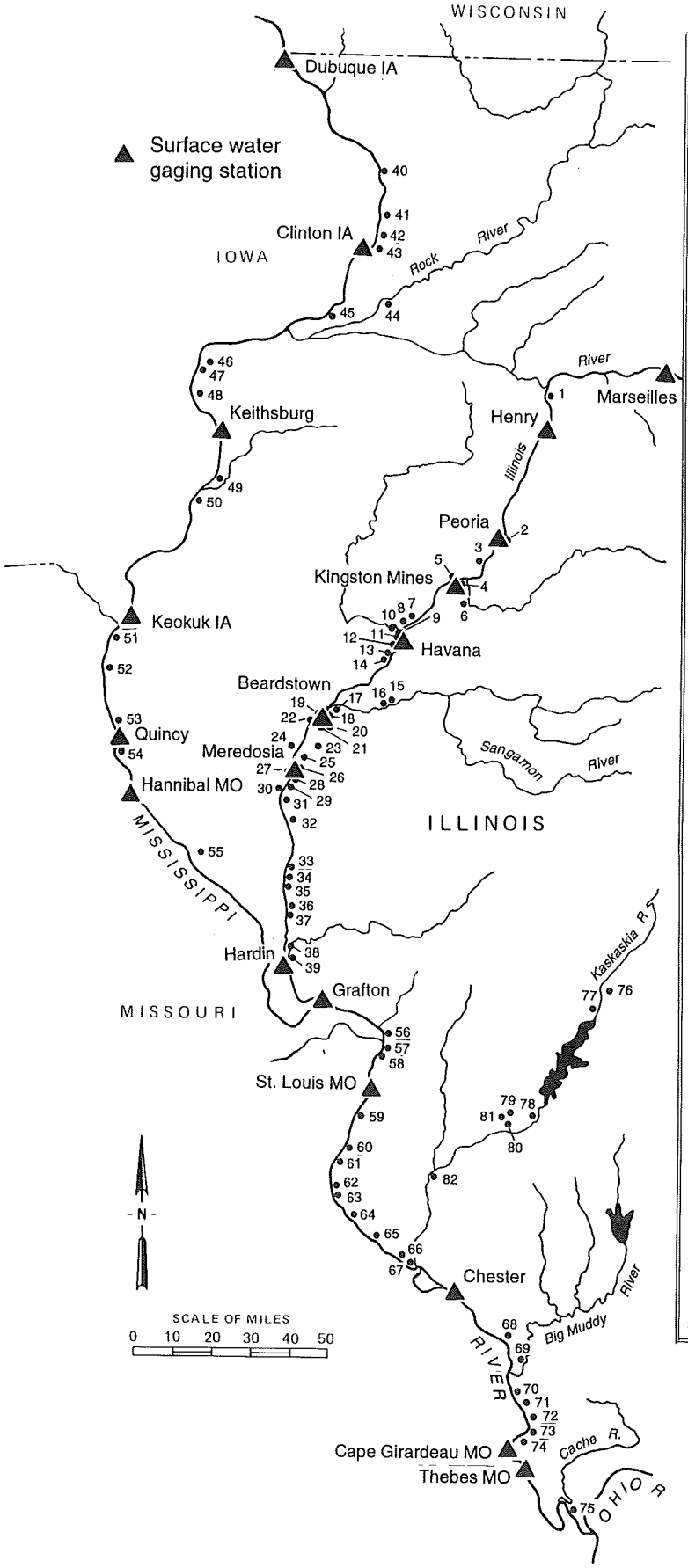
In central Illinois, the Spoon and LaMoine Rivers and the South Fork of the Sangamon have all exceeded flood stage for three to six months, while the Illinois River at Valley City has exceeded flood stage for nine months. In southern Illinois, the Big Muddy River at Murphysboro has exceeded flood stage for seven months. Most of the peak stages were recorded between July 20 and 29. Consult the *Water and Climate Summary* for full details.

The Illinois State Water Survey has copies of the *Illinois Water and Climate Summary*, which provides authoritative data and expert commentary on temperature, precipitation, soil moisture, streamflows, and water levels in the state. This special edition was sent to all *Currents* subscribers on a one-time-only basis to provide complete and accurate information on the Great Flood and is available to subscribers of the *SPECTRUM* upon request. Contact Randy Peppler at the Water Survey; (217)244-1798.









NO.	COUNTY	DRAINAGE AND LEVEE DISTRICT
1	PUTNAM	HENNEPIN
2	TAZEWELL	EAST PEORIA
3	PEORIA	PEKIN & LA MARSH
4	TAZEWELL	SPRING LAKE
5	PEORIA	BANNER SPECIAL
6	TAZEWELL	MACKINAW RIVER
7	FULTON	EAST LIVERPOOL
8	FULTON	LIVERPOOL
9	FULTON	THOMPSON LAKE
10	FULTON	ZEMPEL MUTUAL
11	FULTON	KERTON VALLEY
	FULTON	LACEY
	FULTON	LANGELLIER
	FULTON	WEST MATANZAS
12	FULTON	SEAHORN
13	SCHUYLER	BIG LAKE
14	SCHUYLER	KELLY LAKE
15	MASON	HERGET
16	MASON	FARMERS LEVEE AND RIVER
17	CASS	HAGER SLOUGH
18	CASS	LOST CREEK
19	SCHUYLER	COAL CREEK
20	CASS	VALLEY
21	CASS	SOUTH BEARDSTOWN
22	SCHUYLER	CRANE CREEK
23	CASS	MUD CREEK
24	BROWN	LITTLE CREEK
25	CASS	MEREDOSIA LAKE
26	MORGAN	WILLOW CREEK
27	BROWN	MCGEE CREEK
28	MORGAN	COON RUN
29	SCOTT	MAUVAISE TERRE
30	PIKE	VALLEY CITY
31	SCOTT	SCOTT COUNTY
32	SCOTT	BIG SWAN
33	GREENE	HILLVIEW
34	GREENE	HARTWELL
35	GREENE	KEACH
36	GREENE	SPANKEY
37	GREENE	ELDRED
38	GREENE	MACOUPIN CREEK
39	JERSEY	NUTWOOD
40	CARROLL	CARROLL COUNTY MUTUAL
41	WHITESIDE	JOHNSON CREEK
42	WHITESIDE	CATTAIL
43	WHITESIDE	MEREDOSIA
44	HENRY	PENNY SLOUGH
45	ROCK ISLAND	CAMPBELLS ISLAND
46	ROCK ISLAND	DRURY
47	ROCK ISLAND	SUBDISTRICT #1
48	MERCER	BAY ISLAND
49	HENDERSON	HENDERSON COUNTY #1
50	HENDERSON	HENDERSON COUNTY #2
51	HANCOCK	HUNT
52	ADAMS	LIMA LAKE
53	ADAMS	INDIAN GRAVE
54	ADAMS	SOUTH QUINCY
55	PIKE	SNY ISLAND
56	MADISON	WOOD RIVER
57	MADISON	CHOUTEAU, NAMEOKI, & VENICE
58	MADISON	CHOUTEAU ISLAND
59	ST. CLAIR	PRAIRIE DUPONT
60	MONROE	FISH LAKE
61	MONROE	COLUMBIA
62	MONROE	HARRISONVILLE & IVY LANDING
63	MONROE	MOREDOCK & IVY LANDING
64	MONROE	FORT CHARTRES & IVY LANDING
65	MONROE	STRINGTOWN-FORT CHARTRES & IVY LAND
66	RANDOLPH	PRAIRIE DUROCHER & MODOC
67	RANDOLPH	EDGAR LAKE
68	JACKSON	DEGOGNIA & FOUNTAIN BLUFF
69	JACKSON	GRAND TOWER
70	UNION	PRESTON
71	UNION	MILLER POND
72	UNION	CLEAR CREEK
73	ALEXANDER	NORTH ALEXANDER
74	UNION	EAST CAPE GIRARDEAU & CLEAR CREEK
75	ALEXANDER	CAIRO
76	FAYETTE	DIVELY
77	FAYETTE	VANDALIA
78	CLINTON	SANTA FE
79	CLINTON	GERMANTOWN
80	CLINTON	HANOVER
81	CLINTON	HEIMANN
82	ST. CLAIR	VILLAGE OF NEW ATHENS

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MISUNDERSTANDING FORCE AND MOTION

Introduction

This paper describes the results of a conceptual physics survey given to a small group of high school physics students. Its purpose is to identify common misconceptions held by these students after completing a year of high school physics. These misconceptions may arise from a lack of understanding of such important forces as friction and air resistance as they affect everyday phenomena. Some research would relate the students' understanding to intuitive beliefs about motion, force and impetus developed in medieval times (McCloskey, 1983). For example, many students believe that an object can be given a "circular impetus" and will, in the absence of forces, continue to move in a curved path (McCloskey, Caramazza and Green, 1980).

The survey reported here is a preliminary effort. We hope the eventual outcome of our work will be specific recommendations for content, methods and evaluation of high school physics courses designed to improve students' comprehension of physical phenomena.

Review

Much work has been done analyzing the preconceptions and misconceptions of physics students (McDermott, 1984). Some efforts (McCloskey, et al., 1980; Halloun and Hestenes, 1985; Goldberg and McDermott, 1987; Lawson and McDermott, 1987), including our work, attempt to identify the misconceptions as precisely as possible. Halloun and Hestenes (1985) have attempted to systematize common misconceptions. Others (McCloskey, 1983) have been concerned with the genesis of these misconceptions. Still others (deJong and Ferguson-Hassler, 1986) are specifically trying to understand the cognitive processes involved in learning physics.

Some research (Goldberg and McDermott, 1987; McDermott, Rosenquist and Van Zee, 1987) has focused on students' inability to conceptually link equations, diagrams or graphs used in physics with the situations they represent. This reflects a basic lack of understanding hidden beneath the ability to "do" equations. There is also a belief that we all carry intuitive or common sense concepts about physics. These may be outgrowths of experience or culture.

Method

The chosen method was a written bank of 36 questions, almost all from Mechanics. The format allowed for a range of questions to be covered in a short time. As others (McDermott, 1984; Goldberg and McDermott, 1987; Lawson and McDermott, 1987) have noted, however, the specific errors in students' thinking are not always detected unless one asks follow-up questions. Great care was taken in selecting and wording the multiple-choice responses to help pinpoint students' misconceptions. Many of the questions in mechanics were adapted from, or suggested by, published research (McDermott, 1984; Halloun and Hestenes, 1985). Two questions were suggested by Sadanand. Thirty-two were multiple-choice questions in which students were asked to choose one answer, and four asked the student to draw forces or paths of motion. However, students were encouraged to explain their answers or write in their own answers if none of the choices seemed correct.

The survey was given to 57 students at Wethersfield High School in Wethersfield, Connecticut. These students were enrolled in elective physics courses which are taught at three academic levels, none of which involves calculus.

The students are almost all college-bound seniors and participation in the survey was optional. No incentive was given for it. The survey was administered on the last, or next to last, day before the final exams. Not all students chose to answer all the questions. No time limit was set but the range was from 10 minutes (very few) to two hours.

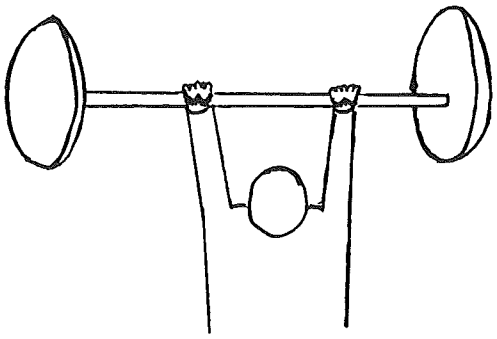
Results and Discussion

We will only examine the students' understanding of forces. Questions about forces were written in two broad categories. In one category, the nature and direction of the forces were either stated or implied and the students were asked to predict the resulting motion. In the other category, the motion of a system was described at a particular point in time and the students were asked what forces were acting on the system at that time. This report deals only with the latter group, in which the students had to determine the forces that were acting on a system by analyzing the situation.

Three common misconceptions may be inferred from the students' answers. They are:

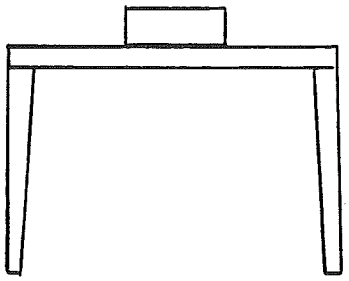
1. animate objects must exert a force to hold things up, but inanimate objects do not have to do so.
2. a constant force is necessary to maintain constant motion.
3. reaction forces are less "real" than action forces.

The first inference above is based on students' answers to a pair of questions in which a mass is supported by either a person or a table. The two questions were separated intentionally in the survey in the hope that students would analyze and answer each independently, and not as part of a pair.



One of the questions was: *What forces are acting on the barbell?*

A. No forces, since it is stationary.
B. The upward force exerted by the weightlifter.
C. The downward force exerted by gravity.
D. Both the weightlifter's upward and gravity's downward.



Only 5% of the students who answered this question did so incorrectly.

The other question asked: *What forces are acting on the block?*

A. None, since it is at rest.
B. The force of gravity downward.
C. The force of the table upward.
D. Both gravity's downward and the table's upward.

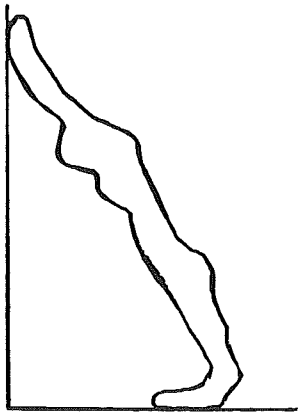
In this case, 30% of those responding chose an incorrect answer.

Six times as many students failed to account for the normal reaction force opposing gravity when that force was supplied by an inanimate object (the table). In addition to supporting the first inference (animate versus inanimate objects), this result also supports the other two inferences; i.e., that a constant force is necessary for constant motion and that reaction forces are not as "real" as action forces.

It is conceivable that a student may have wanted to answer that there were no *net* forces acting on the objects concerned in the two examples, and thus would not choose an answer that indicated the presence of any force. However, the answers selected indicate that such was not the case. The least number of students chose choice A in either example.

The vast majority of incorrect selections indicated the presence of gravity but no counterbalancing upward force. Also, only one student actually remarked that there were no net or unbalanced forces acting on the objects (this student selected the correct answer in both cases). This indicates that the students did not assume that the absence of a net force meant the absence of any forces at all.

The action/reaction inference is also supported by the results of another question suggested by Sadanand. The question asked: *What causes the woman to move (slip) backwards (away from the wall) as she pushes harder against the wall?*



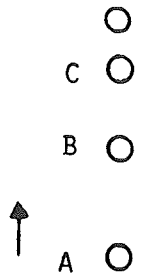
A. A force she exerts on the wall.
B. A force the wall exerts on her.
C. A force she exerts on the floor.
D. A force the floor exerts on her.

