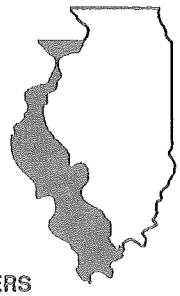
SPECTRUM

THE JOURNAL OF THE ILLINOIS SCIENCE TEACHERS ASSOCIATION

SPRING 1995



ILLINOIS SCIENCE TEACHERS ASSOCIATION

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ISTA NEWS

PRESIDENT'S SPRING LETTER

The cliché "where has the time gone" is certainly an appropriate way to begin this final President's letter. My term in office has been filled with interesting times, and I certainly have had an opportunity to interact with many dedicated and informative science educators. Two great conventions, the establishment of an executive secretary, (Diana Dummitt), the appointment of a new editor for the Spectrum, (Kevin Finson), meetings between ISTA, ICTM, and TENS for the purpose of establishing a science, mathematics, and technology coalition, a performance assessment handbook, and raising dues five dollars a year (Sorry about that!), all while we watched our association membership sky rocket to over 4000 members, has taken place in just the last two years. Yes, I can truthfully say ISTA is on the move, and I am excited to be part of this journey.

But as is true with any worthwhile endeavor, ISTA must continue to work and speak for the improvement of science instruction and the right for science educators all over our state to be part of the process of change. From my perspective as President and through my work as science educator at one of our state universities, I am still concerned that many decisions are being made in our state that affect the way our schools deliver science instruction and that there is not enough opportunity for our organization to have input into the process. Therefore, I challenge each ISTA President who follows to be aggressive in their efforts to seek recognition for ISTA in meaningful ways with the policy makers of our state. Our state board of education is in the process of developing a state framework for science education right now as you read this letter, and never once has this association been officially approached to offer input into this process. Consequently, President-elect Bernie Bradley and I are sending a letter to Superintendent Spagnola requesting that ISTA be recognized as one of the leadership organizations in science education in the state of Illinois and that we officially be involved in all state level initiatives that impact science education.

I would like to express my sincere gratitude to the ISTA Board and committee Chairpersons that have so willingly served ISTA during my term in office. Without all of the volunteer work and time given by these individuals this association could never have blossomed into the prestigious organization it has become.

Finally to the dedicated Illinois science teachers that routinely make learning meaningful and exciting, thanks for all you do for the children of Illinois. You're fantastic.

David Winnett
President

ELECTION RESULTS

Congratulations to all our new regional directors and officers!

Douglas Dirks — President-elect
Donald Nelson — Vice-President
Maureen Jamrock — Secretary
Ann Rubino — Region 1
Cathy A. Flannery — Region 2
Donald T. Powers — Region 3
Jim Zimmerman — Region 4
Dean Dittmar — Region 5
Suzanne M. Asaturian — Region 6

INTERESTED IN RUNNING FOR AN ISTA OFFICE OR SERVING ON A COMMITTEE? contact Diana Dummitt or Bernie Bradley today!

Gwen Pollock
ISBE
100 N. First Street
Springfield, IL 62777-0001

DID YOU KNOW?

I sincerely hope that your school year is progressing masterfully for you and your students. There are so many projects going on here at ISBE; I can hardly wait to tell you about some of them. This is certainly not written with a special hierarchy of importance.

Science Safety Project--Work has begun, using the expertise of local American Chemical Society members, to develop a handbook for chemical safety for Illinois Schools. Inventory, storage, disposal, emergency preparedness and citizen science safety, etc. measures will be developed; first for review through ESC science contacts in schools this spring and then for dissemination through the Regional Offices of Education (ROE) next fall to ALL schools. The handbook will contain software and guidelines for local use. For future inclusion, sections will be added to the handbook which will include K-8 Science Safety, Animals in the Classroom, Physics Safety, Field trips and Outdoor Experience Guidelines.

Science, Technology and Society Interagency Project--All public schools in Illinois should have received a brochure by early February announcing a summer workshop at the Taft Campus of Northern Illinois University in Oregon and follow-up weekend training in Collinsville and Springfield. Teams from middle schools, high schools and full districts will be considered for participation. The brochures were sent to regional and district superintendents and principals with a due date of March 31. Last summer's project was very successful. A synopsis of the STS units which were produced will be offered in the next issue of the *Spectrum.*

Earth Systems Interagency Project--Preliminary plans are being made to bring the expertise of the Illinois Geological Survey, Water Survey and Natural History Survey, the technology enticement of satellite imagery, and the scientific data collection necessity of the *Critical Trends Analysis* Project together to meet needs of Illinois' schools, students and teachers, especially in secondary schools. More details will be furnished as our plans progress.

Environmental Literacy for Illinois 2000 Project--Meetings have begun to create a strategic plan to accomplish a goal of environmental literacy in Illinois by the year 2000. The strategic planning processes is following the models set in several states by legislative mandates. A status report for this project is found in this issue of the *Spectrum* written by Carol Fialkowski from the Chicago Academy of Sciences.

Presidential Awards of Excellence in Science Teaching--This year's search for excellence in Illinois science teaching has been launched. More than 400 teachers throughout the state have been nominated. The selection committee is being formed to choose the best among the best of our science teachers during March.

The White House announced the Illinois winners after our ISTA convention and the last publication of the *Spectrum.* Beverly Sussman, a sixth grade teacher from Ivy Middle School, Buffalo Grove, and Sylvia Gilbert, a first grade teacher from Chicago were chosen to represent Illinois as the 1994 Presidential Award of Excellence Winners in Secondary and Elementary Science. They have been invited to a week-long extravaganza in Washington, D. C. this spring. I have asked them to write a special journal for a future *Spectrum* issue to let you know about their adventures.

Other projects include development of the Leadership Cadre idea, shared in the last issue of the *Spectrum.* More details will be offered later. Scientific Literacy requests for proposals (RFP) will become available during March or April. (As of this writing, the date is not set.) The RFPs will be sent to all regional and district superintendents, colleges/universities and informal science centers.

There are several requests that I need to offer for your assistance There are several possible projects that I would appreciate your suggestions.

How could ISTA respond to the needs of the many new science teachers who have joined our ranks during the past year? Who could help in an organized effort--what could we do?

Could you offer personal chemical safety 'horror stories' which could be used to justify the need for a state-wide chemical disposal effort, repeating the hazardous waste pick-up orchestrated in 1986??? You need to describe the incident, circumstances, costs for containment or clean-up etc.

I also need to be able to contact the Pre-1991 winners for the Presidential Awards for Excellence in Science Teaching; including national and state awardees and honorable mention winners. 1 am working on a complete Illinois database of these exemplary teachers. Just send me a note, including your name, address, phone numbers, school assignment, etc.

If you are a science department chairperson science lead teacher (the person the principal gives the "scienc-y" mail to!), I need to be able to contact you. I am working on another database so that I will be able to contact, through mass mailings, on a somewhat regular and irregular basis, those science teachers whho may be able to disseminate news and opportunities.

Thank you for even reading this far--I really will appreciate your assistance on these matters. Please call me at 217/782-2826, if I can be of assistance to you.

"SCIENCE EDUCATION IN THE LAND OF LINCOLN"

1995 Annual Meeting of Illinois Science Teachers Association
September 28-30, 1995
Prairie Capitol Convention Center
Springfield, Illinois
CALL FOR PAPERS
DEADLINE FOR SUBMISSION: MAY 15, 1995

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

Name	Day phone
Affiliation (School or Organization)	Home phone
Address of above organization	Home address
City, State, Zip Code	City, State, Zip Code

Title of presentation (10 word maximum)_____

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

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

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

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

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

IV. Equipment Required
o overhead projector
o slide proiector

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

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

Please attach a 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 This form is not for commercial or non-commercial exhibits. It is only for educators!

Signature_____ Date _____

Fax or send signed form and abstract to: **Diana Dummitt, ISTA *Spectrum*, College of Education, UIUC, 1310 S. Sixth Street, Champaign, IL 61820, Phone (217)244-0173, Fax (217)244-3711.**

ARTICLES

Arnold R. Guttman
Chemistry Teacher
Waukegan High School
Waukegan, IL

SUMMER PROGRAM ADDS TO THE REPERTOIRE OF HIGH SCHOOL SCIENCE TEACHERS

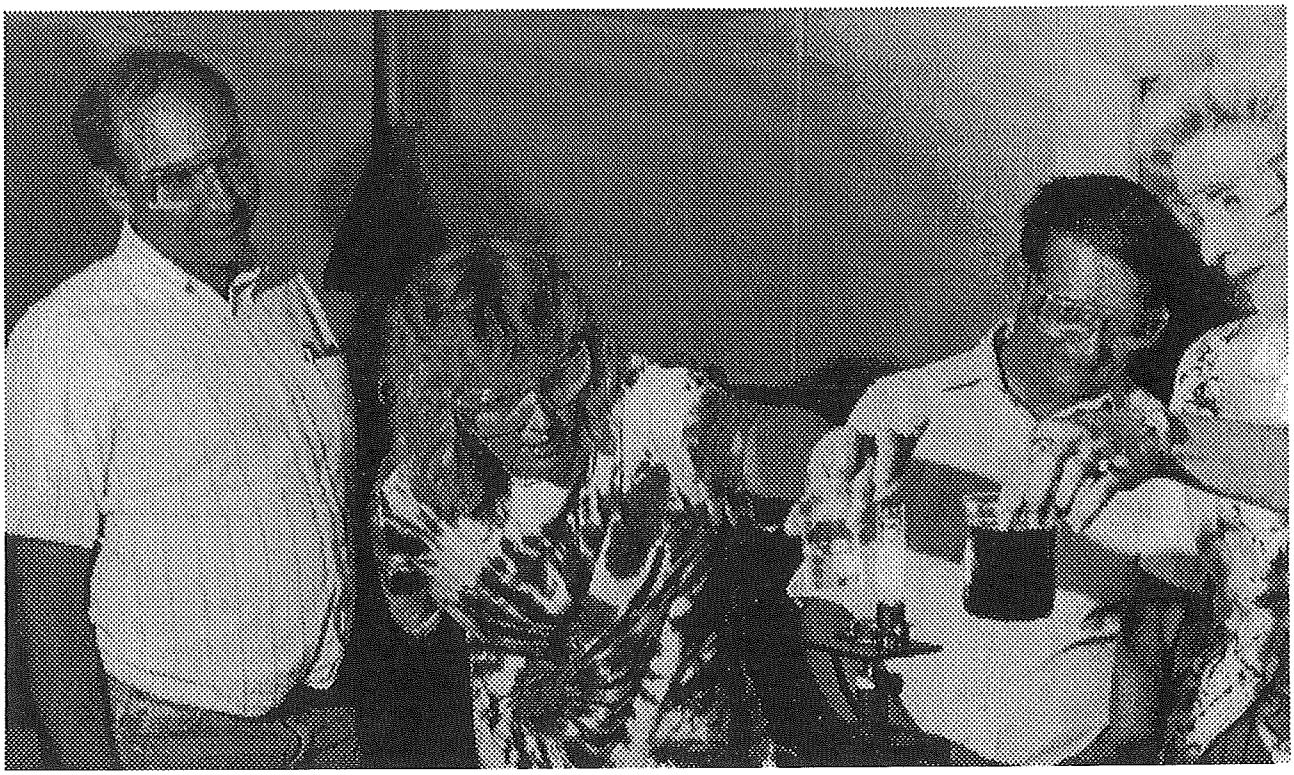
Argonne National Laboratory, a prestigious institution operated by the University of Chicago for the Department of Energy, is working to improve the quality of instruction in high school sciences by conducting a summer teacher enhancement institute through its Division of Educational Programs. The institute premiered in 1993 and its goal is to expand demonstration and experimental capabilities of high school teachers.