Of the students who answered, 51% failed to identify the reaction force of the wall as the cause of her backward motion. Of these, about half chose "A". Arguments could be made about the causality in this case and the question might be re-worded to remove the explicit reference to causation. Even so, an understanding of action and reaction forces would make it clear to the student that *neither* force could exist without the other, for if the woman had no wall to push against, she could not exert a force in that direction. Furthermore, an understanding of the relationship between force and acceleration should make it clear that a backwards acceleration cannot result from a force acting in the forward direction. It is doubtful that many students carried out such a reasoning. A simpler explanation seems more likely—that the students either failed to recognize the existence of a reaction force at all or failed to recognize the reaction force as a "real" force;

i.e., one capable of producing acceleration/motion. In addition, it is possible that the students were unable to distinguish between forces exerted *by* an object from forces exerted *on* an object.

Another group of questions dealt with objects in free fall. Here, we concern ourselves with misunderstandings pertaining only to the forces acting on the objects moving under the influence of the earth's gravity. Students were given the following situation: *A ball is thrown vertically upwards and travels from point A to point B to point C. It eventually reaches a point higher than C. Ignore air resistance. On the way up, what forces act on the ball?*

A. Its weight, vertically downward.
B. A force that maintains motion, vertically upward.
C. The downward weight and a constant upward force.
D. The downward weight and a decreasing upward force.
E. An upward force acting alone for a while, then an additional downward force.



The choices were not made-up arbitrarily but were based on commonly-given incorrect responses in an earlier, written-response test (Halloun and Hestenes, 1985).

Of those responding to this question in our survey, 88% chose one of the four answers which included an upward force. Of all students who chose an incorrect answer, 82% chose "D". This result supports the inference that many students believe a force is required to maintain motion and that a changing velocity must indicate a changing force.

The other free fall situation showed a ball rolling off the edge of a table. Students were reminded to ignore air resistance and friction. The question asked: *What forces act on the ball after it leaves the table?*

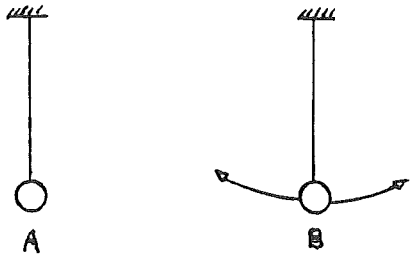
A. The weight of the ball, vertically downward.
B. A horizontal force.
C. A force always pointing in the direction of motion.
D. The weight of the ball and a horizontal force.
E. The weight of the ball and a force in the direction of motion.

Fully 95% of those who responded invoked some non-vertical force. The last two choices (both of which include gravity and some horizontal force component) were the favorites. They comprised, together, 80% of all the wrong answers. These responses seem to strongly support the results from the other questions described—that many students believe a constant force is required to maintain constant velocity.

Additional questions could be designed to further explore the nature of the misconception at work. It is possible that students are confusing force with momentum and/or velocity.

Another question was used to examine the students' understanding of forces, this time explicitly comparing a static system with a moving system. This question did not contain multiple-choice responses. Answers were analyzed with a fourteen item checklist.

The diagrams below show two identical balls suspended by strings. Mass "A" is at rest, while mass "B" is swinging back and forth. Neglect any friction on air resistance. Directly on the diagrams, please DRAW THE FORCES acting on each ball.



Of those who answered, 76% showed different forces acting on the moving and static pendulums. Sixty-three percent showed horizontal forces acting on the moving pendulum (and not the static pendulum) at the moment in question. Again, further questions could help determine whether students are confusing force with momentum or velocity.

Only a third of the students correctly labelled the two forces acting on the pendulum as tension in the string and force of gravity. However, over half did draw an upward and a downward arrow of some sort in the static case. Nearly 40% of the answers showed only the force of gravity and/or a horizontal force on the balls without indicating the tension in the strings. These results further support the contention that many students persist in invoking forces in the direction of motion even when there seems to be nothing that can generate that force but one may need to differentiate between forces and their components to remove ambiguities.

Conclusions

The results of our preliminary survey support the following conclusions:

1. There is a lack of recognition of a passive force, such as a normal reaction.
2. A force on an object is thought essential to maintaining its motion and is directly correlated with its velocity rather than its acceleration. A changing velocity is related to a changing force.
3. Distinctions between velocities and changes in velocity are not made.

Even in successful physics students, there seems to be a lack of basic conceptual understanding. One common explanation is that everyday experience often seems to contradict physical principles. Certainly it is true that most examples studied are idealized. Students are asked to ignore the effects of air resistance or friction while the events they observe may be dominated by these very forces. Perhaps not enough time is spent analyzing more realistic examples that show how the physical principles we learn can be used to explain such phenomena. In fact, it seems that counter-intuitive examples could be a powerful tool in addressing commonly-held misconceptions. For example, in explaining why dragging a box on the floor with a constant force results in a constant velocity of motion of the box, the student may arrive at a clearer understanding of the idealized, frictionless case.

At this stage, it seems to us that the "standard" approach to teaching physics does not address the problems described here. Misconceptions, once identified and classified, can be used to help students find flaws in their mistaken beliefs and erroneous reasoning. Instead of being a block to accurate reasoning, they can become a tool to increase the depth of a student's understanding of physics.

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SPECIAL INTEREST

ENVIRONMENTAL
Connections
Jan./Feb. 1993

AN INTRODUCTION TO SOIL EROSION

Soil erosion is a natural process that has been responsible for much of the scenic beauty of the world. It has also been largely responsible for the earliest development of agriculture, the birthplace of civilization.

Soil erosion is the process of soil particles being dislodged and transferred from one place to another by water or wind. Soil richness on the land can be maintained only when topsoil is formed at the same rate as it is lost—approximately an inch every 100 to 400 years.

The agricultural practices of the last century have not, however, maintained this natural balance. Soil erosion has been permitted to accelerate to the point where much of the land of the planet has very little soil, or has soil with a diminished ability to retain water and with very little nutrients. Worldwide, about 25 billion more tons of topsoil are being lost (actually, misplaced) from croplands each year than is being formed naturally. The agricultural land in the United States alone is estimated to be losing between 2 and 4 billion tons of topsoil each year. In recent years, the soil in our country's agriculturally important Corn Belt is being lost at rates averaging between 6 and 8 tons per acre per year. Considering it takes approximately 150 tons of soil per acre to make an inch of topsoil, the Corn Belt is losing an inch of topsoil (out of its typical depth of 6-8 inches) every 15 years. In other parts of the U.S., particularly in the South, soil is being lost twice that of the Corn Belt! This loss is responsible for damaging agricultural productivity by reducing the soil's capacity to produce crops; and agriculture is the largest business activity in the United States and much of the rest of the world.

Water erosion begins with individual raindrops blasting soil particles into the air ("splash erosion"). Once dislodged, the soil particles are carried by sheets of water running downhill ("sheet erosion"). The runoff water collects in channels, where the soil particles being carried by the water dislodge additional particles along the way ("rill erosion" and "gully erosion"). The amount of rainfall, the soil type, the slope of the land, and the plant cover combine to dictate the degree of erosion at each step in the excavation process.

At the same time as the topsoil is being lost from the land, enormous loads of the eroded soil particles are being carried by streams and rivers to be deposited as deep layers of sediment within lakes. This results in the decline of water quality, complications in flood control, and incomveniences in the recreational use of these water bodies. In many streams and rivers of the United States, sediment is considered the chief non-point water pollutant.

Perhaps the most important step in soil conservaiton is to hold the soil in place. A number of management practices have been acknowledged as effective means of erosion control: Conservation tillage, contour farming, and the use of cover crops, terraces, and grass waterways.

It is important that we teach our students that soil is a fragile and living medium that must be protected and nurtured to ensure its long-term productivity and stability.

Provide an opportunity for your students to see actual examples of splash, sheet, rill, and gully erosion in their own community. Take them on a field trip to a local park, recreational area, abandoned business site, sand or gravel quarry, or a farm. During the visit, guide the students in observation and discussion of what happens when water run-off washes away topsoil. Have them examine trees along a stream to detect the value they serve in holding soil. If a farm in your area uses alternative (or sustainable) agricultural methods of erosion control, arrange an interview with the farmers on a class visit. Prepare questions before the visit.

To obtain one free copy each of the bibliographies "Conservation Tillage, Including Minimum and No-Tillage" (QB 92-02) and "Farmland Preservation (QB 92-05), send a self-addressed, gummed label, along with the name and id number of the desired publications, to Alternative Farming Systems Information Center, National Agricultural Library, Rm. 111, 10301 Baltimore Blvd., Beltsville, MD 20705-2351.

Use your telephone directory to find the phone number of the county or state Cooperative Extension Service nearest you. If you cannot find it there, contact the College of Agriculture at a local major university or your state's Department of Agriculture for the name and number of an Extension specialist. Inquire about the availability of any free publications on land and water natural resources, especially concerning soil erosion. While you have them on the line, request a presentation on erosion and sediment control for your class or school.

For younger students in the classroom, demonstrate some of the agricultural methods of erosion control, and the value of soil in absorbing water and preventing floods, by throwing some water onto the chalkboard. As the water trickles down the board, stop or slow down the flow by attaching strips of moistened toweling just in front of the small rivulets. The toweling can represent terracing, strip-cropping, or a dam. Have students discuss how flowing water can cause soil erosion.

You can purchase a commercially made stream table to demonstrate the types of erosion in the classroom, or you can make one out of a shallow, rigid box. For a simple demonstration, just fill the box to the top with soil, tilt it, and then direct a gentle spray of water on top of the soil. You can plant a cover crop of grass, oats, barley, or rye. You may wish to pack the soil into mounds in order to demonstrate the effect of vertical and circular furrows. Of course, the type, height and amount of compaction of the soil, the angle of tilt, the force and amount of water flow, and the type (if any)) of cover crop or furrowing will all come into play in determining the amount of soil washed from the top of the box. Have your students suggest ways to standardize (hold constant) each of these factors. Once this is perfected, they then can work on experimental procedures of varying, in turn, each one of the factors in an effort to learn more about the causes and effects of erosion. Do the activity outside, and place the box on a large plastic sheet to recover the soil for specific measurements.

Discuss with your students how raindrops can start the erosion process. You can demonstrate erosion in two ways with the very next rainfall. For a demonstration of splash erosion, obtain several stakes (4 inch by 1 inch wide, and 4 feet long), sharpen one end of each, and paint white. Drive the stake about 6 inches into selected spots (bare soil), soil with crop residue, grass covered ground, etc.) just before a rainstorm. Attach a little tin shield to the top of each stake to prevent rain from washing off the stakes. After the rain, observe and measure the height to which the soil splashed up each stake. This would be a relative measure of the amount of splash erosion. For a demonstration of sheet erosion, position /12"-diam. discs (made out of wood or metal) on the bare soil surface just before a rainstorm. After the shower, have your students look closely at the discs. The discs should be lying on a slight pedestal of soil. The exposed soil surrounding the discs would have been loosened by the raindrops, and some of it would have been carried away by sheet erosion.

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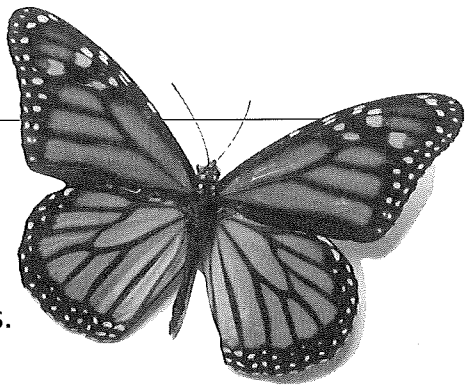

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MINI IDEAS

Kim Pittman
Springman Junior High
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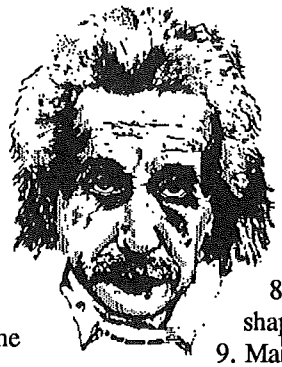
MARIONETTES OF FAMOUS SCIENTISTS



Objective

To understand how a puppet manipulated by strings attached to its jointed limbs is similar to the musculoskeletal system of the human body. The marionettes are allowed to move only in the direction that the students can move.

Background

In addition to meeting these objectives, this activity shows the interdisciplinary nature of science, history and art. Students will appreciate the complexity of the musculoskeletal system.

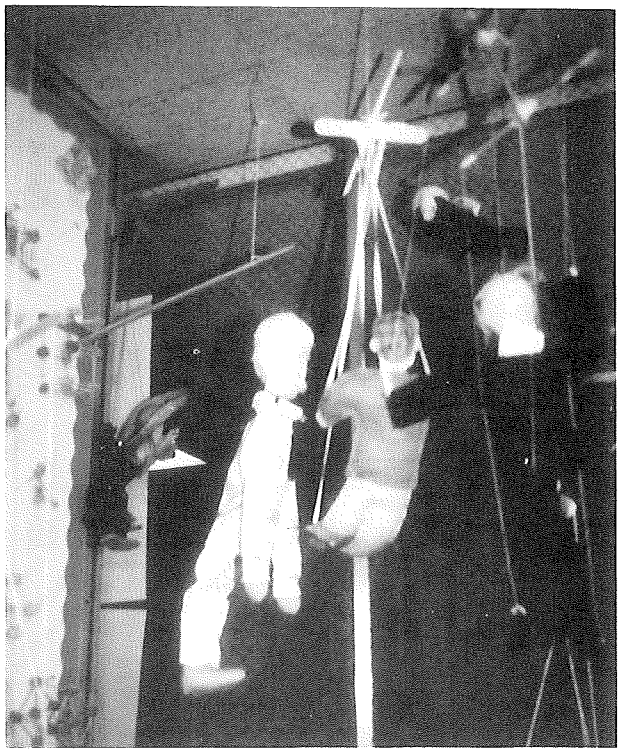
Materials

(Suggestions - Many different supplies could be used)

1. Different colors of various types of fabric (for the pants, lab coat, shirts and dresses)
2. 2 rulers or tongue depressors nailed together in the form of an "X".
3. A picture of a famous scientist that they are interested in or have previously studied. (For facial features)
4. A nylon and cotton or a tennis ball for the head.
5. Sturdy string or fishing line.

Procedure

1. Have students study the musculoskeletal system and how tendons, joints and muscles relate to one another. Stress the analogy of the tendons and the strings of the marionettes being similar.
2. Have students select a famous scientist and research that scientist briefly. This information can be later presentation orally to the rest of the class (This incorporates history in an interesting way).
3. On a large sheet of white paper, have the students draw an outline of their marionette. They should measure at least 24" in length, it is easier to manipulate later.
4. Cut out the template on the paper and trace this pattern onto fabric or your choice.
5. Turn the clothes inside out and sew the inseams well.
6. Turn back and stuff the body with cotton or kleenex.
7. Attach feet (if desired), lab coat, and head. (Hint: Cotton works great for Einstein)
8. Nail the two rulers or sticks together in the shape of an "X".
9. Manipulate the joints so that the marionette can only perform how humans perform (This takes time and understanding of mechanics).
10. Have the student attach 4 pieces of string, one to the wrists, and knees. Then attach the other end to the ruler. Take 4 more pieces of string and attach to the ankles and elbows, then attach them to the ruler. You should now have a working marionette and your students will appreciate the complexity of the musculoskeletal system!