I was fortunate to be 1 of 20 participants in the 4-week 1994 summer institute. Teachers attending the institute represented a variety of public and private schools from throughout the Chicago metropolitan area. The diversity of the teachers provided an excellent opportunity to learn about science programs at other high schools.

As the institute is funded by a grant from the National Science Technology Council and the National Science Foundation's Science Technology Center for Superconductivity, it was not coincidence that our activities were rich in high-tech experiences. By the end of the program, the participants are skilled enough to introduce many of these technologies to their classrooms with the aid of a van carrying sophisticated instrumentation such as computer assisted microscopy.

One of the many innovations of the program was to show how the technologies learned in the training sessions were utilized by law enforcement and private industry. During the program lectures were provided by the Illinois State Police forensic laboratories, forensic experts from the U.S. Secret Service, McCrone Research Institute and Packer Engineering Company.

Scientists from the government forensic laboratories discussed how an array of instruments, including mass spectrometers and gas chromatographs, are utilized to develop evidence during a criminal investigation. A microscopist from McCrone Research, a leading company in microscope applications, discussed forensic and industrial applications of the light microscope. Engineers from Packer Engineering, a multiforced consulting engineer firm, presented the use of scanning electron microscopes to evaluate materials used in the production of equipment parts.



"Flourescence Measurements Using the Optical Bench"
National Science Technology Council High School Teacher Summer Institute
Argonne National Laboratory

After these didactic lectures, the teachers broke up into small groups and were able to gain hands-on experience with a variety of microscopes, spectrophotometers, and chromatographic equipment. To match the diversity of the institute's participants, all of the laboratory training had applications for physics, biology and chemistry.

Another highlight of the 4-week session was an on-site visit to the Packer Engineering Research labs. There we were fascinated to see how the Packer engineers used advanced computer imaging and scanning electron microscopy to solve complicated research problems.

During the final week of the program attendees were divided according to their major teaching areas. Physics teachers worked on superconductivity. Biology teachers worked on electrophoresis, and chemistry teachers worked on an optical bench. The equipment used during these sessions will also be available on Argonne's mobile unit.

Attendees were required to do library research and with the help of laboratory staff developed thought-provoking experiments that they and their colleagues could use in introducing the instruments to their classrooms. My group of chemistry teachers developed a flame test using the optical bench for a classroom demonstration.

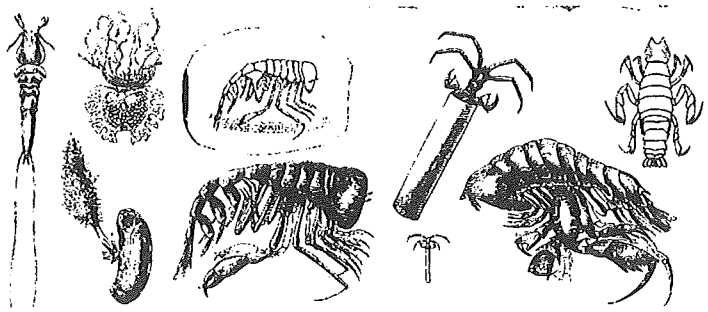
The four weeks passed very quickly thanks to the planning that had gone into the program. The coordinators from Argonne, Ray Thomas and Randy Landsberg, along with their chief Dr. Harold Myron not only made an exciting schedule but put in training that will be very valuable to the attendees. Their linking of scientific technology skills with applications in forensics and industry made the work fun and enjoyable. The team work among the teachers and t he comraderie we shared left us all somewhat sad when the program ended. However, I think all the attendees felt great satisfaction in knowing that they will be bringing new labs and demonstrations to their classrooms.

After having this experience I would hope that other worthwhile programs such as the NSTC Summer High School Teacher Enhancement Institute might be started. I feel they encourage growth in teachers and serve as a breeding ground for a cross fertilization of ideas between teachers. For school districts with limited budgets, programs such as this may be the only avenue by which some teachers can become current on the leading edge of technology.

I had a very rewarding summer and my hope is that many of my fellow teachers have the same opportunity in upcoming summers. I see a model at Argonne National Laboratory for a program that other private and public institutions might use to expand the capabilities of science teachers such as myself.

William Donato
Illinois Middle School
Groundwater Project
Woodstock High School

TEACHERS AS TRAINERS



Teachers hear a lot about working with professionals in the community, developing their own curriculum that deals with relevant local issues and processing their lessons and teaching. Unfortunately, with the increased demands by state and local agencies, and overcrowded classrooms, teachers seldom get a time to reflect opon their skills as professionals. Isolation from other teachers inhibits the free exchange of information needed in the professional world.

With so many pressing needs many teachers don't have a chance to keep up with local issues and work with people outside the classroom. This provincialism sets up teachers as separate from the community which they work. The world of bells, textbooks, triplicate papers and curriculum take center stage. Teaching for the test and standardized test scores seem to be paramount to many educational systems. Real world issues such as land use questions get ignored and are replaced by a standardized curriculum. Because of this, many teachers view their job as routine.

The Illinois Middle School Groundwater Project was designed to change the way teachers view their profession. The goal of the project is to take hands-on science and relate it to critical and relevant issues facing many communities in Illinois. Not of just another curriculum project to be added to an already overloaded curriculum, the Illinois Middle School Groundwater Project uses real data from water samples around the school's community. Students and teachers work with local and state agency personnel to investigate their local watershed. Instead of teaching for a test, students and teachers investigate together.

The $501,000 funding for the project was made possible by the W.K. Kellogg Foundation. The project is designed to be initiated in three priority areas designated by the Department of Energy and Natural Resources as high risk areas for groundwater contamination. Schools participating are given water test kits for well water samples. Dr. Alan Voelker from Northern Illinois University, Dr. Bob Williams from Southern Illinois University and Harry Hendricksen from the Illinois Department of Energy and Natural Resources worked with three coordinating teachers to set up a training program for the schools and agency personnel involved in the project.

The Groundwater Project uses a curriculum written by a group of middle school teachers, the Department of Energy and Natural Resources and the Illinois Farm Bureau. Teaching the curriculum entitled, H_2O: Below, not only educates the students in the concepts and issues of groundwater, but opens up the minds of the teachers involved.

To initiate the project a group of agency personnel was enlisted in the program. The agency personnel met to plan for the application of the program. They not only signed on to donate resources, but to work with teachers and students in the education of local groundwater concerns. After the agency personnel signed on to the program, high school teachers involved in a similar project, the Illinois Rivers Project were trained with the agency personnel on the application of the curriculum. The goal of the project is to have the high school teachers and agency personnel work together to serve as mentors for the middle school teachers involved in the program. The agency personnel and high school teachers work as a team to train the middle school teachers about the program. Since the program is new, all three groups work together to make the program better.

At the training program a pretest was given to the teachers involved. The lack of confidence toward water issues was evident. 73% of the teachers participating in the program ranked themselves as moderate to low understanding of the water quality in their area. Only 15% thought they had a high understanding of water quality in Northern Illinois. Only 13% of the teachers felt they had a high understanding of groundwater in their area. Most teachers felt they had a high understanding about the importance of water to their life, but 50% had a low understanding about the approaches needed to improve water quality in Illinois.

Since most teachers rarely get the time to discuss real issues with science professionals the teacher's understanding of policies and laws governing water issues is low. Only 15% of the teachers felt they had a high understanding of policies and how government agencies deal with water quality. The teachers had a high understanding in working with cooperative groups within the classroom, but exhibited a low understanding on ways agency personnel can be used in their schools.

After only a one day training session held in conjunction with the groundwater project, teachers confidence toward groundwater issues were raised. After the training 86% of the teachers reported that they have learned how to work with agency personnel and look forward to the opportunity. 91% agreed

or strongly agreed that the nature of groundwater problems were made evident by the training.

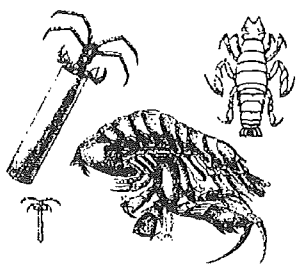
From classroom visits during March, 1994 to May, 1994 the investigator noted a boost in confidence in the teachers toward the teaching of groundwater issues. Instead of just teaching the definition of the words, teachers worked actively with their students researching local groundwater conditions. The teachers not only worked in the classroom, but actively seeked out other teachers within their school and community to explain groundwater issues. Student and teachers performed over three hundred water samples from local wells that haven't been presently tested. Working with their local Health Department and the Illinois Farm Bureau this data was analyzed. Teachers and students became the investigators on an important local concern.

A follow up session will be held approximately one year from the original funding of the program. It is the hope of the investigator that not only the confidence of the teachers involved in the program increases, but that they now become mentors and trainers of other teachers in their district. The teachers will no longer just be disseminating information given to them by a textbook company, but will be part of the ongoing process of research.
Teachers interested in getting involved in the project should call one of the following coordinators:

Northern Region Coordinator;
William Donato 815-334-4086

Central Region Coordinator:
Bill Beckman 309-672-6906

Southern Region Coordinator:
Bob Williams 618-692-3788



Stewart E. Brekke
Northern Illinois University

CHANGES IN THE AMERICAN PHYSICS CURRICULUM IN HIGH SCHOOLS FROM REVOLUTIONARY TIMES TO THE PRESENT

In America, universities did not allow students to perform laboratory experiments until after the 1850s. Another half century was to pass before high school students were granted the experience. England and France were very backward in this respect: as late as 1950 the best scientific work was being done in technical and special schools instead of universities in those countries (Atkinson and Malesda, 1962).

American education was first modeled upon the British system. In colonial times, there were very few secondary schools. The secondary schools that existed were called academies or grammar schools. These academies consisted mainly of preparing boys for college. The subjects taught were primarily Greek and Latin, with a small amount of grammar, rhetoric and practical arithmetic. In contrast, there were the so called" English Schools" which emphasized, in Revolutionary times, subjects such as navigation, surveying, bookkeeping, astronomy and sometimes modern languages (Nye, 1960). After the Revolution with the expansion of knowledge, the academies had changed their course offerings to include mathematics and science courses such as algebra, trigonometry, botany, geology, physics (Nye, 1960).

In post-Revolutionary times, there was a famous teacher in the Albany Academy who taught electricity and magnetism to secondary students. This was Joseph Henry who taught there from 1826 to 1832 before going to teach at Princeton. Henry, who was very advanced for his time, was a firm believer of the learning by doing principle that was popularized by Dewey eighty years later. This method was done by Henry to: 1) spark student interest, and 2) to provide practical experience in applying principles to everyday life. In teaching science, he had to have students assist him in his experiments to supplement the lack of apparatus that characterized most schools of the period. Henry did provide demonstrations to his students and unlike many of his contemporaries, his methodology included visual aids during the lecture or demonstration. Henry, besides urging the trustees of the Albany Academy and Princeton to provide demonstration equipment such as globes and good apparatus for his lectures, used the blackboards extensively. Not only were blackboards virtually nonexistent in the classrooms of the day, but there was little use of the blackboard itself in the course of instruction. Henry also felt that the core of his teaching involved experiments since that allowed the lecturer to "fix the attention of his audience."

Henry's contribution to science was in the field of inductance. Thus, the unit "the Henry" has been named after him as the unit of inductance. While he is chiefly remembered for his contributions to electricity and magnetism, he was a great innovator in high school teaching in post-Revolutionary times. It should be remembered that he was the exception because at the time, there were very few high schools, almost none of which offered courses in electricity and magnetism (Swartz, 1985).

As small high schools came into existence, coupled with the increased interest in sciences and technology, the capacity of public institutions to render proper instruction was outstripped. Small high schools loaded down their teachers with all kinds of courses in science — physiology, botany, chemistry, natural sciences (physics), and astronomy (Swartz, 1985). To illustrate, Massachusetts, in 1857, sparked a growing enthusiasm for science by requiring by law all high schools to teach natural philosophy, which was mainly physics, chemistry, and botany in towns of over 4,000 population (Swartz, 1985).

By the 1870s the laboratory method began to appear in high schools. However, it is difficult to determine how many students actually had laboratory work where they performed experiments individually, since: 1) the cost of providing apparatus was prohibitive for many school districts, and 2) teachers who were trained in laboratory methods were scarce according to an 1870s Commission of Education report (Rosen 1985). In rural areas, instruction by textbook of physics was probably the sole method (Rosen 1985).

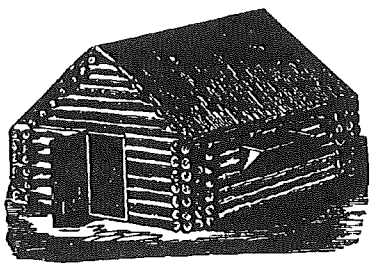
The Harvard University Catalogue for 1870 advised the incoming student to pursue a course in elementary physics before entering. This course was mechanics. In 1872 a new option was designated for admission to the college, that of mathematics and physics. This marked the first acceptance of physics as an accredited secondary school subject by an American college. In 1876 all candidates for admission to the freshman class had to present one of the following combinations of science: a) botany; b) physics and chemistry; c) physics and descriptive astronomy. In 1886 physics itself was divided into a two-part subject: either 1) astronomy and physics, covering designated chapters in specified texts, or 2) " a course of experiments in the subjects of mechanics, sound, light, heat and electricity, not less than forty in number, actually performed by the pupil at school...the Faculty requests all teachers who can command the necessary apparatus to present their pupils in the second of these alternatives" (Rosen, 1985).

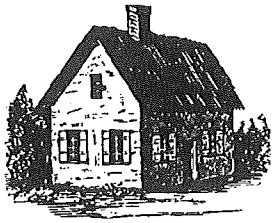
However, at the time the sciences generally were poorly organized and new texts were compiled that stressed abstract principles to the neglect of the concrete examples. The Committee of Ten, who besides urging that all college admissions requirements include a laboratory course in physics and chemistry (Rosen, 1985), advised in 1893, the high schools to teach fewer sciences and devote more time to each area. In this manner the sciences met the challenge of conservative educators to offer a substantial body of knowledge organized logically. (Noble, 1954)

Natural philosophy was giving way to physics by the 1870s. Greater attention was directed toward the mathematical phases of physics, and pupils were being allowed to do more and more laboratory work. However, a statistical survey in 1880 indicated that in the public secondary schools short informational courses were common and the book, Steele's *Fourteen Weeks in Physics* was the most popular textbook. By 1900 the "science of common things" had been replaced by the logically organized subject of physics but the teaching of technical physics had little or no relation to the experience of the student. In such courses mathematics was a prerequisite, and physics was placed in the last year of high school so that they might receive ample instruction in mathematics before beginning the physics. (Noble, 1954)

The secondary physics of the period had become highly theoretical, and the students who did laboratory work performed and "wrote up" a number of experiments. As in the chemistry courses of the times, the students memorized laws, hypotheses, theories, and gained a kind of knowledge that was criticized as not being relevant to their life's experiences. In fact, many of the high school texts of the period were written by college professors with little knowledge and understanding of the needs of secondary students. These texts were in reality college treatises that were abbreviated and simplified. As a consequence of this state of affairs the introductory courses were formal and unpractical. The reaction to the theoretical character of the courses and texts led to a curriculum of more practicality early in the new century.

By the late 1920s physics in the high schools had become more organized with a number of common areas.





These areas were often mechanics, light, heat, sound and electricity and magnetism if the text used in the high schools are any indication of the content of the courses. It must be remember, however, that the subject of physics still had not yet been specifically defined, (Bless, 1928) and even there was still areas that intersected with philosophy, according to one author. (Hagenow, 1928) There was some effort to try to teach high school physics as the study of energy relations, and to stress unifying principles of physics rather than treating the subject as a series of unrelated facts. (Bless, 1928) Further, in the late 1920s there was also some attempt to acquaint physics teachers with "Modern physics," or the study of X-rays, ionization of atoms, atomic theory and other new advances of the times. (Hagenow, 1928) However, there was still the identity crisis in physics itself—what did physics as a subject encompass, and how did it differ from other subjects such as chemistry (Krug, 1972)? It was also pointed out that physics developed by default since other subjects such as chemistry did not deal with mechanics, sound, heat or electricity, and thus, they were inherited by physics.

In a high school textbook commonly used nationwide it was pointed out in the preface that the book in the 1955 edition was basically the same as previous editions with the exception of some additions of modern technology such as electronics chapters, and revisions needed to make the text more of a college predatory course. However, the directness of presentation of the subject was the same as previous editions as well as the drawings. The text includes mechanics, fluid mechanics, heat, light, sound, and machines. (Dull, 1955) Basically, the subject matter and method of presentation had been the same for a number of years.

From the 1930s to about 1957 little attention was given to the revision of the physics curriculum in the high schools. During the war there was some emphasis upon technical subject matter in military courses, but after the conflicts which engaged the United States there a few voices for examining the curriculum in high school physics. In the 1930s physics in high school was relegated to the background because apparently, the social problem of the depression pushed social studies to the foreground in the hope of solving these difficulties. One other factor was that physics was felt to be "too hard" and the new texts of the period were revised in order to make physics easier. Thus, in the 1940s the subject matter was toned down, and there were attempts to connect physics subject matter with the environment in some way. For example, in a newly revised high school text that was widely used, Modern Physics by Dull, Metcalf and Brooks, a new chapter was added on the atmosphere and the weather as well as a chapter on radio and television in the 1955 edition. Further, there is a middle section set of acetate drawings in color on the power shovel as well as other sections of the book on machines (Dull, 1955). Apparently, there was some attempt to relate physics to "life" as illustrated by the examples from Modern physics mentioned above, and this was done in part in order to acquaint the high school student with the need for taking physics courses. At the time many people had never even heard of physics let alone had even wanted to take the subject.

Another problem facing physics in the high schools was not only the difficulty of the subject since most courses required a strong mathematics background, but also decreasing enrollments. In order to combat decreasing enrollments there were calls for reassessing the typical high school physics curriculum in order to avoid having physics become replaced by high school physical science. (Kelly, 1955) In fact there were some published articles which predicted that physics would indeed lose out to physical science because the frequent need to revamp high school physics curriculums had been largely ignored. The author of one article started in 1955 that in order to avoid losing the place of physics in the high schools altogether more effort must be made to increase enrollments through a variety of methods such as making courses responsive to the "differential treatment of pupils according to their ability and interest," and that there was need to change the admissions policies of colleges and graduation policies of high schools to require physics as a subject. He also stated that there was a need to revise and scrutinize the present physics curriculum inasmuch as it had grown not through design but accretion (Kelly, 1955).

Innovation in physics courses, that was also incorporated into many other science programs at the time in the early 1950s, was the use of the "discovery method" pioneered by Dr. Zacharias at M.I.T. in 1956. It had been pointed out by psychologist Jerome Bruner that "any subject can be taught effectively in some intellectually honest form to any child at any stage of development." Dr. Zacharias put this theory into reality by devising a new high school physics course based on the notion that it was more fun, and more instructive, to understand the principles of physics by performing experiments rather that by memorizing a body of facts and rarely testing them in the laboratory. This system, called the "discovery method," quickly spread to other science curricula as university scholars and high school teachers organized to make new high school science curricula (Time, Jan. 29, 1965).