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San Antonio, Texas 78227.
Reprinted from *The Texas Science Teacher*
March 1993

A MULTI-DISCIPLINARY LESSON PLAN FOR GENETICS

Teachers as well as students tend to compartmentalize subject material. It is very easy to just teach the material presented in the textbook and not try to integrate subject material from other disciplines. This non-integration or compartmentalization does a disservice to our students who are learning fragments of information in other classes. We, as science teachers, have the best opportunity to tie many of these pieces together and give our students relevance as to why they must learn science or any other subject material.

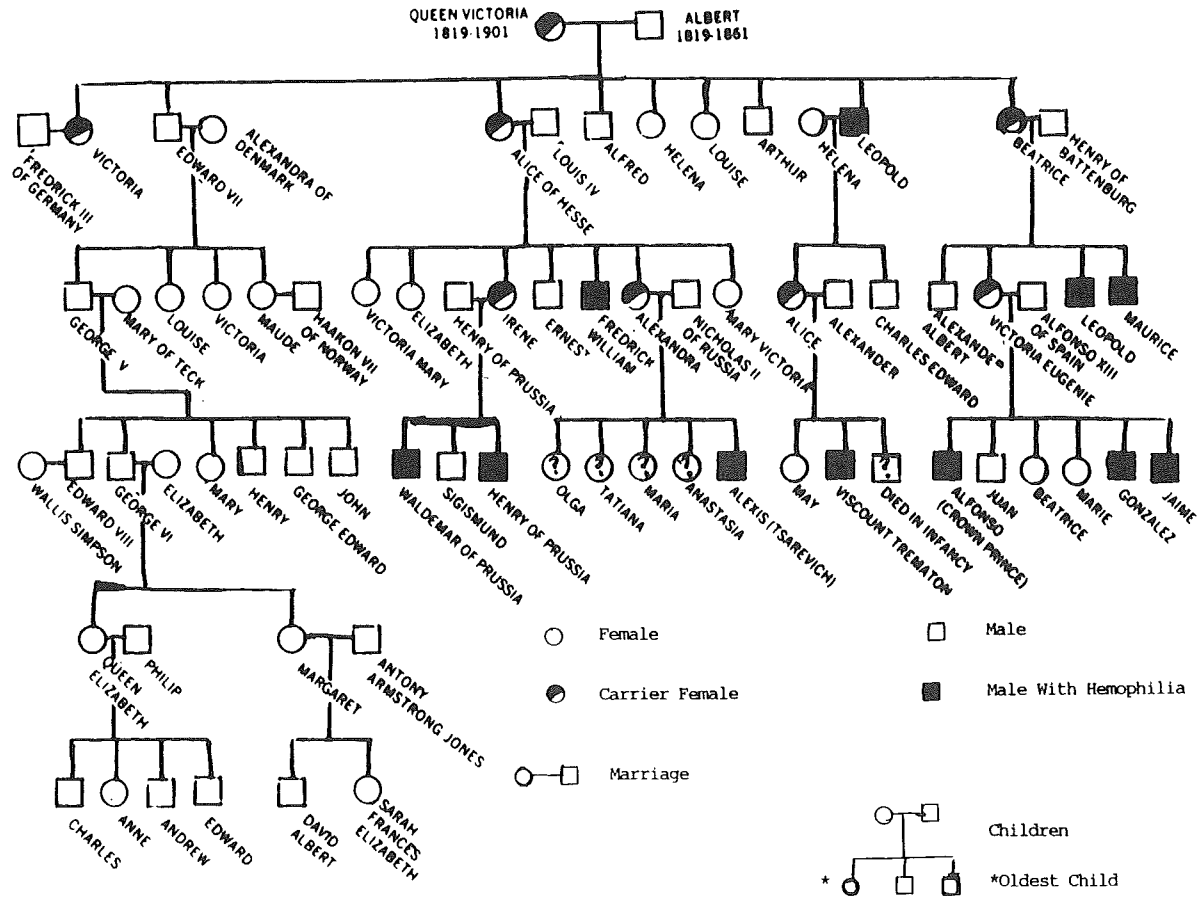
I will be presenting in this article a way to integrate the disciplines of history, mathematics, English as well as biology. This lesson was inspired by an article found on the front page of the San Antonio Express-News newspaper: "Bones of czar, wife believed to be genuine". The lesson topic will be hemophilia.

Biology

The following information will either be presented by the teacher or by the students working in small groups. The students can gather the information themselves and create an original poster on butcher paper to illustrate their findings.

Genes which are carried on the X chromosome are said to be sex-linked. It is easy to spot recessive defects in genes located on the X chromosome because the genes are expressed more frequently in males. This occurs because males normally have only one X chromosome. Males therefore have all genes located on the X chromosome expressed. In order for a female to exhibit the recessive trait, she must carry two recessive genes; one on each X chromosome. If a female carries only one recessive gene on one X chromosome, she is known as a carrier of the trait. She may then pass this gene on to her offspring. Hemophilia or "bleeder's disease" is a sex-linked disorder.

The recessive genes cause the factor (protein antihemophilic factor) to be missing. Because of the missing factor people who have hemophilia can bleed to death from even the smallest cut. Bumps and bruises can cause internal bleeding. Injection of AHF extracted from donated blood can be used to relieve the most serious effects of the disease.



Mathematics

Now students should be ready to integrate mathematics into the study of hemophilia. This can be easily done by using Figure 1. which is the pedigree of the inheritance of hemophilia in descendants of Queen Victoria. Explanation of each symbol and connecting lines are necessary to successfully interpret questions. (See chart)

With the symbols in mind, the following questions can now be answered.

1. List Queen Victoria's children as shown on the pedigree. (Remember she had nine children.)
2. Which of her children are carrier females and which are hemophiliac males?
3. Queen Victoria's daughter, Alice, married Louis IV of Hesse, and they had three children. List their children and tell which are carrier females and which are hemophiliac males.
4. Queen Victoria's granddaughter, Alexandra, married Nicholas II, Czar of Russia. Who was their only son? Did he have hemophilia?
5. Queen Victoria's Son, Leopold, had one daughter. What was her name? Who did she inherit the gene from: Was she a carrier female?

The next series of questions requires the use of symbols to calculate probabilities or explain how a gene was inherited.

X^HX^H Normal Female
X^HX^h Carrier Female
X^HY Normal Male
X^hY Hemophiliac Male

Draw Punnett Squares to explain answers to the following questions. Remember Punnett squares may be used to calculate probabilities of inheritance. Sexlinked traits are handled the same way as nonsex-linked traits. We have used Punnett squares to demonstrate simple inheritance.

6. Would it be better for Leopold to have only sons or only daughters?
7. What is the probability that the daughters of Czar Nicholas II of Russia and Alexandra were carriers? (Remember we do not know for sure.)
8. Five of Queen Victoria's children did not have the disease nor were they carriers of the disease. Explain why.

History

Now that the students have a basic understanding of how the relationships are set up through the pedigree, historical relationships can be established. The history assignment lends very easily to taking students to the library for research. Here you will find it easy to assign students specific people or times and events to look up.

When you assign specific people, you must remind the students that they are trying to establish relatedness between royal houses. The relatedness may help to explain how hemophilia showed up in many of the European royal houses. You must also remind students that they must, in some cases, go back several generations to find this relatedness. In other words, if you assign Henry of Battenburg, is there a possibility he is in some way related to the woman he married?

Here is a possible list for students to look up relatedness. You may assign one or two students to each name depending on time and class size.

1. Frederick III of Germany
2. Louis IV
3. Helena
4. Henry of Battenburg
5. Mary of Teck
6. Haakon VII of Norway
7. Henry of Prussia
8. Nicholas II of Russia
9. Alexander
10. Alfonso XIII of Spain

Other students can be assigned a specific time period to determine what events were occurring throughout the world. For example, have several students determine what was happening in the following countries on or about July 17, 1918 (the execution day of the czar and his family).

1. Russia
2. United States
3. Great Britain
4. China
5. Japan
6. Mexico
7. Germany
8. Spain
9. Canada
10. Italy

After students have completed their assignments, the information on relatedness will be worked into a larger pedigree. This pedigree will then help the student to see that the hemophilia gene has to be passed in families through intermarriage. Students who worked on events in specific countries on the date given will share the information with students in the class. Handouts for each student can be compiled and used for the writing (English) assignment.

English

The final step will be to create a front page of a class newspaper. The class will be divided into groups and each group will prepare a news story using compiled information from the library. Before the stories are written, the students will decide which story is most probably a headline or lead story. All stories will be graded for content and correctness of grammar. Stories will be corrected by the students, typed and layed-out as on a front page of a newspaper. Usually one or more students are artistically inclined and can add pictures to the front page.

Although not all units can be taught in this fashion, it is important for teachers to realize that our subject material can be integrated with other material in different disciplines. Once we realize this, it is easier to answer the question: "Why do I have to learn this?"

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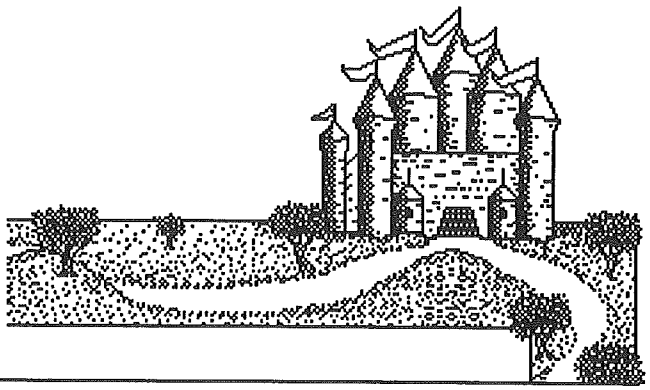

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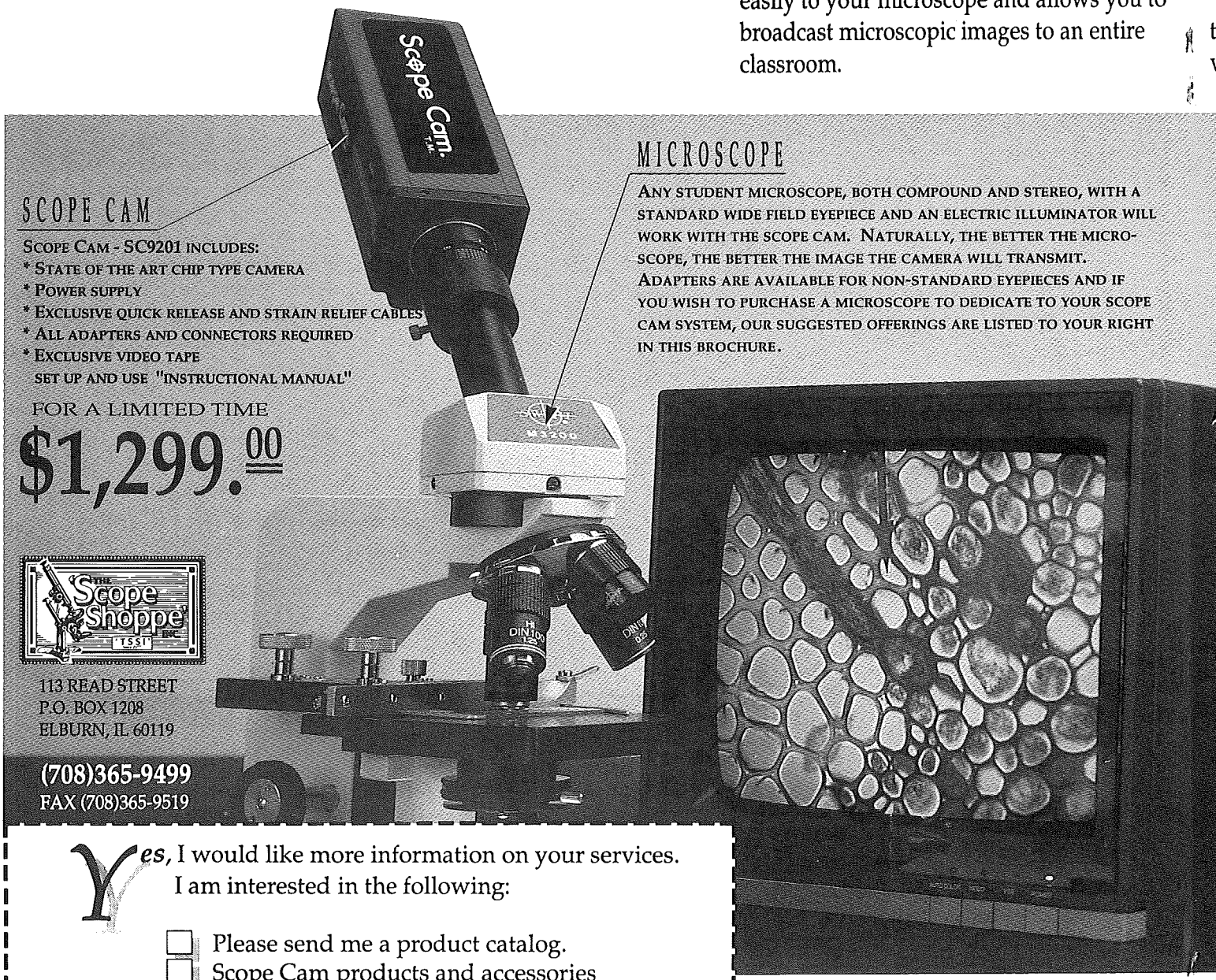

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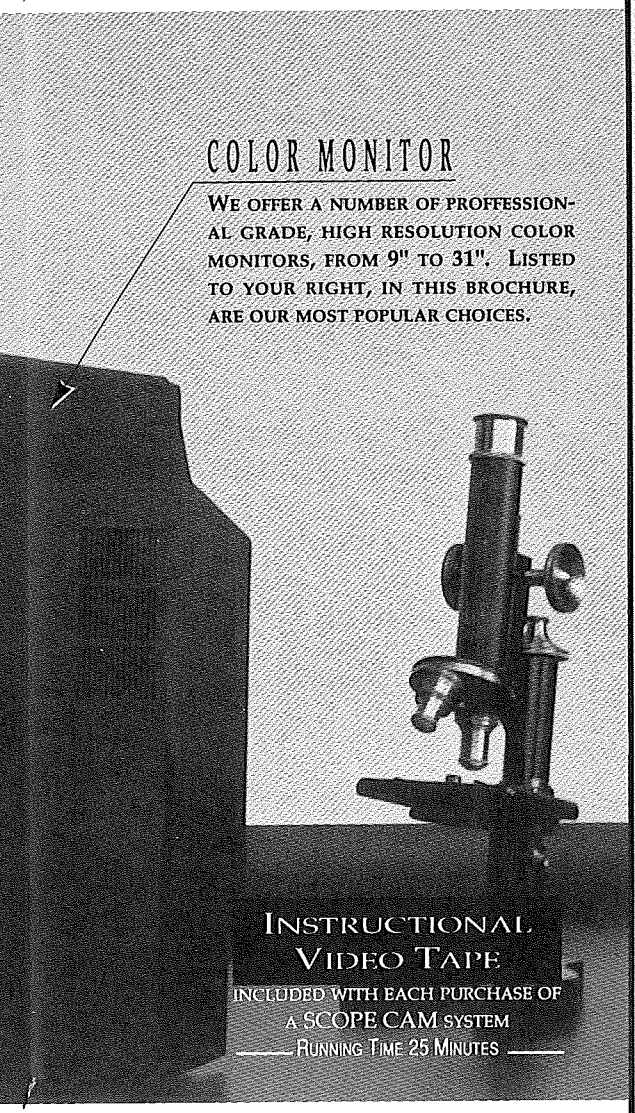