Although some scholars, teachers and scientists had been active in curricular work, such as Dr. Zacharias, their efforts had not been accepted as meritorious work for the scholar. It took the successful orbiting of Sputnik 1, in October 1957, to bring the American consciousness to the teaching of science. Besides attacks from persons seeking to blame the schools for the Russian success, the event of Sputnik 1 had a good effect on American science education. The citizenry became more attentive to the needs of the schools, and students have become more aware of the importance of academic achievement. Many students in the aftermath of Sputnik 1 became interested in science and engineering, sometimes with the encouragement of the high school faculty and administration. Further, one of the most significant results derived from the Russian first was the stimulation of interest in public school science on the part of some professional scientists. (Anderson, 1964)

As the high school and elementary science curricula were scrutinized it became clear that:

1. Factual description choked out the investigatory nature of science.

2. The textbooks were quite standardized, bulky, and not very interesting.

3. A workbook accompanied many texts: pupils were often required to copy material from the book to the workbook.

4. Laboratories had limited equipment, some very expensive and rarely used. Time allotted for labs was inadequate.

5. The purposes of the laboratory work and demonstrations alike were to verify facts stated in the text, or to illustrate some principle.

It was not that these activities were bad in themselves, but the experimental and investigatory nature of science did not permeate the then current teaching of science, (Anderson, 1964)

Scientists, some of whom were outstanding researchers, and educational personnel set out to obtain grants to reform science teaching. Besides forming new curricular committees, such as the Physical Science Study committee in physics, some scientists had begun to show interest in the public schools illustrated by their willingness as individuals or groups to aid teachers, local schools, and regional districts as advisors on projects, guest speakers, sponsors of activities, and judges in science fairs, to name a few of the things which benefited from their involvement (Anderson, 1964).

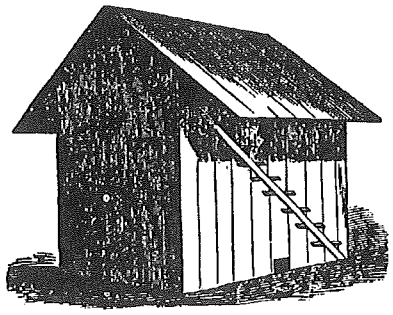
A national effort to update the physics curriculum was implemented in 1959 with the National Science Foundation giving a grant to the Physical Science Study Committee, now remembered as the PSSC. This committee brought together very able physicists, teachers, school administrators, professors of education and human learning to create a new high school course in physics.

After examining the current curriculum, textbooks and courses of study of American high school physics, it was found that there had been no real change in the high school basic physics course since 1910. In these high School courses there was no adequate representation of Modern physics, and the committee reported that the courses were out modeled, and that the content and objectives of present day physics had changed. Thus, it was determined that a new basic high school physics course was needed. It was at this point that the Physical Science Study Group began a pioneering effort in building a new physics course for the American high school student (Anderson, 1964).

One of the approaches of the PSSC was to make significant education possible in spite of the massive amount of material accumulating in all fields, let alone in physics. What the PSSC did was to organize the new high school physics course in a way that can be understood by the student and used by him effectively,. The PSSC course utilized only a relatively small number of concepts such as energy, time and motion. Actually, only thirty-four concepts were emphasized, and it is around these that the whole high school PSSC course was built. If the young high school student could master these specific concepts, and the facts relating to them, the youngster could then explain most of the physical phenomena he encounters, according to its designers (Tyler, 1967).

In 1964 the Harvard Project Physics Course was granted major funding from the U.S. Office of Education and the NSF. Starting with a high school physics teacher, a university physicist, and a professor of science education, the project grew into a major undertaking, with national participation for over four years. The Project Physics Handbook begins with a quotation from 1.1. Rabi, a famous physicist. The quote states that science should be taught in the humanistic way, "with certain historical understanding, with a certain philosophical understanding, and a human understanding, in the sense of the biography of the people who made this construction, the triumphs, the trials, the tribulations."

In the Harvard Project Physics Course there was an attempt to reduce the traditional student dependence upon the text through the use of educational



media. Thus, an extensive array of materials and guides had been developed. There were instruction books, and six books of selected readings. Fifty laboratory experiments and demonstrations had been prepared with newly developed equipment. Further, for the teacher each unit had about 10 transparencies to be used in lectures and demonstrations.

This course was made so that it could be finished in one year in any school. It was made so that an average high school student could take the course and finish it. In above average classes the students can finish the six basic units in six to eight months leaving one to three months for enrichment. The philosophy of the course is to deal with the diversity in high school students exploiting individual differences.

The PSSC physics course was supposed to be the archetype of curricular reform in the 1960s Underlying the effort of the PSSC, and other science curricular committees, was the idea of Jerome Bruner that "the schoolboy learning physics is a physicist, and it easier for him to learn physics like a physicist than doing something else." This premise served as a key doctrine for the new high school physics, the PSSC course (Tanner, 1971). It should be noted also that there were attempts to advance subject matter to lower levels of students and to apply the mode of inquiry discovery to the high school physics course of the PSSC as well as the Harvard Project Physics.

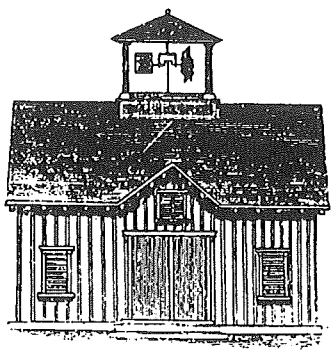
However, the PSSC course in which many millions of dollars of federal funding were pumped, did not live up to expectations. In retrospect almost all the testimonials of advantages from the PSSC course turned out to be from the

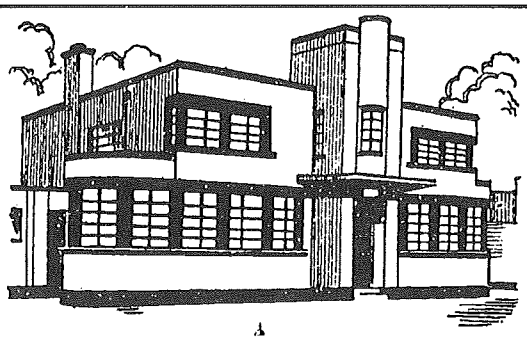
project staff and certain teachers who used the course materials and not from any kind of objective studies. It was soon found that many high school students who took conventional physics courses scored high on standardized achievement tests than did the PSSC students. On some tests the PSSC students did the same as students in conventional courses once the PSSC material had been included as part of the test (Tanner, 1971).

Also, it was realized that the student does not have to be a discoverer in every thing he learns. After all, the basis of culture is that fundamental knowledge need not be rediscovered by each new generation. Finally, it remains to be shown that it is easier for a young schoolboy to learn physics like a physicist than by other means (Tanner, 1971).

The Harvard Project Physics course did not attract new students into high school physics courses and thus, there is still a crisis in high school physics enrollments. (Layman, 1983) The Harvard Project Physics course was not strong enough to stand by itself as a producer of capable high school physics students: the students did not get as deep a grounding in basic physics. Thus, this course failed too. At this time a survey by the Educational Testing Service, which used a small but national sample, found that about 9 % of all U.S. high schools offered PSSC physics, 8 % offered Project Physics, and 54 % offered the conventional course using Modern Physics by Williams, Trinklein and Metcalfe (Pallrand and Lindenfeld, 1985).

However, the effects of PSSC and the Harvard Project Physics can be noticed in the development of the standard course used most widely, Modern Physics by Williams, Trinklein and Metcalfe. This text had been used in various editions and forms since 1922. It can be said that the ideals of the PSSC and the Harvard Project Physics were slowly implemented in the changing editions of Modern Physics since the 1960s Below are some of the changes made in new editions, from 1955 to 1976. Also, there are some other effects on some lab manual such as more inquiry discovery and more Modern physics experiments for high school students.





The changes in the texts from the 1955 edition of Modern Physics to the 1972 edition is probably in large measure due to the national attention devoted to the physics curriculum because of the orbiting of Sputnik. One can see the level of the subject presented in each edition, 1955, 1964, and 1972 is successively higher. Further, more attention is given in each edition to atomic, nuclear, and subatomic physics. The influence of the PSSC on shaping these texts can be seen in 1) the attempt to unify the subject through the concept of energy, 2) the increasingly high level of presentation, and 3) the devotion of larger and larger sections of the textbook to Modern physics such as atomic, nuclear and particle physics (Modern Physics, 1955 - 1972).

Finally, the 1976 edition of Modern Physics is still different. One can see the same forces at work stemming from the work of the PSSC shaping this 1976 Modern Physics As stated in the preface of Modern Physics, 1976, this new edition attempts to "strike a realistic balance between physics theory and practical applications." In the 1955 edition of Modern Physics there was a great deal of emphasis upon applications such as motors, steam shovels, and practical electricity. In comparison there are fewer problems for the students to solve and fewer questions to answer in the 1976 edition. In the 1976 edition the MKS system of units is used throughout the text exclusively as compared to previous editions in which the English system was used alone such as in the 1955 edition. There are introductory pages on energy in the 1976 edition. Motion is dealt with in the 1976 edition in 30 pages. It was dealt with in 50 pages in the 1972 edition. Wave motion, emphasized in the Project Physics curriculum, is given more space in the 1976 edition of Modern Physics. There is a more advanced character to the 1976 edition as compared to previous editions, and it appears that the course has been more logically organized. It is also pointed out in the preface that there are many sections in the texts so that the book can appeal to different student's interests rather than handing down of the subject to the students without accounting for individual differences and interests. In the 1955 edition the Modern Physics had many problems and questions and these were graded into questions and problems for all students and the second section, section B, was for the more advanced student. Student interests were not considered in the text. Further, there are historical sections in the 1976 text probably reflecting the Project Physics and its humanistic approach to the subject.

The older type of laboratory manual such as the Physics Workbook printed to accompany some earlier editions of Modern Physics in 1964 had many experiments in which laboratory equipment was used but not much thinking was required. The student collected data in the laboratory and filed them into

neatly arranged data tables that were preprinted. While the student received practice and familiarity with the equipment, there was criticism that the student basically did not know what he was doing. This type of manual for the course in the high schools also had some places for the student to answer according to multiple choice questions and answers as well. This was not what the PSSC had in mind for an ideal Modern physics course. Another workbook and laboratory manual still in print by AMSCO utilizes the older approaching which the student mechanically performs the experiments. The workbook section still has the fill in type questions in which work from the text is copied into the blank spaces. However, in keeping with the Modern trend AMSCO has put out a PSSC oriented laboratory manual that is designed fit into any high school introductory physics course. It points out that high school physics courses have become harder and this manual, although keeping the ready-made data table and the blank spaces for answers to be copied from the text, tries to give the student an overview of the experiment by using " strategy" sections. Also included is a section on what a student needs to know before doing the experiment. The goal, according to the author, is to provide easier understanding of the experiments, and the format of each experiment goes back to the type of experiment of pre-PSSC and pre-Project Physics. Modern physics is accounted for, however, because there are experiments on finding Planck's Constant, Spectra, and the typical Radioactivity experiments (Walker, 1973).

In the 1980s standards were being set by the MPT for not only student achievement but also for recommended teacher preparation. Large numbers of workshops for upgrading teaching skills and knowledge were an integral part of the teaching scene. Further, in the universities courses were continuing to be upgraded and requirements for teaching certificates in physics and other fields have been increased by the colleges and universities. Textbooks continue to be upgraded as educational psychology is applied to the creation of these texts. In my opinion one of the more significant developments in high school physics texts was the high school text for physics by Merrill publishers in which drill and practice, a basic teaching strategy, is used in problem solving for the various topics in high school physics. The text and its successors also show the effects of the PSSC and Project Physics by having many sections on Modern physics and references to the historical background of the topics in the book. Also, there was the continuing problem of enrollments in which physics from its earliest times in the high schools repeatedly suffers.

In conclusion one can see an evolution of high school physics from its inception in this country from no laboratory work for students to laboratory work and from simple laboratory work to a more sophisticated experience in the laboratory in which more thinking is done by the student. Also, there are now more Modern physics laboratory experiences. Coursework has gone from virtually none at all to a higher and higher level and some of the work previously reserved for the introductory college course is now regularly taught in high school. Further, texts now have substantial sections on modern physics, an area ignored at first, but now in the high school an integral part of the course.

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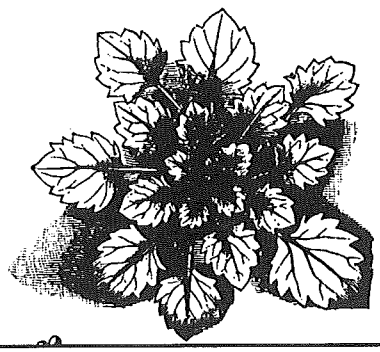

A Week With AIMS 1995 - Series 1
Aurora East School District #131
June 19-23, 1995
East High School
500 Tomcat Lane • Aurora, Illinois
Local Contact: Ed Brouch (708) 898-5880

The AIMS Education Foundation is pleased to announce *A Week With AIMS* Workshop. Teachers from schools and districts other than the host are welcome.

Generally, these workshops are organized to offer instruction for teachers with assignments at three levels: K-2, 3-5, and 6-9. The precise configuration will be determined by the distribution indicated in the reservations. Each grade level section is limited to 40 participants.

Teachers attending a workshop will receive a binder of selected AIMS investigations and will select three AIMS publications to be shipped to their home or school at the conclusion of the workshop. The value of the materials is in excess of $100.00.

The total workshop fee, which includes instruction and materials, is $270.00.

The workshops are made-to-order for schools seeking a cost-effective way to incorporate this dynamic program into the mathematics and science curriculum. It is highly cost-effective for a school or district to sponsor attendance of key teachers to receive this training and then to have these teachers conduct local staff development sessions, sharing the content of the AIMS workshop and program.

Attendance at *A Week With AIMS* qualifies for funding under the Eisenhower Act. For additional information about these federal funds, please contact the Math/Science office at your State Department of Education.

Reservations are required and must be submitted to the AIMS Education Foundation. *The reservation form together with payment in full must be submitted to* ***AIMS*** *for processing.* Submit reservations at the earliest possible date since many grade level sections and workshops fill early. If it becomes necessary for you to cancel your reservation, you must do so 21 days prior to the workshop or a $75.00 fee will be assessed. Cancellation after the beginning of the workshop or non-attendance requires forfeiture of the full reservation fee.

- University credit is available — 2 grade hours at Aurora University
- Reservations are accepted in the order in which they are received.
- Register Early! Call Ed Brouch for application materials.

To Earth Science Teachers of Illinois:

Anyone interested in taking over the reigns of the Illinois Earth Science Teachers Association should contact Ann Holda Wiewel by June1, 1995. There is currently a membership list of over 100, and a bank account of approximately $600.

I have not been able to send out a newsletter since then, and am resigning as Secretary/Treasurer due to other personal committments. I am a founding officer since the fall of 1987, when the Illinois Earth Science Association decided to change to the Illinois Earth Science Teachers Association. Previous attempts at finding volunteers to run for office have failed, and I am hoping someone will step forward.

There is a strong need for this organization in our state. Russ Ruswick, our past President, and I have presented at almost every ISTA convention since 1987, when the association was founded. Over 100 people have attended our workshops each time. We need leaders who are willing to organize workshops at the convention, and send out a newsletter at least once a year.

Please contact me by June 15, 1995 or I will have to end our organization. At that time I will send 1/2 of our remaining funds to ISTA, and the other to NESTA. Both organizations have been supportive of us in the past.

If you are interested please contact me as soon as possible. Please don't let the IESTA become another extinct species!

Sincerely,

Ann Holda Wiewel

School
Mundelein High School
1350 W. Hawley
Mundelein, IL 60060
708-949-2200 ext. 320

Home
1931 Dunhill Ct.
Arlington Heights, Il 60004
708-818-8913

MOVING?

Keep Your Spectrum Coming
Send Address Changes to:
George Zahrobsky
Membership Chair
P.O. Box 2800
Glen Ellyn, IL 60138

SPECIAL INTERESTS

Carol Fialkowski
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2001 North Clark Street
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ENVIRONMENTAL LITERACY IN ILLINOIS 2000

A process is underway for the development of a comprehensive master plan for environmental education for the State of Illinois to be implemented by the year 2000. Forty-four participants representing diverse environmental professions, agencies, and constituencies are contributing to the efforts of 11 subcommittees. These committees range from pre-service education to funding and are inclusive of those elements identified and included by other states in plans already completed and those unique to Illinois.

The mission statement articulated by the planning committee reads:

In order to serve the citizens of Illinois, the Environmental Literacy for Illinois 2000 Plan will establish environmental literacy as an integral part of life-long learning. The primary purpose of this comprehensive five-year plan is to encourage, excite, and empower individuals and groups to further strengthen environmental education programs in Illinois. Such programs will:

encourage a pro-active citizenry who can make informed, responsible environmental decisions.
establish environmental awareness and action as integral learning, both in the formal and informal learning settings.
include multicultural experiences
develop an awareness of environmental justice issues.

The Environmental Literacy for Illinois 2000 Strategic Planning Committee has identified eight program focus areas for research and proposed implementation. They include Pre-Service Training, In-Service Training, Environmental Literacy Centers and Resource Library, Agency Collaboration, Environmental Careers, Curricular Requirements and Mini-Grant Funding.

The Environmental Literacy Plan will play a central role in achieving the goals of each of the program focus areas by:

- providing a mechanism for implementing environmental education programs and utilizing the resources of Illinois' communities;
- assisting access to local state, and federal environmental information and data resources;
- designing implementation options for modelling and adapting effective programs;
- developing a mechanism for including business, industry, civic groups, etc. in partnership opportunities, including career awareness;
- providing avenues for environmental learning for providers from throughout the learning continuum, including pre-service, inservice and informal education, as well as scientific expertise;
- correlating with input from emerging and existing national, state and local standards and recommendations; and
- continuing internal evaluation and external review.

Each subcommittee is currently in the process of determining goals and strategies with accompanying timelines and budgets. These will be melded, folded, and integrated into the evolving plan draft to be ready by mid-April. The draft plan will then be circulated and presented to educators and environmental constituencies around the state for comment and revision. One review has been set for April 29, 1995 at the Environmental Education Association of Illinois meeting at the Chicago Botanic Garden all are invited to attend. Your response and input is important and essential. If you would like a list of review meetings in your area or a copy of the draft for review, please contact Carol Fialkowski at the above address.

CUTE, CUDDLY AND FASCINATING

Most students can identify with mammals, but can they identify the local mammal species? Do they know what makes an animal a mammal? Do they understand how the lives of mammals interface with other organisms, including humans? The American Society of Mammalogists shares with fellow scientists in other disciplines a concern for the science literacy of our country's youth, and would like to help. We can provide assistance in:

- locating a local mammalogist to:
  - speak to your class
  - acquire live mammals from your local habitat
  - construct mammal "units" to meet your specific needs
  - consult for science fair projects dealing with mammals
  - learn about possible summer opportunities to participate in mammal research (students or teachers)
- acquiring slides of mammals from around the world
- awards for science fair projects on mammals
- career opportunities in mammalogy

For assistance, contact the ASM Public Education Committee, c/o Tom Tomasi, Dept. of Biology, Southwest Missouri State University, Springfield, MO 65804. (E-mail: TET962F@VMA.SMSU.EDU)

Our goal is to establish a clearing house for mammal-related activities which will educate/entertain your students. To this end, descriptions and comments on activities that you have already tried will be gratefully accepted.

Marilyn Morey
Science Advisory Board
Kid's Crossing

The McLean County Children's Discovery Museum, also known a Kid's Crossing, provides a hands-on learning environment where children and their families can explore and make discoveries designed to stimulate imagination, curiosity, and self-confidence and have fun in the process. Kid's Crossing is the county's first hands-on museum for children. The museum is currently housed at College Hills Mall in Normal, Illinois near the Target store. However, soon after the first of the year Kid's Crossing will be relocating to a 7,000-square-foot site in Constitution Place, 716 E. Empire St., Bloomington.

Kid's Crossing meets the children's needs for hands-on learning by providing an environment which emphasizes touching, exploring, experimenting, inventing and playing. The museum features interactive discovery centers for children ages 2 to 12, which children can enjoy with their parents, grandparents, brothers, sisters, or classmates.

Numerous teachers in the county have already found the museum to be an excellent field trip for their students. Nearly a hundred field trips have been hosted by the museum since it opened last spring. Kid's Crossing strives to provide school groups and organizations with learning experiences difficult or impossible to achieve in the context of school or home.

Current exhibit areas at the museum include Q-Kids Radio, the Art Room, the Body Works Medical Discovery Center, Kids' Depot Railroad Discovery Center, and Kids' Farm Agriculture Discovery Center. Once the museum moves to its new location, some of these exhibits will be expanded and new ones will be added.