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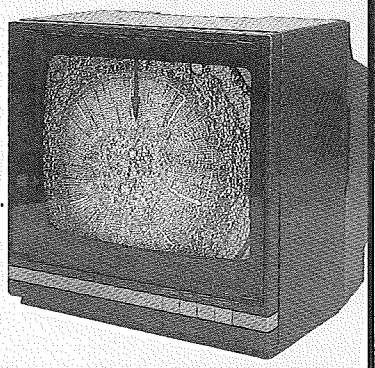

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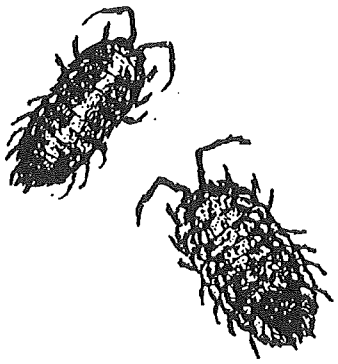
Nancy Ann Fischer
Meeker Junior High School
Kent School District
Adapted from *Washington Science Teachers Journal*
Summer 1990

ISOPOD RESEARCH LAB



Introduction

In this investigation, students study an *Isopod* to learn about what environmental conditions are required for it to live. *Isopods* are common in gardens and may be called either sowbugs or pill bugs (because they roll into a ball). One usually considers them harmless because they generally eat decaying plant materials and stems. However, under certain conditions, they may be quite harmful. In the Spring, they have been known to eat and kill primroses. (Slugs usually are mistakenly blamed for this damage.) Students determine the conditions under which the bugs thrive, so that they can postulate how the bugs may be controlled.

Background

You are a Research Assistant to the University of Illinois Cooperative Extension Master Gardener program. You have been assigned the task of compiling research that will help determine an environmentally safe way to limit the populations of *Isopods* that are currently plaguing home gardeners. From your studies of biology you know that these creatures are in the phylum *Arthropoda* (because of their jointed legs and exoskeletons), class *Crustacea* because they have legs on their abdomens as well as their thorax (recall: *Insecta* have legs only on their thorax). There are seven pairs of legs on the segmented thorax and the abdominal segments are fused. *Oniscus asellus* is the scientific name for the common sowbug, *Cylisticus convexus* is the Latin name for the pill bug which can roll into a ball.

In this lab you will:

1. Identify a problem
2. Collect information
3. Form a hypothesis
4. Test the hypothesis (by observation and experiment)
5. Accept or reject the hypothesis
6. Report the results

The *problem* is that *Isopods* are damaging flowers and vegetables. They seem to be a particular problem for people who grow plants in containers on decks and patios. You must collect enough information to form a *hypothesis*. As you collect your research population you keep *field notes* (Figure 1). From the information above, you form a hypothesis about the habitat, niche and limiting factors of light, moisture and temperature.

Collection Date _____

Time of Day _____

Weather Conditions (hot, cloudy, etc.) _____

Description of Collection Site _____

Type of Substrate _____

Moisture Level _____ Light Level _____

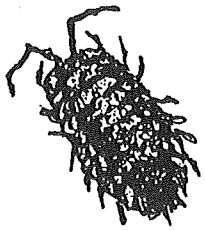
Number of Individuals Collected _____

Figure 1 Sample Chart for Collecting Field Notes

I. HYPOTHESIS

II. MATERIALS

Shoe Box
Plastic Bag
Soil
10 *Isopods*
Scissors
Beaker, Water, Pipette
Ice in Container
Heat Source
Metal Tray



III. PROCEDURE

A. To determine the light requirements of *Isopods*:

1. Cut a 4 cm. hole in the lid of the shoe box close to one end.
2. Mark the bottom of the box into 4 sections of equal size.
3. Label each section bright, medium, dim and dark from beneath the light to the other end.
4. Place 10 *Isopods* in the center of the box and close the lid.
5. Do not disturb or move the box for 5 minutes. You may need to tape the lid to exclude light.
6. After 5 minutes open and quickly count the number of *Isopods* in each section.
7. Record your *observations* on a chart (Figure 2).

B. To determine the moisture requirements of *Isopods:*

1. Carefully remove the *Isopods*.
2. Line the bottom of the shoe box with plastic.
3. Place a 1 cm. thick layer of soil in the bottom of the shoe box.
4. Using the pipette, carefully saturate one end of the soil. Count the drops until the saturation point has been reached. (No more water can be held by the soil.)
5. Use half as many drops of water in the section next to the first to moisten the soil.
6. Use half as many drops of water in the third section as in the second and leave the fourth section dry.
7. After 5 minutes count the number of *Isopods* in each section.
8. Record your *observations* on a chart (Figure 2).

C. To determine the temperature requirements of *Isopods*:

1. Set an aluminum tray up so that one end is on a light bulb and the other end is on a container of ice.
2. Allow the tray to adjust to the sources of heat and cold. Test with your hand.
3. When there is a noticeable temperature difference between the two ends of the tray, place your 10 *Isopods* in the center of the tray.
4. After 5 minutes count the number of *Isopods* in each area of the tray.
5. Record your *observations* on a chart (Figure 2).

Lab Results

Light Requirements	#	Moisture Requirements	#	Temperature Tolerance	#
Bright		Soaked		Hot	
Medium		Wet		Warm	
Dim		Damp		Cool	
Dark		Dry		Cold	

Figure 2. Sample Chart for Data and Observations

IV. CONCLUSION

According to your data:

1. What light conditions do *Isopods* seem to prefer?
2. What range of moisture conditions do *Isopods* seem to prefer?
3. What seems to be the temperature range preferred by *Isopods*?
4. If you were to keep *Isopods* for pets, describe the environment that you would need to create in a terrarium:
5. How does your research data compare with the conditions of the collection site described in your field notes?
6. Do you accept or reject your hypothesis?
7. If you reject your hypothesis, how would you correct it?
8. What recommendations would you make to people who are having trouble with *Isopods* eating their flowers?
9. What other limiting factors could you study in order to better understand *Isopods*?
10. Using a bar graph compare the habitat moisture and light levels with your Lab Results.
11. Which is which? Label the pictures with their Latin names.

EXTRA CREDIT

Design an experiment to test a hypothesis about your answer to 9.

Terry Helser, Chemistry Department
SUNY at Oneonta, NY
Soon Young Kim, Woodrow Wilson Outreach

ELEMENTARY MY DEAR WATSON

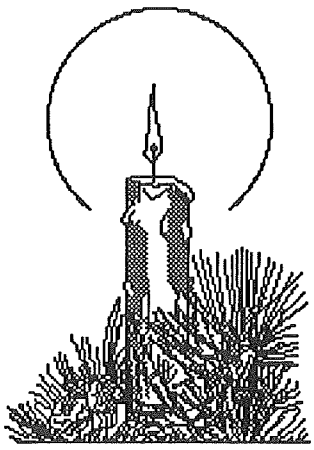
The solution to the mystery that follows depends on your knowledge of chemical elements, symbols, and formulas, Dr. Watson. If a symbol is given, substitute the name of the element: if the name is given, substitute the symbol. The names of compounds may also be symbolized by formulas. Do not fail me, good doctor. The solution must be in my hands by midnight a week hence, or the consequences could be devastating for your grade!

Twas the week before Christmas, when Inspector Lestrade came to me with a most distraught gentleman in tow. (Helium) _____ explained that the gentleman had purchased several pieces of (Ag) _____ and (Au) _____ jewelry for his wife (or mistress, (iodine) _____ surmised), which had disappeared during a street (carbon + argon) _____ ride ((nobelium) _____ doubt to see (hydrogen + erbium) _____ !). The victim interrupted with "You must (Fe) _____ this out before the 24th, Mr. (Ho) _____! I will not (Fe_2O_3) _____ until the jewels are recovered and the culprit made to (S) _____ as (iodine) _____ have this day! (holmium + tungsten) _____ dare someone (sulfur + tellurium + aluminum) _____ from *me*! I'd gladly (Ba) _____ with the fishes and watch him (Zn) _____ in the Thames!" His diatribe did tend to (B) _____.

(Oxygen + nitrogen) _____ questioning, I learned the (carbon + argon) _____ was number (Sn) _____, and express which did not stop during (hydrogen + iodine + sulfur) _____ trip. (Arsenic) _____ to unusual events, (helium) _____ remembered a (Cu) _____ evicting the occupants of the seat behind him and sitting there himself. Enjoying the ride, (helium) was just thinking "these areas (As) _____," when a bad jolt made the (calcium + selenium) _____ of jewelry (sulfur + lithium + phosphorus) _____ between the seat and back of the bench (helium) occupied. The (Cu) _____ retrieved it for him. (Oxygen + nitrogen) _____ checking later, he found the jewelry missing from the (calcium + selenium) _____. (Astatine) _____ their destination, (helium) _____ and the (Cu) _____ searched everyone, and each other, (arsenic) _____ well as the (carbon + argon) _____. (Nobelium) _____ jewels were found.

By this time, Lestrade seemed eager to (beryllium) _____ rid (oxygen + fluorine) our pompous victim, as (tungsten + arsenic) _____ (iodine) _____. (Indium) _____ private, the Inspector explained that he wasn't personally (Sb) _____, but just wanted the theft cleared (uranium + phosphorus) _____ quickly (sulfur + oxygen) _____ he could get (oxygen + nitrogen) _____ to matters more important than petty theft. (Iodine) _____ agreed to help, not to save the Inspector time and embarrassment (tungsten + helium + nitrogen) _____ he failed (arsenic) _____ I (potassium + neon + tungsten) _____ he would, but because I had the (calcium + selenium) _____ already solved. Informed of this, the Inspector cried, "(Sulfur + oxygen) _____ fast! (Hydrogen + oxygen + tungsten) _____?!" My only reply (tungsten + arsenic) _____ that he meet me after (I) _____d, armed, and carrying a (Ni) _____.

(Astatine) _____ dusk, the Inspector and (iodine) _____ rode the next to last streetcar of the day to the end (oxygen + fluorine) _____ the line, the (C) _____. I used Lestrade's (Ni) _____ to pay my fare. (Indium) _____ the deserted (C) _____ I found number (Sn) _____ and climbed inside. Reasoning that the culprit sat behind our victim (Pb) _____ me to examine that seat, and I found scratches on the (F) _____. Prying (uranium + phosphorus) _____ a loose piece of (F) _____, I found the missing (Ag) _____ and (Au) _____ jewelry in a (boron + silver) _____. I substituted worthless (SiO_2) _____ to simulate the heft of the (rhenium + aluminum) _____ articles, and replaced the (boron + silver) _____ under the (F) _____. The Inspector and (iodine) _____ then concealed ourselves to await the thief. Nearly dozing (oxygen + 2 fluorine) _____, I was startled by the sound of footsteps echoing (indium) _____ the deserted (C) _____. A shadow entered number (Sn) and I heard the (F) _____ being lifted, a brief silence, then an expletive and "The jewels (Ar) _____!" The Inspector yelled "Police!" and I yelled (Cs) _____!" as we both jumped into different ends of the streetcar. After a brief struggle, the inspector had his (Ne) _____ the culprit, (tungsten + holmium) _____ was subdued and handcuffed. I turned (oxygen + nitrogen) _____ the torch and beheld a uniform (oxygen + fluorine) _____ blue with (bromine + arsenic + sulfur) _____ buttons. "(Ho) _____!" exclaimed the Inspector, "It's the (Cu) _____!" "Of course," I replied, "it's elementary, Inspector, He's a (Si) _____ who found his comedy routine impersonating a (Cu) _____ in prison to (beryllium) _____ infinitely (molybdenum + rhenium) _____ rewarding on the outside-almost."



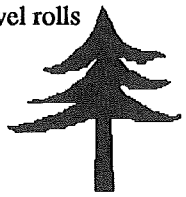
C. John Graves
Monforton School
Bozeman, Montana
Reprinted form *Science and Children*

SECONDHAND TREES, FIRSTHAND LEARNING: HOLIDAY EVERGREENS REVITALIZED

Sustaining the excitement of the holidays as students return from a fun-filled vacation can prove a difficult task for classroom teachers. I've developed some hands-on science projects that not only take advantage of the numerous trees discarded after seasonal festivities, but also help offset those post-holiday back-to-school blues.

For these projects, you will need:

- a variety of discarded evergreen trees (one for every two or three students; I get mine from friends and neighbors and load them in a pickup truck to bring to school),
- a saw
- sandpaper
- pruning shears
- cardboard paper towel rolls
- straws
- toothpicks
- clay
- graph paper



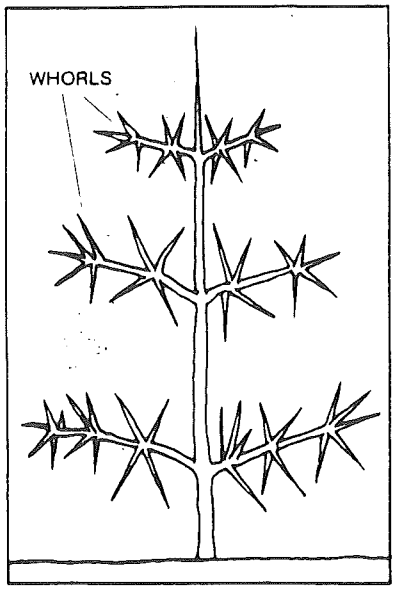
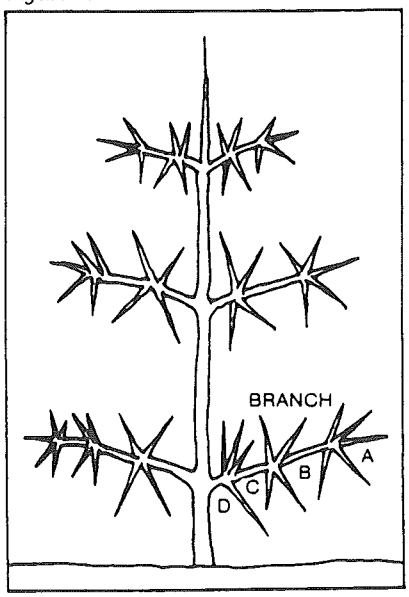


Figure 1.