Q-Kids Radio

Q-Kids Radio, sponsored by WBNQ Radio FM 101.5, consists of a fully functioning radio station that provides visitors with the opportunity play a song, read a news or weather cast, introduce upcoming songs, or create and broadcast commercials all from the control console of Q-Kids Radio.

The Art Room

You can let your imagination go wild in the art room. The art room is stocked with numerous materials, recycled and new, that allow visitors to create their own unique masterpieces of art. An excellent environment in which to combine art and science.

The Body Works

The Body Works, sponsored by The McLean County Medical Alliance, provides visitors an area to explore the various hospital and medical related activities. Children have the opportunity to read and diagnose x-rays, complete anatomical puzzles, perform surgery on soft doll patients, or dress up as a doctor or nurse.

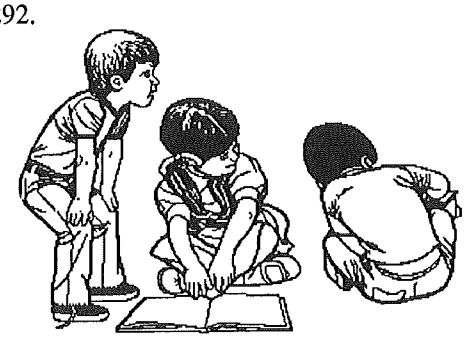
Kids' Depot

The Kids' Depot, sponsored by The McLean County Association for the Education of the Young Child, features the cab of a train . . . and the caboose too. The Kids' Depot caboose is a quite area full of books and puzzles with a railroad theme. Visitors can operate their own ticket booth, do "rubbings" of their favorite train car, manipulate the giant "Brio" train set, and take the controls of Kids' Crossing steam engine.

Kids' Farm

The Kids' Farm, sponsored by The McLean County Farm Bureau, offers a fun farm learning environment where young people are able to explore various aspects of agriculture and the ground from which their food is grown. Through hands-on activities, children learn to create biodegradable plastic from Illinois corn products, study the effects of erosion on the earth in the Kids' Farm Erosion Table, pump their own water supply, and engage in activities using seeds and soils.

Kids' Crossing staff are currently developing teacher resource materials related to the exhibits that will provide teachers with ideas for pre- and post-field trip activities. While many parents and teachers have already taken advantage of the educational opportunities at Kids' Crossing, there are many more yet to enjoy the exciting interactive learning experiences available there. While located at College Hills Mall, as a preview site, there is no required admission though donations are graciously accepted. For further information, you may call Kids' Crossing at (309) 862-1516 or send your tax deductible contributions to: The McLean County Children's Discovery Museum, P.O. Box 292, Bloomington, Illinois 61702-0292.



THE CHANGING ILLINOIS ENVIRONMENT: CRITICAL TRENDS
Executive Summary of the Critical Trends Assessment Project

Twenty-three years after the first Earth Day, Illinois has made impressive strides in repairing the damage done by 150 years of sometimes heedless development of its natural resources. Although much has been accomplished, more remains to be done.

The Critical Trends Assessment Project, or CTAP, seeks to develop a base of practical, real-world information that will help Illinois citizens and policy-makers shape effective and economical environmental policies for the future on a sound ecosystem basis.

As a first step, CTAP undertook the first comprehensive examination of the Illinois environment. The project involved staff of the Illinois Department of Energy and Natural Resources (ENR), including the Office of Research and Planning, the Geological, Natural History, and Water surveys, and the Hazardous Waste Research and Information Center. They were assisted by the state's other natural resource agencies.

The technical findings generated by the initial CTAP investigations fill seven volumes. These have been condensed into a 100-page summary report titled, *The Changing Illinois Environment: Critical Trends.* Highlights of that summary report follow.

Illinois remains a resource-rich state. While erosion continues to pose troubling questions about long-term sustainability, Illinois soils remain richly productive under appropriate management. The state's coal reserves are ample, even if their use is environmentally problematic because of their sulfur content and because of concerns about global warming. Water and buildable land remain abundant, although conflicts over their use are likely to continue.

In general, Illinois is a cleaner and healthier place for humans than it has been in decades. Stream pollution is less widespread, in large part because of substantially lower discharges by industrial and municipal sewage treatment plants. One proof of progress is the fact that the rate of species decline among fish statewide has dropped since 1950.

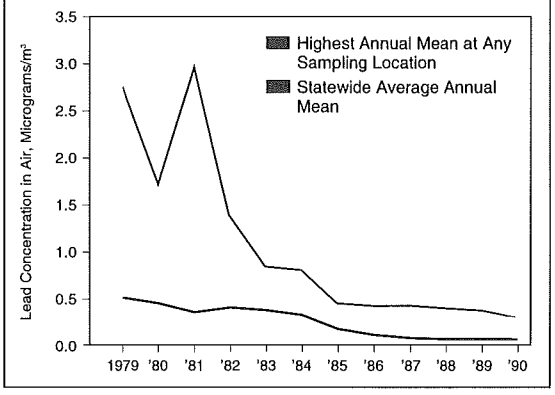
In general, air quality in Illinois is improving. From 1978 through 1990 concentrations of "criteria" pollutants and several heavy metals were either steady or decreased. Acidity of precipitation decreased in the 1980s. Ozone levels are reduced or stable, and lead concentrations are down substantially in all areas of the state. Emissions of air pollutants from utilities and factories are down substantially. For example, between 1973 and 1989, particulate matter from industrial sources dropped 87%, sulfur oxides 67%, nitrogen oxides 69%, hydrocarbons 45%, and carbon monoxide 59%.

Current groundwater withdrawals do not exceed long-term supplies in spite of the fact that roughly one billion gallons of groundwater are pumped from Illinois aquifers every day to irrigate crops, cool power plants, and supply drinking water. The "mining" of groundwater has been largely reversed as Chicago suburbs have switched to Lake Michigan as a water source. Surface water supplies, while stretched by drought in some parts of the state, are generally adequate in quantity and quality.

Injuries to the land have been diminished markedly. Mineral extraction has slowed and surface mining must meet strict regulatory standards. Land reclamation laws enacted beginning in 1962 have seen nearly 108,000 acres of the state's 153,000 strip-mined acres reclaimed to some kind of productive use. Net landfill capacity in Illinois increased since the mid-1980s, but again, these newer facilities are substantially less polluting than their predecessors and many materials are no longer landfilled at all, such as yard wastes and lead batteries.

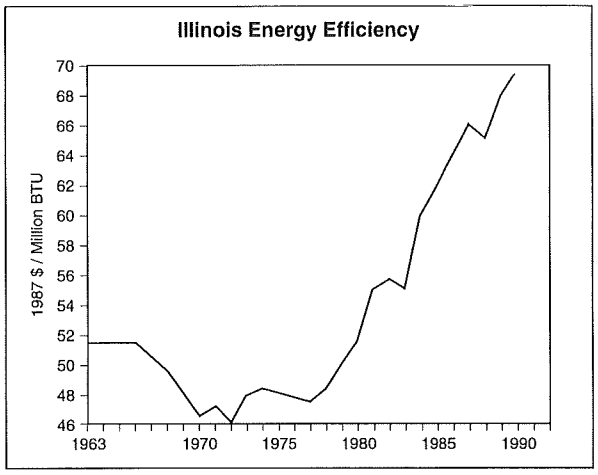
Energy efficiency improved steadily in Illinois throughout the 1980s and energy consumption is showing a downward trend. Output of greenhouse gases declined 18% from 1970-1990, although the state's annual global carbon dioxide production exceeds by fivefold its share of the world's population.

Figure 2-5 Statewide Trends in Airborne Lead Concentrations in Illinois 1979–1990



Source: *Air Resources*, Illinois State Water Survey, 1994

Illinois Energy Efficiency



Source: *Earth Resources*, Illinois State Geological Survey, 1994

The number of old waste sites that are potentially hazardous continue to increase as more accurate surveys are conducted. Clean-up continues to be costly and time-consuming, but tighter regulations are making the practice of storing and disposing officially designated hazardous wastes on land less attractive.

Past damage to Illinois streams and rivers has taken a heavy toll. Of the species present in Illinois at the turn of the present century, about one in five fish, one in three amphibians and reptiles, more than half the freshwater mussels, and one in five crayfish have been extirpated—eliminated from the state—or are threatened by extinction.

While water quality in Illinois streams is improving in many respects, ecological quality remains low. Populations of native fish and aquatic plants are rebounding following precipitous declines in the discharge of industrial effluents into Illinois' 26,000 miles of streams, but full recovery remains a distant hope.

Illinois has more forest today than it has had since the turn of the century. Wooded acreage increased by 41% since 1926. However, the increase in forest acreage has not been matched by an increase in quality. Today's forest is more likely to be populated by fast-growing, less commercially desirable species such as maples and beeches rather than the oaks and hickories of the past. (Since 1962, the acreage dominated by maples has increased 40-fold.)

Physical, rather than chemical, changes are probably the most perturbing force in Illinois stream ecology today. For example, urbanization is encroaching on Illinois streams, sedimentation smothers stream bottoms, and widespread channelization has altered water flow. Dams contribute to upstream flooding (and almost every sizable stream in Illinois is dammed in at least one spot), and drainage of wetlands destroys important habitat.

Outside its major river valleys, Illinois has lost an estimated two to nine inches of topsoil over the last 150 years. While net soil movement from erosion is lower overall, it remains sizable enough that sedimentation is one of Illinois' top water quality problems; Peoria Lake, the largest and deepest of the bottomland lakes on the Illinois River, lost 68% of its capacity between 1903 and 1985. However, Illinois has been a national leader in conservation tillage during the last 15 years, when soil conservation practices increased sharply.

By 1976 less than 1/100th of 1%, or 2,352 acres, of high-quality original prairie remained in the Prairie State. Four of every five remaining acres of prairie are less than ten acres in size. One in three is smaller than one acre—too small to be a self-sustaining ecosystem.

Illinois wetlands harbor a great wealth of biological diversity. An estimated 64% of Illinois' threatened or endangered species inhabit wetlands. Presettlement wetlands constituted one acre in every five in Illinois; wetlands have since dwindled to 918,000 acres, of which only 6,000 acres are undisturbed. Recent laws have slowed the rate of wetlands destruction, and federal rules have led to the mitigation of wetland losses by the construction or restoration of wetlands. Unfortunately, even intact wetlands remain vulnerable to invasion by pollutants, sediments, and exotic species, and artificial wetlands to date have duplicated neither the biological diversity nor the hydrological complexity of natural wetlands.