Branching Out

Begin by observing an evergreen tree with the class. Explain that the branches of coniferous trees are arranged in *whorls*, growing outward from the trunk in a spokelike fashion (Figure 1). You can roughly estimate a tree's age by counting the number of whorls, since a new set of whorls is added each year. As students count the whorls, however, remind them that many evergreen trees are pruned regularly to retain an ideal shape, so the number of whorls may not reflect an accurate age.

Figure 2.



Next, have students identify the whorls on an individual branch, from those closest to the trunk to those at the tip of the branch (Figure 2). Mark the sections between the whorls with letters. Students should examine the scales on the bark in each section and note the differences. They will see that the scales at the tip of the branch are well-defined and rough. Those scales closer to the trunk are stretched to accommodate the growth in the cambium layer, which is just under the bark and gives rise to new cells. By cutting samples along the branches and displaying the sections on poster board, students can easily see a difference in growth along a branch.

Growing Up, Treestyle

Trees grow very differently than do other organisms, especially humans. To illustrate that point, I compare a three-year-old child and an evergreen tree, both of the same height. A three-year-old has arms relatively close to the ground. By age six his arms are higher off the ground, indicating that growth has occurred in the main "trunk" of his body. Unlike a child, however, the branches of an evergreen are still the same approximate distance from the ground three years later.

In trees, growth occurs both at the tips of the trunk and branches and around the branches and trunk, causing them to get both taller and thicker. Have students construct models of their trees using cardboard paper towel rolls, straws, and toothpicks for trunks and branches, and a piece of clay for the base. Encourage them to reproduce a model of "their tree" as closely as possible.

Tell-tale Signs of Age

Once the class has begun to understand how a tree grows, have students examine cross sections of the trunks. Help students to make 4-cm-thick cross sections of their tree trunks just below each set of whorled branches. (Make sure students use the saw only under your supervision.) Students should label these cross sections 1, 2, 3, and so on, as they are cut (Figure 3). Then have students rub the top of each cross section with sandpaper until smooth—the rings will show up clearly.

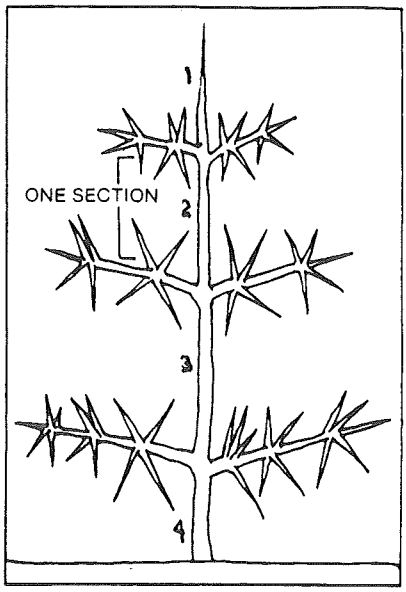


Figure 3.

As students examine the cross sections, discuss what they can learn from their observations. For example, they can tell a tree's age by counting the rings. Under a hand lens, two types of cells should be clearly visible in the rings. Large cells, called *early wood*, grow in late spring and early summer. Beyond the early wood, other cells, called *late wood*, become smaller as growth slows during the middle of the summer. The late wood cells are then followed by another ring of early wood, the following year's growth. The resulting dark-colored early wood and light-colored late wood make up one annual ring. Using the largest section of the cut pieces, have the students determine the age of their tree by counting rings.

As a follow-up, have students make a display of their cross sections on poster board. They can then identify the major events during the tree's lifetime. In addition, have students measure the width of each ring. Construct a graph with the data collected, and answer the following questions.

- In what year did the tree grow the most? The least? How can you tell?
- How old is your tree? How do you know?
- What is the average rate of growth in millimeters?
- Why do you think the rings aren't perfectly round?

You may also want students to make a display of the cross sections of various types of evergreens you are examining in class. With the aid of identification keys, such as *Audubon Society Picket Guides*, students can name the tree and research the habitat in which it grows, including amount of precipitation, average yearly temperatures, and appropriate soil conditions.

When you finish with the trees, put them in a compost pile and study their decomposition rates. Or, grind them up and spread them on soil to test the changes in soil acidity.

This creative science activity ushers in the new year with a conservation activity that shows the ordinary nature of science and generates enthusiasm among your students. Minimal cost, numerous activities, and lots of hands-on fun—why not let the holiday season linger just a little bit longer?

Resources

Audubon society pocket guides: Familiar trees of North America, western region. (1988). New York: Alfred A. Knopf.

Montana evergreen handbook. (1986). Great Falls, MT: Great Falls Public Schools.

Artwork by Max-Karl Winkler.

OPPORTUNITIES

Illinois Mathematics and Science Academy
1500 W. Sullivan Road
Aurora, IL 60506-1000
(708)801-6101

IMPACT II 1993-94

IMPACT II is a teacher recognition and networking program which seeks to identify K - 12 Illinois public school teachers who have developed and implemented creative ideas in mathematics and science instruction. Disseminator grants are being accepted through **February 7, 1994**. Grants are for $500 for each individual teacher on the team. IMPACT II catalogues and current applications are available from your principle's office, your local Educational Service Center or your math and science department chair.

For information, please write or call the above address and ask for IMPACT II.

THE GLOBAL SYSTEMS SCIENCE PROJECT OF THE LAWRENCE HALL OF SCIENCE, UNIVERSITY OF CALIFORNIA ANNOUNCES TWO INSTITUTES OF TEACHER/LEADERS IN BERKELEY.

High school teachers interested in development of interdisciplinary course materials related to global environmental problems are invited to apply for either the June 22 - July 13, 1994 or the July 17 - August 5. 1994 institutes. This early date is necessary to allow teachers time to receive and test some of the educational materials in their classrooms prior to the institutes. The objectives of the institutes are to involve teachers as partners in the development of Global Systems Science educational materials, to develop new teaching techniques, and to play an important role in the science education reform movement.

Participants in these NSF funded institutes will receive graduate credit in addition to a stipend, room and board, and reimbursement for travel. For information and an application, contact Harriette Searle, Global Systems Science, Lawrence Hall of Science, University of California Berkeley, CA 94720 (510)643-5082 Internet: lhsGSS@maillink.berkeley.edu

International **Museum of Surgical Science**
1524 N. Lake Shore Drive
Chicago, Illinois 60610

THE MED PROJECT *PARTNERS* SUMMER WORKSHOP FOR TEACHERS AND ADMINISTRATORS AUGUST 1-5,1994

Who should attend the workshop?

Any Illinois high school teacher or administrator who wishes to implement a program in his/her own school or community similar in nature to the MED Project should consider applying. Participation is limited. Participants will visit hospitals and medical centers and do laboratory activities just as students do in the Museum's MED Project. Read the information below for more details about the MED Project and the Partnership.

What does it cost to participate?

There is no fee for participation. The ISBE has provided funding through a grant from the Scientific Literacy Program. Participants from outside the Chicago area will stay in a hotel nearby the Museum and receive a per diem to cover misc. expenses. Transportation to and from Chicago will not be provided.

How do I apply?

Simply call the Museum at 312/642-6502 Tuesday through Saturday from 10 a.m. to 4:30 p.m.

What is the MED Project?

Offered at the Museum, the MED Project is a high interest, motivational summer program combining activities and field trips to address the science literacy of high school students as related to health and medicine. Students participate in laboratory activities and travel to hospitals, medical schools, and other medical centers to meet medical professionals and learn about practices and technologies. In Partner sites throughout Illinois, Partners offer programs similar in nature to the Museum's program but adapted to the needs, schedules, and facilities of their own situation.

What is the Partnership?

The MED Project *Partners* is a partnership between the International Museum of Surgical Science, the Museum's MED Project Instructors, and Partner sites throughout Illinois funded through the Scientific Literacy Program of the Illinois State Board of Education. Partners are high schools and other agencies providing educational programs for students similar to the MED Project offered at the Museum.

By joining together as Partners, The MED Project *Partners* will offer programs for students in sites throughout Illinois. Partners will learn from each other, share ideas and resources, gain recognition, and seek funding to strengthen the partnership and its various student programs.

What are the benefits of belonging to the Partnership?

The sum of our student programs is more powerful than any one of the programs alone. Partners benefit in many ways but especially by...

1. Learning how to offer quality educational experiences for students from the ideas and experiences of the MED Project Instructors and the Partners. Information sharing is definitely one of the strengths of this collaborative effort.
2. Gaining statewide and national exposure. Collaborative activities such as this one more readily gain recognition than local projects do on their own.
3. Receiving materials, equipment, and funding through grants received by the MED Project *Partners*. While there is no guarantee that a Partner Site will receive any financial support beyond this summer's Implementers' Workshop, it is possible that the Museum can secure funding for the Partnership.
4. Linking with the Museum and Partner Sites via computer bulletin board. The Museum is currently setting up a computer bulletin board. Partners will be able to communicate with the MED Project Instructors, Museum staff, and each other throughout the year.

What are the expectations from the Museum for each Partner Site?

The Museum will act as the coordinating agency for the Partners. Partners are expected to...

1. Use the banner "The MED Project" and properly credit the Museum and the Partners in all print materials, PR, and other communications. The Museum will provide the details.
2. Share information through the Museum to the Partners, including information about the Partner program, evaluation data, and resources.
3. Attend the summer workshops (if funding is secured to offer the workshops). Funding has been provided by the ISBE to hold a workshop this summer for current Partners and new Partners.

Do we have to belong to the Partnership?

No, you are under no obligation after attending the summer Implementers' Workshop. But we do ask that you do not use any of the materials without proper credit to the Museum and the Partners and that you not use the MED Project name for any of your programs. Printed pages must identify the source including the words "Used with permission by The MED Project, International Museum of Surgical Science, Chicago, IL".

THE POWER HOUSE

"TURN ON TO ENERGY EDUCATION"

100 Shiloh Boulevard
Zion, Illinois 60099

POWER HOUSE GENERATES "E'S"

A power house that generates "E's" must be producing electricity. Correct? If you said yes, you are missing the other "E's" produced at Commonwealth Edison's Power House in Zion. Excitement, Enthusiasm, and Exuberance are being generated as students, educators, and the general public discover the energy education center.

Opened in October, 1992, The Power House has hosted over 55,000 visitors. The facility was designed to make learning about energy stimulating and fun through hands-on exhibits and interactive educational programs. Since this educational facility is part of Commonwealth Edison's ongoing commitment to educate the community about energy issues, the admission is free.

The Power House offers a wide range of activities for educators. First, there is the 7,300 sq. ft. exhibit area which is divided into four sections: The Nature of Energy, Sources and Forms of Energy, Energy Use Through Time, and Energy in Transition. More than 50 exhibits, most of them hands-on, are located here. Your students can ride a bicycle to generate their own power, and then to calculate the watts produced. You can step into a booth that uses your age, height, and weight to calculate the number of calories you need to get through the day. (Unfortunately, it does not differentiate between school days and institute days.)

When you make your reservation, you can request an educational program to be presented tin the 100 seat Power House Theater. You may choose any one of the following:

"Alternative Energy Sources"
"Basic Principles of Energy"
"Energy and the Environment"
"Energy Conservation"
"Power Generation"
"Safety and Electricity"

These programs, presented by an energy education specialist, can be designed to match the age and ability levels of your class. The Power House's Energy Resource Center was developed with both students and educators in mind, and houses books, periodicals, and reference materials for visitors to use while at the facility. Computers and videotape library are other ways visitors young and old can learn more about energy and how it affects their lives. The center is fully accessible to disabled visitors and is open Monday through Saturday from 10:00 a.m. (flexible for school groups) until 5:00 p.m. and is located on the shores of Lake Michigan, next to the Zion Generating Station. For additional information call The Power House at (708)746-7080.

It could be an electrifying experience!

Nancy Joyce
Kids Internationally Distributed Superstation
935 Morrison Ave.
St. Louis, Mo. 63104 - (314) 421-2284

STUDENTS & TEACHERS HELP BREAK WORLD RECORD WITH MATH-SCIENCE PROJECTS

Do any of these environmental science topics interest you?

Elementary School Topics

Bio-Diversity Habitats Wetlands
Recycling Woodlands Praries

Middle School Topics

Soil Conservation Water-The Life Cycle

High School Topics

Conservation of Energy Envision the Future
Energy Conservation Machines

YES?
Then you and your students are invited to join the fun!

Help break the Guiness Book of World Records for mazes by creating *very special* Math-Science projects on one of the environmental science topics listed above. This is an opportunity for you, your students and your school to be represented at a historical event, and to be permanently entered in the K.I.D.S. archives.

Project Overview

The K.I.D.S. Global Forest Art Exhibit ® is a whole language, whole-mind, whole-brain learning experience that encourages team teaching to prepare highly artistic Math-Science Reports and Summation Statements. Students are asked to study a topic, then make a report using a special technique for graphs, charts, maps and illustrations.

Then, students express their thoughts, feelings and accumulated knowledge by combining their visual and verbal skills in a variety of two dimensional activities.

Please Note: *Teachers are invited to participate, too.*

When teachers and students combine science with poetry and paintings, focusing on their environmental concerns, the messages are dynamic and visionary. To draw the world's attention to these messages, a huge maze is being constructed to break the world record. And on the walls of this maze, all the projects are to be displayed.

There has never been a project like this before. The Maze will receive global press and be recorded in history books. The teacher's and student's messages will be heard by leaders around the world, resonating into the future. And the projects will eventually reside in an archive as a priceless resource for generations to come.

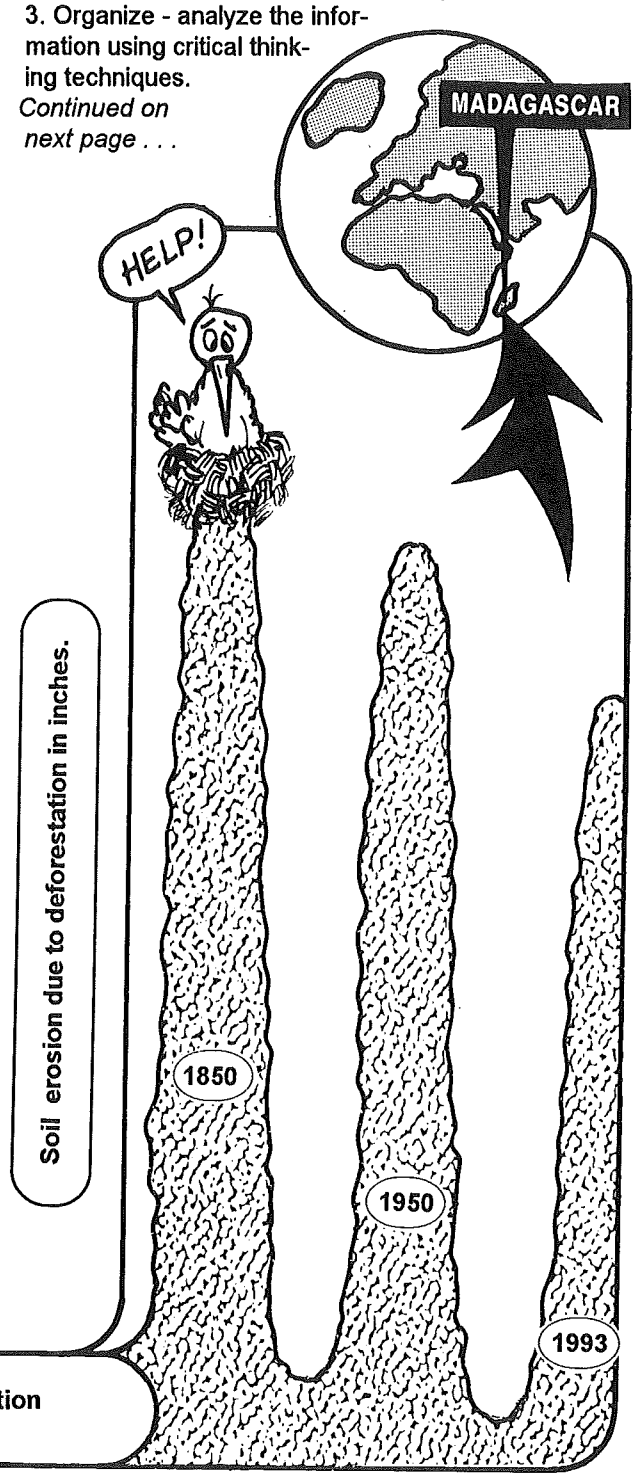
The May-Day Maze ® celebrates the creativity of teachers and students and the environment.

The Math-Science Report

To create a whole language Math-Science Report, the following steps should be considered:

1. Select a topic from the list to the left.
2. Gather historical, scientific, statistical information about the topic using research techniques.
3. Organize - analyze the information using critical thinking techniques.

Continued on next page . . .

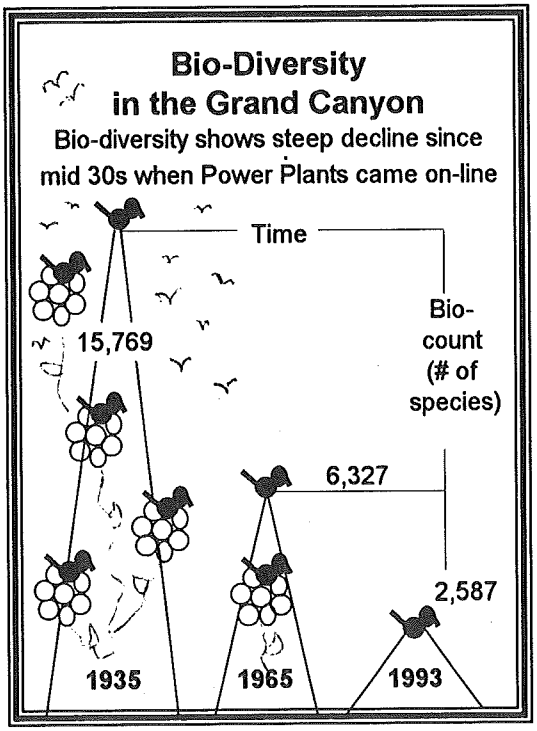


4. Identify challenges to achieving a happy, healthy, peaceful, loving world.
5. Brainstorm solutions using creativity techniques.
6. Create a written/visual two-dimensional report. Consider transforming mathematical data into visual graphs, charts, maps and illustraions.

Fun Graphs, Charts and Maps

Turning statistics into paintings with text and captions is a whole language/brain way of teaching math. And there is a wonderful sense of excitement when numbers suddenly have so much meaning in every day life they send an important message that moves the peoples of the world.

The process is easy. On the front page of USA Today, in the lower left hand corner, are *wonderful* examples of math-science data turned into creative graphs, charts and maps. They are fun, imaginative, thought provoking. And it's a great way to motivate students to include statistics in their reports.



Creative Summation Statements

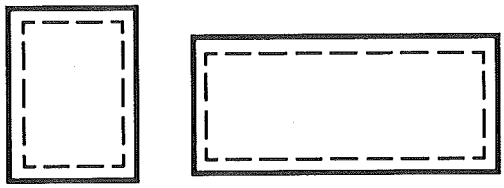
Once a Math-Science Report is completed, the next step is to express thoughts, feelings and accumulated knowledge about the topic in a creative way:

Write a poem, short story, myth, play, lyrics to a song or a philosophical treatise. Create a painting. Compose original music. Design an invention that improves the future. Draw a building that is kind to the environment. Develop an environmental game. Choreograph a dance. Be creative. Let your imagination soar!

PROJECT GUIDELINES
Information needed to complete a Math-Science Report and a Summation Statement

Follow these guidelines carefully. Each is important for specific reasons:

1. There is no limit to the number of pages in a Math-Science Report or Summation Statement.
2. Each page in a project must be completed on either 8 1/2" x 11" paper or on 11" x 17" paper.
3. Portions of projects may be duplicated for display. To ensure accurate duplication, please include a one-inch border on each page submitted. We recommend colorfully decorating the margins.



4. We suggest that artwork be painted with magic markers, water colors, finger paint, poster paint or another medium that can be clearly duplicated on a color copier. Pastels do not duplicate well, and when crayons are used, they need to be placed on the paper with a heavy hand.
5. Both the Report and the Summation Statement must be accompanied by Identification forms. Send a SASE for duplication copies.
6. Each project must be accompanied by a signed permission form that allows us to duplicate the project for special displays. Please send for them.
7. Number consecutive pages of a Math-Science Report, short story, poem, myth, song, etc. at the bottom of the page in the one- inch margin.
8. Each page of each project, plus the project ID forms, plus the permission form must be laminated together. How you laminate the projects is the key to the May-Day Maze, so follow directions very carefully. Graphic instructions will be sent with the ID forms and permission slips.

Team Teaching

Creating a Math-Science Report with imaginative graphs, charts, maps and illustrations, and a Summation Statement with paintings, poetry, musical scores and/or games is a golden opportunity for teachers with various specialties to guide participants toward excellence.

An Important Project

By combining science with art while focused on an important topic, we can create new myths. And myths are the bases for paradigm shifts.

Thus, the graphics that teachers and students design for this project are bound to have far reaching implications.

Join the fun!
May-Day Maze Festival
May 5-8, 1994 - St. Louis, Mo.

THE COUNCIL FOR BASIC EDUCATION 1994 SUMMER FELLOWSHIPS

Sci-Mat Fellowship Program

Win a $4,900 Team Fellowship Award!

Who Is Eligible?

Teachers of Science, Mathematics, and the Humanities who teach full-time in grades 6-12 in U.S. schools and have at least three years of teaching experience and who have not been awarded a Sci-Mat Fellowship previously.

What Do We Do?

CBE will award Sci-Mat Fellowships competitively to 70 teams of two teachers—one Science or Mathematics teacher and one Humanities teacher—to spend six weeks of independent, self-directed study linking the sciences and the humanities during the Summer of 1994 in a setting of their own choosing. The stipend is $2,300 per team member, plus $300 for related materials.

Change the climate of learning as you design a curricular unit which will become a teaching model in your school.

How Do We Apply?

Write CBE for program guidelines and application forms, available now! Completed Sci-Mat applications must be postmarked by **January 19, 1994.**

This program is funded primarily by the National Science Foundation (NSF).

The Council for Basic Education is a national advocate of a sound education in the liberal arts for all pre-college students.

Request your Application Today!

It Takes Time to Develop a Study Plan and a Reading List.

For Sci-Mat application, write:
CBE
Attn: 94-S
P.O. Box 135
Ashton, MD 20861

Zero Population Growth
1400 Sixteenth Street NW
Washington, DC 20036
202/322-2200

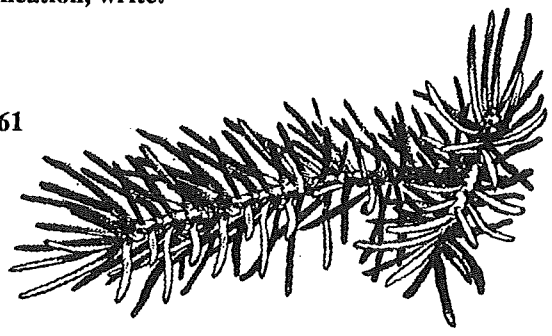
ZPG ANNOUNCES STUDENT POSTER CONTEST

Zero Population Growth (ZPG) is sponsoring a poster contest to commemorate its 25th anniversary, as well as the upcoming U.N. International Conference on Population and Development to be held in Cairo, Egypt in September of 1994. The poster contest gives young people the opportunity to share their visions for a quality future, and to educate others about what must be done to achieve them. The theme is *"Envisioning a Quality Future: People, Resources and the Environment."*

All entries and requests for the official poster contest guidelines should be sent to: **ZPG Poster Contest, 1400 16th Street NW, Suite 320, Washington, D.C. 20036.**

ZPG is a national, nonprofit organization which works to educate the public about the need to bring human population into a sustainable balance with the environment and the Earth's limited resources. Since 1975, ZPG's Population Education Program has provided teaching materials and training workshops for K-12 educators.

The U.N. International Conference on Population and Development (ICPD) is the third in a once-every-decade global meeting of national governments to set population policy. Specific issues to be addressed at the ICPD are population programs and policies; the links between population, development and environment; migration; the status of women; and family planning programs.



TOYOTA/NSTA TAPESTRY GRANTS

WHAT IT IS: *Toyota's Appreciation Program for Excellence to Science Teachers Reaching Youth.* Teachers propose innovative one-year programs with budgets up to $10,000 that enhance science education in their schools.

WHO IS ELIGIBLE: All science teachers 6-12 residing in the 50 United States. "Science teacher" is defined as anyone who spends at least 50% of his/her classroom time teaching science.

HOW TO APPLY:

1. Obtain the TAPESTRY Proposal Cover Form and program rules from your science department chair, or write to NSTA at the address below.
2. Design and plan a one-year long project that centers on either environmental education or physical science applications (applied physics, chemistry, and technology).
3. Projects should demonstrate creativity, involve risk-taking, possess a visionary quality, and model a novel way of presenting science.
4. Projects should be hands-on activities, have an interdisciplinary approach and relate science to students' lives.
5. Write a proposal according to the TAPESTRY rules. Required proposal components include an Abstract, Description, Rationale, Potential Impact, Evaluation Plan, Project Calendar, Budget (up to $10,000), Project Staff Vitae, and letters of support.
6. Mail completed TAPESTRY Proposal Cover Form, and typed proposal to:

NSTA/TAPESTRY
1742 Connecticut Ave., NW
Washington, DC 20009

APPLICATION DEADLINE: January 12, 1994

AWARDS GIVEN:

Grants: At least 40 grants of up to $10,000 each will be awarded this year.

Trips: The project director from each winning project will be flown to Anaheim, California for an Awards Banquet held during the 42nd NSTA National Convention, March 30-April 2, 1994.

The *Transformations* Project

The American Institute of Mining, Metallurgical and Petroleum Engineers (AIME) is now accepting teams of at least two middle school teacher to participate in the Transformations Project: *Partnering Technology with Education*. This unique multi-year partnership between technologists and teachers includes an intensive two-week 1994 summer session exploring technology, participation in follow-up meetings, localized peer to peer training, and an opportunity to explore local technology through a network of practicing scientists. Applicants must be middle school teachers from districts involved in reform initiatives with some presentation and computer skills. Teams should include at least one science teacher. Applications must be postmarked by **January 25, 1994** and include a letter of support from a building administrator. For a Project brochure and application form call 1-800-433-2463 or write: The Transformations Project, PO Box 1205, Jamaica Plain, MA 02130.

APS HIGH SCHOOL SCIENCE TEACHERS RESEARCH IN PHYSIOLOGY PROGRAM

The American Physiological Society (APS) is sponsoring a program to provide high school science teachers with experience in physiology research. Each grant supports the involvement of a high school teacher in the research program ongoing in an APS member's laboratory. Grants include a $5,000 stipend to support the teacher's full time participation in laboratory research for up to ten weeks during the summer and a $750 travel allowance for the high school teacher to attend the annual APS meeting, *Experimental Biology '95*.

The program makes special efforts to include high school science teachers whoa re members of underrepresented minority groups or who teach significant numbers of minority students. Additional information can be obtained from:

Dr. Marsha Lakes Matyas
Education Officer
American Physiological Society
9650 Rockville Pike
Bethesda, MD 20814-3991
Phone: (301) 530-7132
FAX: (301) 571-8305
Email: marsha@aps.mhs.compuserve.com
Application Deadline:
January 31, 1994

John G. Shedd Aquarium
Education Department
1200 S. Lake Shore Drive
Chicago, Illinois 60605

SHEDD AQUARIUM ACTIVITES FOR 1994

Programs are held in the Aquatic Science Center. Discussion, slides, films, activities and aquatic specimens are used to enhance these programs. Program lengths and subject matter vary with grade level and student participation. To accommodate larger groups, teachers may book two programs for the same time slot if space is available.

Grades K-4

Teeth, Tails, Spines and Scales (Grades K-1)

An imaginary story draws children into the world of aquatic animals and many of the adaptations they need for survival. children will handle both preserved and live specimens to discover how animals protect themselves in water. This program encourages student interaction and is an excellent way to introduce youngsters to natural science. Group size limited to 15, 30 minutes

Turtle Time (Grades 1-2)

How do turtles move? What do they eat? How do their hard shells keep them safe? Students will learn about these unique reptiles and get a close-up look at pond turtles as they are fed. Find out some of the problems endangered sea turtles face and what you can do to help. Group size limited to 15, 40 minutes

From Seahorses to Sharks (Grades 2-4)

In this introduction to fishes, students help to design a "typical" fish, then discuss why all fishes don't look alike. Discover interesting adaptations that allow fishes to survive in various habitats and niches. Group size limited to 40, 50 minutes long

Basically Belugas (Grades 2-4)

Beluga whales are mammals much like us. Review mammalian characteristics and discover what makes belugas unique. Students will learn how belugas are trained through classroom interaction, and then test their knowledge by "building" a beluga. Group size limited to 40, 40 minutes

Grades 3-8

Sharks! (Grades 3-6)

Superb adaptations have allowed sharks to exist for millions of years. This program uses slides and hands-on specimens to illustrate the diversity among these much-maligned marine predators. Group size limited to 40, 40 minutes

Whalewatch (Grades 4-6)

"Come Aboard" for a slide program that explores the lives and habitats of four North American whales. Learn about the biology of these majestic marine mammals as you "sail" to the waters of Alaska, California, New England and the Arctic. Group size limited to 40, 40 minutes

So Excellent A Fish (Grades 5-8)

Fishes are the most successful animals of all the vertebrates. Investigate examples, physical and behavioral adaptations exhibited by fishes, that have enabled them to inhabit so many niches. Learn to "read" a fish's anatomy and match it to its lifestyle. Group size limited to 40, 50 minutes

The following classes are available from January to June only.