Introductions of non-native species—either deliberately or accidentally—are a growing threat to native populations. These species have rendered the ecology of Lake Michigan unstable, and native mussels are threatened by accidentally introduced zebra mussels. Invasions of Illinois forests by exotic insect and plant pest species are increasing in severity and scope.

Habitat fragmentation and other physical changes have surpassed conventional pollution as threats to ecosystem functioning. The splintering of wetlands, prairies, and forests into fragments makes it harder for small, isolated populations of plants and animals to breed; it also leaves them vulnerable to accidental eradication through fire or other mishap. Competition from exotic species often increases as well, since many exotics from cowbirds to honeysuckle thrive along the increased "edge" environment produced when contiguous habitats are split by development.

Farms are increasingly more specialized. Nearly 2/3 of acreage is planted in crops such as corn or soybeans which usually require pesticides and the cultivation of which can expose topsoil to erosion.

Illinoisans are arraying themselves on the land in suburban densities. By 1990, Illinois' urban fringe had grown to house 37% of the state's population—as many people as lived in its central cities. The trend has had effects on air quality, petroleum consumption, and land use that are disproportionate to the population. One estimate found that 17 of Illinois' top 20 farming counties are located in or adjacent to urbanized areas as defined by the U.S. Census Bureau.

Illinois in recent years has moved from dirty industries (high emission) toward clean ones (low emission), from complex natural systems toward simpler ones, from stable natural systems toward unstable ones, from native species toward non-native ones, from integrated natural systems toward fragmented ones, from self-sustaining natural systems toward managed ones.

The result is a trend toward a generic Illinois environment populated mainly by "generalist" species able to exploit simplified ecosystems. Illinois still boasts an impressive range of habitat types. But habitat fragmentation and competition from exotic species have combined to render once-stable ecosystems less so. Complexity lingers mainly in habitats of only marginal use to humans, such as river bottomlands, swamps, hillsides and bogs.

Humans have become so ecologically dominant in Illinois that it is impossible to draw clear lines separating natural systems from the social, economic, political, and technological systems that influence them.

Economic and technological changes can have significant impact in curbing pollution. Greenhouse gas emissions peaked in 1970 but have declined since then as Illinois generated more of its electricity using nuclear power rather than fossil fuels.

We don't know enough. Agencies of both state and federal governments generally collect specific kinds of data for specific pollution control and wildlife management purposes. But whole ecosystems have proven to be too complex to be managed on a pollutant-by-pollutant or a species-by-species basis. Baseline data that might be used to monitor broader ecological conditions have not generally been systematically collected on a statewide basis. This has made it difficult to assess, much less to prevent or repair, the more subtle kinds of damage done to Illinois' natural ecosystems.

To obtain copies of the summary report or the seven-volume technical report call the ENR Clearinghouse at 1/800/252-8955. TDD customers call 217/785-0211. CTAP information and discussion forums can also be accessed electronically at 1/800/528-5486.

The Executive Summary of the Critical Trends Assessment Project is a joint publication of the Illinois Department of Energy and Natural Resources and The Nature of Illinois Foundation.

Let's Talk...

...about critical trends
...about ecological indicators
...about environmental data

We are staffing an ongoing electronic discussion on the Critical Trends Assessment and other environmental issues and we'd like - to hear from you. Share your opinions, comments, publications or data by logging onto the environmental bulletin board:

EcoForum

All you need is a computer, a modem and this number:

1-800-528-5486.

Once in EcoForum, you'll have to register as a new user; just type 'new' after the initial prompt. The system will give you instructions after that. To join the CTAP discussion, in the main menu select 'Environment'; then in the 'Environment' menu 'CTAP'. This will take you into the Critical Trends Assessment Project main menu where you can access the CTAP forum. From there on, just follow the instructions.

We are also beginning to load the CHEAP report text and CTAP data. And while you're in EcoForum, take a look at the other environmental and energy information available. See you there. EcoForum will soon be accessible via the Internet.

COMPUTER SPECTRUM

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GOPHER AND BEYOND: A LOOK AT INFORMATION RETRIEVAL IN THE 90s

A short time ago, there was an experimental distance education course to teach people in the Internet about an exciting information retrieval tool called "gopher." Gopher was developed at the University of Minnesota (home of the Golden Gophers) as a way for departments on campus to share information. Quickly this distance education course had over 17,000 participants. The information contained in this document contains concepts presented there in brief form so that you too can have the full benefits of the capabilities of gopher. The original course was developed by Richard J. Smith (smithr@clp2.clpgh.org) and Jim Gerland (gerland@ubvm.cc.buffalo.edu). It was called Navigating the Internet: Let's Go Gopherin'.

A little background on Gopher

The Internet Gopher is a navigating tool that takes the features of the Internet and puts them all into one handy little program. Things such as ftp (file transfer protocol) and telnet (remote login) are made easier with a gopher application called a client application. Gopher even allows you to "burrow" around the Internet without knowing domain names, IP addresses, ports, or sockets.

To operate gopher two things must be in place. First, you must have a gopher client application (such as Turbo Gopher for the Macintosh, or H Gopher for the DOS/Windows platform). Second, you need to be able to connect to a gopher server. A gopher server is a computer running a program that can communicate with your gopher client. Several platforms can be used to run a gopher server. For example, the mother gopher at the University of Minnesota that many gopher clients come configured to connect to are run on Macintosh IICi's. Once connected, most gopher sites point you to a variety of resources related to the content of the gopher. You may even point to "All the Gophers in the World," a list of resources available with gopher.

Getting connected to "Gopherspace"

There are several ways to get information from a Gopher server. On a Unix, VMS, or CMS system, if a Gopher client is installed, preferably by the system's administrator, all you have to do is type "gopher" (without the quotes) at the system prompt. The machine immediately takes over and goes out to retrieve a menu from a Gopher server—the first door into Gopherspace.

You may have a DOS or windows or Macintosh menuing system that will allow you to click on a Gopher item that gives you direct connection or an X window system that will start at a command. it depends on your system and if a Gopher client has been installed.

Networks are not perfect. They do stop operating from time to time. This is called "being down" or "crashed." So, using a substitute Gopher may be needed at some point. If you have a Gopher client on your system, you may want to go directly to a specific Gopher server.

Depending on the type of client you are using, there will be a command that allows you to connect to another gopher either by opening a connection, or starting a new gopher, or something similar. To use a gopher, you will need to know the remote machine's address. For example, if you wanted to remotely connect to the Department of Education's Gopher server the remote address is "gopher.ed.gov" (again, without the quotes) and when it asks for a port number, enter 70. If you wanted to connect to the home gopher at the University of Minnesota, you would enter the address "gopher.tc.umn.edu" and a port number of 70.

Some places that you can download/retrieve the latest gopher clients for your machine are listed in the table 1.

Hostname	IP#	Login	Area
consultant.micro.umn.edu	134.84.132.4	gopher	North America
gopher.uiuc.edu	128.174.33.160	gopher	North America
panda.uiowa.edu	128.255.40.201	panda	North America
gopher.sunet.se	192.36.125.2	gopher	Europe
info.anu.edu.au	150.203.84.20	info	Australia
gopher.chalmers.se	129.16.221.40	gopher	Sweden
tolten.puc.cl	146.155.1.16	gopher	South America
ecnet.ec	157.100.45.2	gopher	Ecuador
m3270 Public Logins:			
Hostname	**IP#**	**Login**	**Area**
pubinfo.ais.umn.edu	128.101.109.1	-none-	North America

Display/Open current item

A Gopher menu can have a variety of items on it. A line on a gopher menu might be a directory which contains more Gopher items. It could be a plain ASCII (American Standard Code for Information Interchange) file, an archive file or an image, or an electronic form for you to fill out. Selecting an item will allow the Gopher client to process the item for you.

Bookmarks

A bookmark is used just like marking a page in a book to remember where you were at some point. A bookmark for Gopher is the same thing. After burrowing through several menus, you can set a bookmark to a particular item or menu so they you can quickly return to that place again.

Item information

Information about an item usually includes the domain address and selector information about the item. If the Go-

pher server is using the Gopher+ protocol, you can find out where the site is located and who the administrator of the site is. Table 2 is a list of Gopher "items" that can be obtained.

Gopher item types.

0	Item is a file
1	Item is a directory
2	Item is a CSO (qi) phone-book server
3	Error
4	Item is a BinHexed Macintosh file
5	Item is DOS binary archive of some sort
6	Item is a UNIX uuencoded file
7	Item is an Index-Search server
8	Item points to a text-based telnet session
9	Item is a binary file! Client must read until the connection closes. Beware.
T	TN3270 connection.

Experimental IDs for files.

s	Sound type. Data stream is a mulaw sound.
g	GIF type (CompuServe graphics format)
M	MIME type. (Bellcore Labs Multimedia format)
h	html type. (HyperText Markup Language)
I	Image type
i	"inline" text type (used by Panda)

The usefulness of an item depends on whether or not you have an application that can support the file format. For example, if you retrieve an archived file that has been compressed with ShrinkIt (an Apple II compression utility) chances are that your Macintosh or IBM/compatible machine does not have a decompression utility. Even if it does, the resulting programs will not run on your machine. Only the text files that are contained will be of use.

All the Gopher Servers in the World

Many gophers will allow you to connect to a location where All the Gopher Servers in the world are listed. This is an alphabetical listing of as many Gopher servers as are known to exist. This is a very long list and not compiled by subjects. If you are interested in a subject list of Gopher servers, you might be interested in Gopher Jewels from the University of Southern California (USC).

It would be worth your while if you are a serious user of the network, scholar, researcher, entrepreneur, or whatever to page through the forty-four+ pages of Gopher listings to get a feel for what is available. There will be many surprises as to what you find there and explore.

When you select an item from All the Gopher Servers in the World you get another list of Gopher items. Now, you have over 700 Gopher servers each containing their own Gopher menu of items which contain lists of items... you get the idea. The resources available via Gopher are darn near endless. If only there were a way to search these menus! (See section on Veronica below)

Gopher Jewels

After looking at the All the Gopher Servers in the World for a while, you might be wondering why you are taking wild guesses and spending hours on searching Gopherspace.

Fortunately, the Internet community is resourceful and cooperative. Gopher itself is a product created to meet a need—to facilitate access to information on the Internet—and we have the people at the University of Minnesota to thank for that. As the number of Gophers grew beyond the limits of browsing for information, the problem of getting around Gopherspace became apparent, and the Internet community came to the rescue.