Between the Tides (Grades 5-8)

Explore a Pacific Coast tide pool including sea stars, barnacles, and anemones through slides and touchable specimens. Discover how the plants and animals of this marine community are adapted to living in this miniature ocean created by changing tides. Group size limited to 40, 40 minutes

Coral Reef Adventure (Grades 5-8)

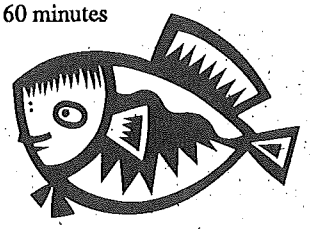
Enter the underwater world of a coral reef through an imaginary snorkeling trip. Discover the diversity of life that makes up a coral reef community by viewing slides and handling preserved specimens. Learn about coral reef conservation and Shedd Aquarium's involvement in these efforts. Group size limited to 40, 40 minutes

Staying Alive (Grades 5-8)

Shedd Aquarium is home to animals from all over the world. Learn how we acquire these animals and meet their daily needs—from feeding to veterinary care. Take a brief behind-the-scenes look in the Aquarium to see where our aquarists work. (Sorry, this does not include behind-the-scenes in the Oceanarium.) Group size limited to 30, 60 minutes

Alien Invaders (Grades 6-8)

Lake Michigan has been invaded by aliens! What are these creatures, where did they come from, and how have they impacted the largest freshwater resource in the world, the Great lakes? Find out the answers to these questions through viewing slides, examining specimens and participating in cooperative activities. Group size limited to 40, 60 minutes



High School Programs

Shedd Aquarium offers in-depth aquatic science programs for high school students. Classes include discussion, slides and preserved specimens.

Fish Adaptations

Fish that breathe air, produce electricity, change sex? Find out what the advantages are to these and other physical and behavioral adaptations that have enabled fishes to survive in a variety of aquatic habitats. Group size limited to 40, 60 minutes

Marine Invertebrates

From tiny shrimp to giant squid, marine invertebrates represent approximately 95% of the animal life on earth today. Students will examine representatives of six major invertebrate phyla and their adaptations for survival. Group size limited to 40, 60 minutes

Ecology of a Coral Reef

Part animal, part plant, and part mineral, coral is responsible for building the foundation for one of nature's most productive ecosystems. Explore life on a coral reef including snapping shrimp, angelfish, and Christmas tree worms through slides and preserved specimens. Discuss conservation issues concerning reefs and the need to protect this fragile environment. Group size limited to 40, 60 minutes

The Pacific Northwest—a Fragile Ecosystem

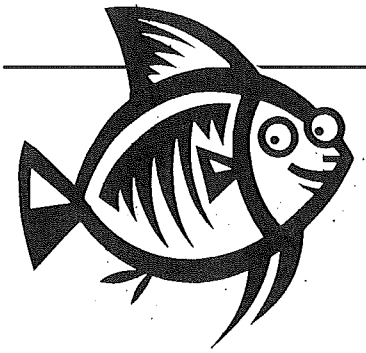
Created by the dynamic forces of volcanoes, earthquakes and moving glaciers, America's Northwest Coast is a land of superlative beauty and productivity. At one time, the rich variety of plant and animal life sustained a native culture built around great respect and concern for both the land and the sea. Today these natural resources are used by a greater population of people in many different ways. Discuss the consequences of disturbing the delicate balance of this coastal ecosystem. Group size limited to 40, 60 minutes

Laboratory Workshops

Increase your students' understanding of aquatic life through participation in a laboratory experience and discussion. Workshops last between 60-90 minutes. There is a $10 materials fee per workshop. Groups are limited to 15 students.

What is A Fish? (Grades 4-8)

From head to tail, inside and out, this lab is a basic introduction to fish anatomy. Using a microscope and dissection instruments, each student will examine a fish closely, drawing conclusions about is lifestyle.



Lifestyles in the Sea—A (Grades 6-8)
Lifestyles in the Sea—B (Grades 9-12)

Introduce students to the diversity of life found in the sea. Learn about adaptations of animals that drift, swim, and live on the ocean floor. Examine microscopic plankton, dissect a squid and handle living invertebrates.

Lakeshore Biology—A (Grades 6-8)
Lakeshore Biology—B (Grades 9-12)

Students will use basic sampling equipment to collect plant and animal specimens from the shoreline of Lake Michigan, then take them back to the lab for closer study and identification. (Available, weather permitting, October, April and May.)

Self-Guided Visit

Visiting the Aquarium and/or Oceanarium on your own can be a fulfilling educational experience. Guide your students with our self-guided materials or activities you have developed for their participation. Request an educator's free pass to visit the Aquarium/Oceanarium when you make your reservations so that you may become familiar with the facility, prepare materials, and plan your day.

Combined Oceanarium and Aquarium Visit

Explore a Pacific Northwest spruce/hemlock rain forest when you visit the Oceanarium and its inhabitants. Belugas, Pacific white-sided dolphins, sea otters, harbor seals and tide pool animals are at home in this rocky coastal environment. Evidence of wildlife abounds along the nature trails—bear footprints in the shallow soil, porcupine up a spruce tree, dipper wading in a waterfall. Plan on 40-60 minutes to walk the nature trails and talk with interpreters, discover the tidepool animals, and find out how marine mammals survive in their cold water home through interactive exhibits in the Underwater Viewing Gallery. To round out your visit, enjoy a 15 minute behavioral presentation featuring the dolphins or belugas, which begin at 10:30, 12:00, 1:30, 3:00 and 4:30. Admission fee for a self-guided Oceanarium visit includes both the Aquarium and Oceanarium. See Aquarium Visit information, below.

Aquarium Visit Only

Challenge your students to use their observation skills as they explore galleries of fish and other aquatic animals from all over the world.Plan on 30-60 minutes to view the aquatic animals in six exhibit galleries, the Coral Reef Exhibit, and home aquarium fish in Tributaries, watch a diver feed the fish in the 90,000 gallon Coral Reef Exhibit (11 a.m. or 2 p.m.), explore the specimens at the Activity Station between galleries 5 and 6, and additional time to do activities that you have created for your students. Suggested self-guided visit materials are sent with your confirmation of reservation. Self-guided visits in the Aquarium may be reserved for any day of the week for up to 100 students at 20 minute intervals throughout the year.

Teachers' Services

Trips

Local trips and excursions to more distant places are offered through the education department, some for college credit. You might be interested in attending an adult lecture or class offered through public programs. For information on these opportunities, call 312/986-2300 and request a trip brochure or public programs brochure.

College Credit

The Office of Aquatic Studies, a partnership between Shedd Aquarium and Western Illinois University, offers college credit biology and ecology courses at Shedd Aquarium. For further information, call 312/939-2426, ext. 3388.

Just for Teachers: Preview the Aquarium to plan your visit:

We all know how important it is to plan a well organized field trip. A free pass is available for teachers to preview the Aquarium and Oceanarium. Take this opportunity to become familiar with the facilities and plan your schedule for the day, including activities that you may create. Request your free pass when you make your reservations.

Special Exhibits available to your students though March 13, 1994:
"Aquatic Visions"

Images of aquatic life and nature are expressed through paintings, prints, sculpture and photographic works by contemporary Midwest artists.

April 11 - September 11, 1994:
"Ship Models" (not final title)

From an Egyptian reed sailboat, circa 200 B.C., to an aircraft carrier from the 1940s, trace the changes in ship design and function through ship models. Note: Some special exhibits have teachers' guides—ask for availability.

Teachers' Workshops All Grades

Register for workshops by filling out the form at the end of the workshop listings. Chicago Public School teachers note: Lane Credit may be arranged. Call School Program Coordinator 312/939-2426, ext. 3371 for details.

Oceanarium Workshop

Explore the diversity and uniqueness of the Oceanarium and the Pacific Northwest coast, it portrays. Become familiar with the geology, climate, plants and animals of this fragile temperate rain forest ecosystem. We'll discuss the philosophy and challenges involved in building this exhibit, tour the facility, investigate how you can use the exhibit with your students, and provide support materials. **Sat., Mar. 19, 1994, 9:30-12:30 (code 013SA) or Wed., July 13, 1994, 9:30-12:30 (code 019WE) Workshop fee: $3**

Using Shedd Aquarium as a Resource

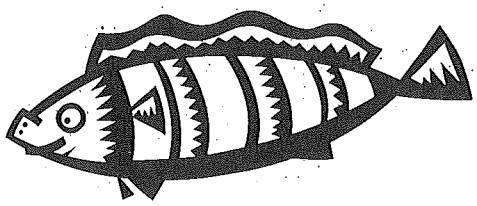
Become familiar with the variety of programming the education department offers and comfortable using this aquatic resource. An overview of classes, labs, and self-guided visits will be presented along with a chance to touch a sea star or urchin in our labs. Take a short behind-the-scenes tour of the Aquarium galleries to see where the aquarists work. **Wed., Jan. 12, 1994, 4:30-7:30 (code 007WE) Workshop fee: $3**

An Aquarium in your Classroom

We'll introduce you to basic aquarium-keeping through discussion and give you a take-home packet on aquarium care. Find out how to integrate aquatic animal behavior and physiology into your curriculum using non-invasive experiments and observation skills. **Wed., Jan. 19, 1994, 4:30-7:30 (code 008WE) or Sat., Aug. 6, 1994, 9:30-12:30 (code 023SA) Workshop fee: $3**

Project Wild Aquatics

An interdisciplinary approach to teaching about aquatic wildlife and habitats, this collection of K-12th grade activities includes both freshwater and marine environments. Participate in Project Wild Aquatics activities, share ideas with fellow educators, and take home a PWA activity guide. Bring a brown-bag lunch. **Sat., Mar. 12, 1994, 9s:30-3:30 (code 012SA) Workshop fee: $3**



AWARDS AND RECOGNITION

OUTSTANDING EARTH SCIENCE TEACHER

The Outstanding Earth Science Teacher Award (OEST) is for "exceptional contributions to the stimulation of interest in the earth sciences at the secondary school level," and the excellence in teaching at the secondary level. Candidates for these awards are nominated in each Section annually. Deadline for nominations is **February 1, 1994**. Nominations are available from Samuel F. Huffman (Central Section) at the addresslisted below.

Recipients will receive:

1) a solid walnut plaque inscribed with the recipient's name and award

2) a two-year membership in the National Association of Geology Teachers Association, which includes a subscription to the *Journal of Geological Education*

3) $1000 from the Geological Society of America, $500 for geoscience educational purchases,. $500 to cover costs of attending either a sectional or national meeting of the Geological Society of America

4) a teacher's packet prepared by the US Geological Survey, which includes useful single topic publications and appropriate maps

To request Nomination forms, contact:

Samuel F. Huffman
Plant and Earth Sciences Dept.
University of Wisconsin
River Falls, WI 54022

PRESIDENTIAL AWARDS DEADLINES

The Presidential Awards of Excellence in Science Teaching has begun its 1994 nomination, application and selection round. All ISTA members should have received the nomination brochures by now. The deadline for nominations is supposed to be December 1, however, (slightly) late nominations will be accepted since the mailings were so late this year to our membership. The deadline for applications, which cannot be altered, is **February 28, 1994.** The selection process will be completed by the April 8 deadline.

If you have questions about this award, please contact Gwen Pollock at the State Board of Education (N-242), 100 North First Street, Springfield, 62777 (217)782-2826 or at home, after 5 pm at (217)452-3209.

ANNOUNCING A SEARCH FOR ILLINOIS' OUTSTANDING HIGH SCHOOL PHYSICS TEACHER

The search is on for the 1993 Illinois Outstanding High School Physics Teacher of the Year. This award, sponsored by the Illinois Section of the American Association of Physics Teachers, is given annually to recognize the efforts of one outstanding high school physics teacher.

Do you know this person? We would like to hear about him or her. Please send a brief letter of nomination to the following address. This is your chance to help bring recognition to a colleague who places a high value on the physics education of Illinois students.

Send letters of nomination postmarked by **January 10, 1994,** to

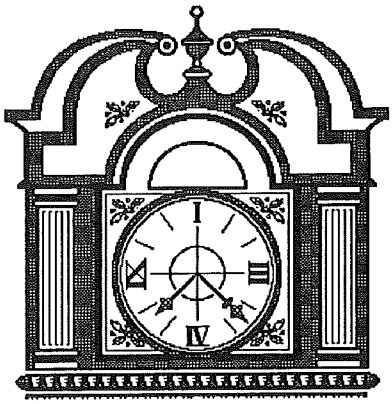
Dee Beene
Massac County High School
Rt. 2
Metropolis, IL 62960
(618)524-3440

MEETINGS AND WORKSHOPS

207th ACS National Meeting in San Diego, March 13-18. 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.

CICI, Chemical Industry Council of Illinois, Presents its 20th Annual Chemistry Career Conference for High School Students at the Museum of Science and Industry, March 17-18. Students can see chemical company exhibits and examples of jobs utilizing a chemical education. There will be practical chemistry demos and college/Univ. admissions & Chem. department representatives. For more information and registration contact: John Hand, Chemical Industry Council, 9801 Higgins RD., Rosemont, IL 60018 708-823-4020.

ACS 27th Great Lakes Regional Meeting June 1-3 at Univ. of Michigan, Ann Arbor. A major chemical education program is planned for Friday & Saturday in conjunction with Michigan College Chemistry Teachers Association. For info on program contact Henry C. Griffin, Dept. of Chemistry, Univ. of Michigan, 930 N. University Ave., Ann Arbor, MI 48109 (313-764-1438).



SUMMER SCIENCE IN ENGLAND

The University of North Carolina at Asheville (UNCA) will conduct a summer comparative science education program through the cooperation of the College of Education of the University of Bath, England, from July 6 to August 2, 1994. US science teachers can visit English classrooms that are still in session and attend lectures on the new "National Curriculum", the historical development of the British education system and on global environmental problems. Field trips to areas of special educational interests such as Oxford University, to the Slimbridge environmental field station, and to science museums are also part of this program.

Any person who is or has been involved with science education, K-12, is eligible. The $1,800 fee covers tuition, ground transportation for the course and private room housing, which will be on the University of Bath campus. The spouse and/or dependent adolescent children of the participant may also attend at the cost of $900 each.

For information or to enroll, contact Dr. Gary Miller, UNCA, One University Heights, Asheville, NC 28804-3299 (704)251-6441 (days) or (704)891-9595 (evenings). Registration will remain open until the course is filled. **If possible, enroll prior to March 15, 1994.**

EDUCATIONAL MATERIALS

Kathleen M. Andrews
Illin ois Department of Conservation

CONSERVATION EDUCATION PROGRAM

Now available from the Illinois Department of Conservation's Education Program are several new environmental education publications. For a **single copy** of any of these publications, write the Illinois Department of Conservation, Conservation Education Program at 524 S. Second Street, Springfield, Illinois 62701-1787.

The Conservation Education Catalog has been recently revised by the Conservation Education Advisory Board. The Board consists of representatives from the State Board of Education, Department of Conservation, Department of Agriculture, Department of Energy and Natural Resources, Environmental Protection Agency and four members appointed by the Governor. The catalog provides a listing of over 260 natural resource education materials, projects and contests available from or supported by state agencies.

An activity book has been developed for distribution to children visiting Conservation World at the Illinois State Fair. Conservation Quest provides 24 pages of natural resource learning activities for children between the ages of 5 and 13. Activity pages may be photocopied for classroom use.

Zebra mussels, bottom-dwelling invertebrates native to Europe, are invading Illinois waters! To introduce students to these problem mussels, request a copy of the 4-page activity guide entitled What is a Zebra Mussel?

Now available for use in conjunction with the Illinois Hill Prairies poster is a 4-page leaflet providing background information on the habitat as well as detailed information on the plants and animals on the poster. Learning activities for classroom use are included. Donations to the Nongame Wildlife Conservation Fund are appreciated for the poster. Educational guides are free.

Illinois will participate in the fourth annual Federal Junior Duck Stamp Design Contest, with judging to occur in the spring of 1994. The contest is open to students grades K-12. The accompanying curriculum unit, designed by the U.S. Fish and Wildlife Service, integrates waterfowl biology and issues into the fine arts. Copies of the curriculum unit are contained in the *Illinois Birds* education kit developed by the Illinois Department of Conservation and distributed to schools with grades 3-6 in march 1993. The 1993 Illinois winner was named the first national winner in a contest held in Washington D.C. in June 1993. Contact the IDOC for information about the 1994 contest or a curriculum unit.

SEISMOLOGY

Seismology: Resources for Teachers. A reference for K-12 teachers on earth science topics including earthquakes, and earthquake preparedness. FREE from Seismological Society of America, 201 Plaza Professional Bldg., El Cerrito, CA 94530-4003. Include a SASE.

BEYOND THE LIMITS

Beyond the Limits: Flight Enters the Computer Age. Curriculum package for grades 3-12. FREE from: Education Resource Center, Education Division, MRC 305, National Air and Space Museum, Washington, DC 20560.

PARENTAL HELP

For free (or almost) information for teachers, students, and parents contact Consumer Information Center, Pueblo, Colorado 81009. One can order such publications as *Helping Your Child Learn Science* (October, 1992), Item # 143Z, $3.25 per copy, or *Helping Your Child Learn Math* (December 1992), Item #612Z, single copies can be obtained without charge.

POSTERS FROM MINERAL INFORMATION INSTITUTE

The Mineral Information Institute has released the first in a series of three posters that is of the new elementary education packet for classroom teachers and students. The packet, which is still under development, carries a recurring theme that *Everything is Made From Something*. Single copies of the 11" by 17" poster, *If It Can't Be Grown, It Has To Be Mined*, can be obtained for $1.50 (prepaid, to cover postage and mailing tube) from MII, 1125 17th Street, Suite 1800, Denver, CO 80202. The second in the series of posters is available beginning Spring, 1993. Classroom teachers can obtain FREE copies of the poster by writing to MII and describing the type of materials they would like to have to help present more information about mineral resources to their students.

Save the Rainforest, Inc.
604 Jamie Street
Dodgeville, WI 53533
(608) 935-9435

FREE: SAVE THE RAINFOREST TEACHER'S GUIDE TO ENVIRONMENT ACTION.

This guide features an up to date educational resource section, describes rain forest conservation programs that your school can support, includes an extensive country-wide listing of rain forest speakers that can come to your school, and provides information on regional workshops designed for educators who want to learn more about the rain forest. It also provides information on the two week ecology courses that Save The Rainforest conducts for teachers (K-12) and high school students in Costa Rica, Mexico, Belize, Panama, Ecuador and Washington State's Olympic Peninsula. Average cost of a course is only $675 plus airfare. Write to above address.

UNIQUE KIT ADDS A NEW DIMENSION TO CHEMISTRY

For many science and engineering students, forming a mental map of how atoms organize themselves to make such solid-state materials as diamonds, silicon, graphite and the new superconductors is an exercise in frustration.

Textbook pictures lack depth and no computer software package seems tangible enough to give students a feel for the atomic structures that form the basis for the high-tech materials that are assuming increasing importance in the worlds of science and engineering.

Now a new, low-cost, east-to-use kit developed by scientists at the University of Wisconsin-Madison, San Jose State University and Beloit College promises students a three-dimensional handle on extended atomic structures.

The kit was developed by Mayer in collaboration with Professor George Lisensky of Beloit College and the Institute for Chemical Education (ICE), which is directed by Professor John Moore at UW-Madison.

The kit, which in some ways is similar to the plastic three-dimensional models long used in organic chemistry, is based on the way atoms naturally pack into solids. Layers of colored balls are stacked with smaller atoms fitting in the spaces between larger atoms. Students are guided in building a particular structure—from table salt to superconductors—by templates over a plastic base and a series of rods that together serve as road maps.

Once built, a structure can be looked at from any angle and manipulated to show how atoms are arranged, for example, in planes that correspond to the flat faces of salt and other crystals.

"The idea is to help students connect chemistry with common and high-tech materials," said Arthur B. Ellis, a UW-Madison professor of chemistry and head of the project under which the kit was produced. "To my knowledge, there is no kit for these important structures that's as simple as this and that's as versatile as this."

The kit, which can work as a companion to virtually any general chemistry book, also meets a pressing societal need, Ellis said, as materials science is becoming one of the hottest areas of research in all of science. The development of everything from submarine hulls to computers depends on new materials and an understanding of their atomic structures.

Developed with the help of the National Science Foundation, the Dreyfus Foundation and the Dow Chemical Company Foundation under the auspices of ICE, the kit can be used to build nearly 50 different structures that would commonly be discussed in science and engineering courses. ICE is making the kits available in the United States at cost for $80.

For more information about the ICE Solid-State Model Kit or to order a kit, contact: The Institute for Chemical Education, University of Wisconsin-Madison, 1101 University Ave., Madison, WI 53706 Phone: (608) 262-3033. FAX: (608) 262-0381

ILLINOIS AEROSPACE INSTITUTE

PROGRAM DATES: July 10-16, 1994

WHERE: University of Illinois at Urbana-Champaign

PARTICIPANTS: Students who will enter 9th, 10th, 11th or 12th grade in the Fall of 1994

PROGRAM DESCRIPTION:
Explore the areas of aeronautical and astronautical engineering, propulsion and aviation technology. Activities include:

- •Study and experiment in Depart. of Aeronautical and Astronautical Engineering labs and computer simulators.
- •Talk with NASA astronauts and aerospace engineering specialists.
- •Visit an FAA control tower and learn about aircraft navigation during flights at University Institute of Aviation.
- •Design, build and fly a model airplane and a model rocket.
- •"Fly" in a flight simulator.

CONTACT PERSONS:
Diane Jeffers, Dept. of Aero/Astro Engineering, 308 Talbot Lab, 104 S. Wright St., Urbana, IL 61801
Phone: 217/244-8048
David Powell, Illinois Jets, 207 Engineering Hall, 1308 W. Green St., Urbana, IL 61801
Phone: 800/843-5410

SPONSORS: UIUC Dept. of Aero/Astro Engineering & Aerospace Illinois Space Grant Consortium

APPLICATION DEADLINE: April 15, 1994

COST: Approximately $650. **FINANCIAL AID AVAILABLE BASED ON NEED.**

FUTURES

IN SCIENCE AND ENGINEERING

University of Illinois at Urbana-Champaign
July 4 - 29, 1994

Eligible students are those who will enter the 11th or 12th grade in the Fall of 1994.

Students choose between 3 and 5 college level courses creatied to provide an overwiew of major topics in science and tehcnology. All will take 2 required courses and participate in field trips, laboratories. A sports and social program will be created by participants with staff assistance.

April 15: Deadline for applications

Cost: $2,200. Financial aid is available based upon need. Minority scholarships are available for qualified Latino/a, African-American, and Native American applicants.

For more information contact:

David Powell
1308 West Green-Room 207
Urbana, Illinois 61801
(800) 843-5410

YES, I WOULD LIKE TO CONTRIBUTE TO THE ISTA SPECTRUM

I have a good idea that I'd like to share!

Name: _____

School or Business: (name) _____
(address) _____
(city, state, ZIP) _____
(telephone) (____) _____

Home: (address) _____
(city, state, ZIP) _____
(telephone) (____) _____

Title of Contribution:_____

I would like may article to appear in:

___ARTICLES
___IN FOCUS
___SPECIAL INTERESTS
___MINI IDEAS
___REVIEWS
___POTPOURRI
___OPPORTUNITIES
___MEETINGS
___AWARDS/RECOGNITION
___FIELDTRIPS/WORKSHOPS
___EDUCATIONAL MATERIALS

Please print my contribution in the following issue(s):

___Fall (due June 1)
___Winter (due September 1)
___Spring (due December 1)
___Summer (due March 1)

SPECTRUM welcomes black and white glossy photographs. We can sometimes use color pictures but they must be sharp with high contrast. Please enclose a stamped self-addressed envelope if you want your photos returned.

Send to:

Diana Dummitt
ISTA Spectrum
University of Illinois
College of Education
1310 S. Sixth Street
Champaign, IL 61820

ISTA REGIONAL DIRECTORS

REGION II
Karen Meyer
Ridgewood School
9607 West 14th Street
Rock Island, IL 61201
(309)793-5980

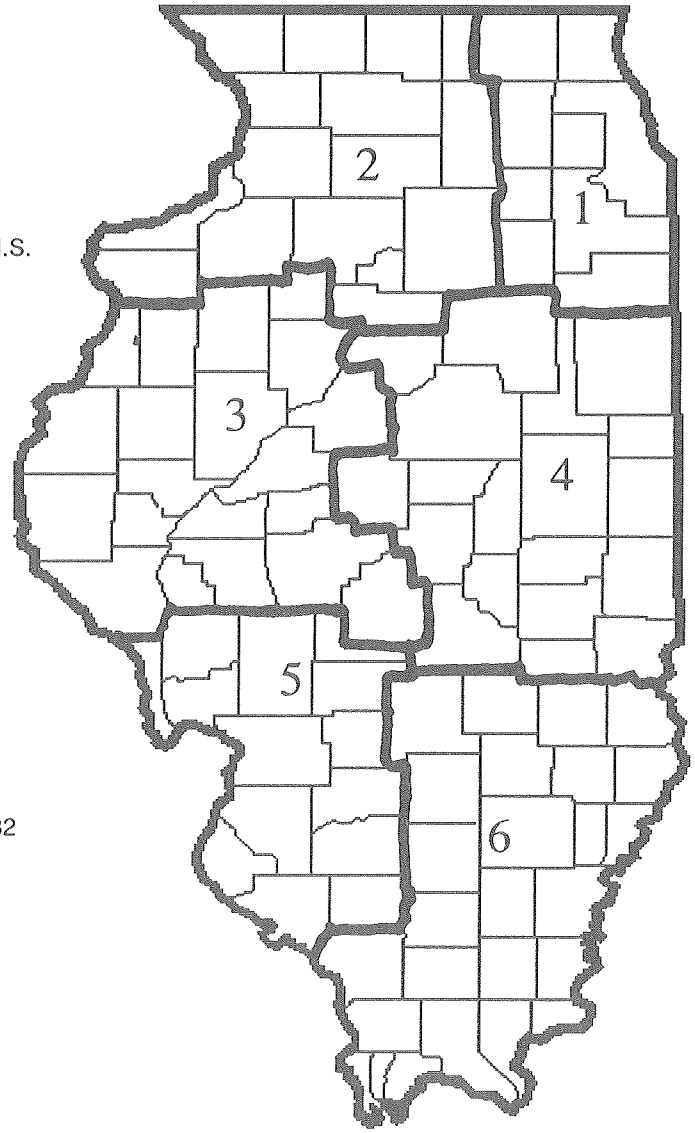
John Carleton
Hononegah Community H.S.
307 Salem Street
Rockton, IL 61072
(815) 624-8951 Ext 52

REGION III
Linda Lucas
Grundy Elem. School
1100 S. Fourth St.
Morton, IL 61550
(309)263-1421

John B. Beaver
Western Illinois University
47 Horrabin Hall
Macomb, IL 61455
(309) 298-2065

REGION V
Gail Letcher
Red Bud Comm. Dist. #132
200 Field Dr.
Red Bud, IL 62278
(618)282-3858

Paulette Burns
Millstadt Dist #160
211 W. Mill St.
Millstadt, IL 62260
(618)476-1681



REGION I
Doug Dirks
West 40 ESC #5
1st Ave. and Ridgewood
Riverside, IL 60546
(708)447-6070

Barbara R. Sandall
North Central Regional
Educ. Lab.
1900 Spring Rd.
Oak Brook, IL 60521
(708)571-4700

REGION IV
Robert Fisher
Ill. State Univ.
242 DeGarmo Hall
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Fairfield, IL 62837
(618) 842-2649

Max A. Reed
Hutsonville H.S.
West Clover St.
Hutsonville, IL 62433
(618) 563-4913

Listing of Counties Comprising Each ISTA Region

Region I	McHenry, Lake, Kane, Cook, DuPage, Kendall, Will, Grundy, Kankakee
Region II	Jo Daviess, Stephenson, Winnebago, Boone, Carroll, Ogle, DeKalb, Whiteside, Lee, Rock Island, Henry, Bureau, LaSalle, Putnam, Marshall
Region III	Henderson, Warren, Knox, Stark, Peoria, Hancock, McDonough, Fulton, Tazewell, Schuyler, Mason, Adams, Brown, Cass, Menard, Pike, Scott, Morgan, Sangamon
Region IV	Woodford, Livingston, Ford, Iroquois, McLean, Logan, DeWitt, Piatt, Champaign, Vermillion, Macon, Shelby, Moultrie, Douglas, Edgar, Coles, Cumberland, Clark
Region V	Calhoun, Greene, Macoupin, Montgomery, Madison, Bond, St. Clair, Clinton, Monroe, Washington, Randolph, Perry
Region VI	Fayette, Effingham, Jasper, Crawford, Marion, Clay, Richland, Lawrence, Wayne, Edwards, Wabash, Jefferson, Franklin, Hamilton, White, Jackson, Williamson, Saline, Gallatin, Union, Johnston, Pope, Madison, Alexander, Pulaski, Massac

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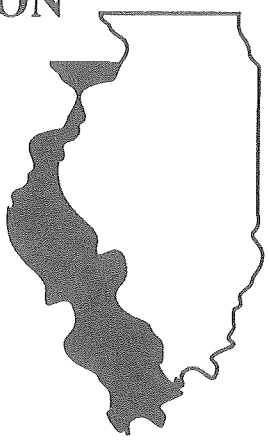

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LAST FIRST

DATE _____ REGION (SEE MAP) _____

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_____
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STREET

_____
CITY STATE ZIPCODE

(HOME ADDRESS WILL BE USED UNLESS OTHERWISE SPECIFIED)

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WINTER 1993