David Riggins decided that a list of Gopher servers by categories would be appropriate. According to the distance education course, David has searched over 700 Gopher servers to amass this list. The resulting list is called Gopher Jewels. You can connect to Gopher Jewels at: cwis.usc.edu and it is in the Other Gophers and Information Resources/ Gopher-Jewels directory and in port 70.

Veronica - Searching Gopherspace

Veronica was developed at the University of Nevada to help access Gopher directories and the many files they contain. Veronica is a very powerful means for finding information quickly in Gopherspace. Veronica stands for: Very Easy Rodent-Oriented Netwide Index to Computerized Archives (VERONICA).

Veronica is a service that maintains an index of titles of Gopher items, and provides keyword searches of those titles. A Veronica search originates from a user's request. The result of a Veronica search is a set of Gopher items. The user can access any of the resulting data from the returned menu.

Veronica is an intelligent database. It actively seeks new gopher sites and finds the information that is on them. Veronica does the job of a million and one librarians by searching through all known Gopher sites to see what's there...so you don't have to. Veronica is kind of like little Dow(tm) scrubbing bubbles that work on Gophers instead of sinks.

Composing Veronica searches

The Veronica search engine supports or understands the logical operators AND, NOT, OR, (, and). Adjacent keywords without an intervening operator are treated as though they were conjoined by an AND.

Interpretation of the query starts from the righthand, interpreting operators as encountered. If in doubt about order of interoperation, USE PARENTHESES! Search keywords are not case sensitive. You can restrict your search to certain Gopher types. Refer to table 2 for a listing of types of documents available in Gopherspace. If you wanted to only search for plain ASCII files that contained the word "internet", you could enter the following query:

internet -t0

The -t flag tells Veronica that a type identifier is following. You can include more than one type with the -t flag. For example, if you wanted both plain ASCII files and directories, you would enter:

internet -t01

Table 3 shows a list of available searching flags for Veronica.

Obtaining Veronica Frequently Asked Questions (FAQ)

The current version of the Frequently Asked Questions file usually called FAQ files can be located in the veronica directory through gopher at:

gopher.scs.unr.edu

Veronica search flags.

l	return link information as a file
m	maximum items to return from search
t	specify item type(s) to search

What's next?

Clearly, Gopher is an important advancement in the ability of for novice to advanced users of the Internet to retrieve information and access vast resources. The connectivity of multiple databases and information residing on multiple computers was very insightful. It is not the end in information retrieval. It is an important stepping stone to the future of information delivery. Being in the information age, developments happen quickly. Perhaps the most exciting work being done right now is happening at the National center for Supercomputing Applications (NCSA). A new interface for information retrieval called "Mosaic" is based on the "World Wide Web" developed at CERN in Switzerland. The significant advancement with Mosaic is its ability to unify the access to a variety of protocols, archives, and data formats. Mosaic creates interfaces with external programs that are able to handle such data formats as JPEG, TIFF, DVI, MPEG, and postscript.

Mosaic displays HyperText Markup Language (HTML) documents. HTML was based on the Standard Generalized Markup Language (SGML), the ISO standard for internal document description. HTML is used to create links to data files. The data files may be on the same server or on a remote server.

Christinger Tomor, Assistant Professor, School of Library and Information Science, University of Pittsburgh writes:

Mosaic is capable of supporting several modes of asynchronous collaboration, including document annotation, document cross-linking, and document revision control. In addition, NCSA Mosaic can communicate directly with Collage, which is NCSA's synchronous collaboration tool intended mainly for use in scientific data analysis and manipulation, and NCSA's Data Management Facility, which is a relational database system designed especially for scientific data. (One of the threads connecting Mosaic, the World Wide Web, and the Internet Gopher is a scheme for document naming known as the Uniform Resource Locator (URL). The URL has been described as a networked extension of the standard filename concept: not only can you point to a file in a directory, but that file and that directory can exist on any machine on the network, can be served via any of several different methods, and might not even be something as simple as a file: URLs can also point to queries, documents stored deep within databases, the results of a finger or archie command, or whatever." Perhaps more to the point, the use of URLs and the deployment of a similar scheme for resource naming represent key factors in further regularizing the processes supported by tools like Gopher, WWW, and Mosaic.)

The Near Future

In the near term, we can expect that the Gopher system will be superseded, albeit slowly, by Mosaic and similar applications. Already there are Mosaic clients—in effect, "proof-of-concept" applications—that will run successfully under Microsoft Windows 3.1 and Macintosh System 7. The speed of this transition will depend in large measure upon the capabilities of the local area networks from which clients are launched and the processing capabilities of the computers upon which those clients run. For example, so-called "fast Ethernet" will support transfer rates of up to 100 megabytes per second. Coupled with the next generation of desktop computers, which are expected to be RISC machines, or the equivalent thereof, available network bandwidth and local processing power should be great enough to support a generation of robust resource discovery/retrieval tools based on or emulating the X Window interface.

The more difficult question is how long it will be necessary to support the several generations of machines built on the PCAT bus and running versions of MS-DOS. However, as long as those machines represent a significant factor, and it would seem at this point, given their numbers, the state of the general economy, and the nature of end-user computing, that these machines will be a significant factor for at least another five years, the Internet Gopher and other essentially low-end systems will remain a potent factor in this area of network computing.

Conclusion

I hope you have enjoyed reading about the Internet Gopher. Changes are occurring rapidly in the information retrieval industry. It is an exciting time to be involved. If you have any comments you would like to send along to the author, he can be reached at the above address.

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The Greenhouse Gas-ette
Chris Harper
Climate Protection Institute
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Oakland, CA 94619

TRAFFIC SIGNS ON THE ELECTRONIC SUPERHIGHWAY

Environmental Internet Guide:

For those of you looking for some environmental "beaches" on the internet ocean you may want to acquire the Murphy Briggs guide. A Guide to Environmental Resources on the Internet by Carol Briggs-Erickson and Toni Murphy came out in December 1993. It was written to be used by researchers, environmentalists, teachers and any person who is interested in knowing and doing something about the health of our planet.

You can get a copy of the guide at the following access points:

anonymous FTP:
host: una.hh.lib.umich.edu
path: /inetdirsstacks
file: environment:murphybriggs

Gopher: North America
USA
Michigan
Clearinghouse for Subject-Oriented...
All Guides

URL for WWW/Mosaic:
gopher://una.hh.lib.umich.edu/
00/inetdirsstacks/environment:
murphy briggs

The Murphy Briggs guide is the most comprehensive listing of internet resources regarding the environment. There are many other guides, but they do not have the environmental focus. Consequently with many guides you find yourself overwhelmed by information in which you have no interest.

One of the nice things about the Murphy Briggs guide is that it is divided into subject resources. So if you want to find some resources on Acid Rain you go to that section of the guide and it may offer you telnet, gopher, ftp, and listserv addresses, all of which pertain to acid rain.

Other subject resources in the guide are air pollution, alternative energy, ecosystems, endangered species, environment (general), environment and education, forestry, greenhouse effect/ozone depletion, hazardous waste, oceanic, recycling, sustainable agriculture, water quality, wetlands, and wildlife.

CDIAC: One resource that is not mentioned in the Murphy Briggs guide is the Carbon Dioxide Information Analysis Center or CDIAC. The CDIAC is part of the Environmental Sciences Division of Oak Ridge National Laboratory in Oak Ridge, Tennessee sponsored by the U.S. DOE's Global Change Research Program.

It provides information concerning the environmental effects of elevated levels of carbon dioxide and other gases. In other words this is where you go to get Mauna Loa data.
The ftp address is:

cdiac.esd.ornl.gov.

If you don't know how to ftp find a copy of the last Greenhouse Gassette, and if you cannot do that send some email to

chharpe@ctp.org.

One of the challenges presented by resources like the CDIAC ftp site is what does a teacher do with all that data. Putting much of the data in a comprehensible form is not possible given 24 hour days and the typical teacher's work load. A natural response to this challenge is to let the students do the work. This might just be that answer assuming the students have access to the necessary resources.

Modem recommendations: Bob Shayler, editor of NetWays, a Bay Area internet newsletter gives some valuable advice for those of you looking to buy a modem: "Get an external modem which is at least 14.4K and supports v.32b. These modems tell you that they do this on the box they come in. Excellent brands include AT&T, Global village, Hayes, Practical Peripherals, Telebit, and US Robotics. Supra and Zoom get mixed reviews. Prices (as of July '94) for these kinds of modems are from $120 and up.

Modems and commercial software are best purchased from the big mail order house such as MacConnection (800 800-0002), PCConnection (800 800-0005), and MacWarehouse (800 255-6227). Modems are often available for about the same price as mail order at Fry's or Egghead. Sometimes, excellent brands are sold at Costco and Price Club!

GSS FTP AT CTP.ORG WHAT'S THAT AGAIN??

If GSS means Global Systems Science what does FTP mean?

File Transfer Protocol refers to the method by which electronic files can be transferred from one computer to another, hopefully yours. More commonly called FTP, File Transfer Protocol allows you to poke around the hard drives of projects like Global Systems Science. Wouldn't you like to know what we have on our hard drive? If there is a file that interests you, say the latest carbon dioxide readings from Mauna Loa, you type "get mlco2data" and that file is whisked along the super highway directly to your computer or to your BBS account.

Usually you don't get to look at our actual hard drive. Instead we set up a Global Systems Science directory (or folder for those with Mac) on a big hard drive called an FTP site. We have set up such a directory, and I'm inviting you to "get" those files!

Currently there are just a few things in the directory, but I am attempting to make it grow whenever I get the chance. I suppose I should now try and dig up the latest Mauna Loa data. I'm sure it's on an FTP site somewhere.

Please send us some email if you successfully retrieve some files and if you have something you'd like us to "put" out for other teachers.

How Do I Connect?

One way is to ask an Internet addict or the system administrator of your local network or service. If they are not available try this.

On most networks there will be a menu choice called FTP. Select it. If it is a bare bones network you will be presented with a FTP prompt. At the prompt you need to type "open" and then the host of the FTP site you want. The host of the GSS FTP site is ctp.org, so you would type "open ctp.org" (no quotes).

Sometimes this process is made easier by programs that allow you to point and click your way through it. The Macs in our office use a program called "Fetch." Ask around to see if something like this would be available for you.

The nice thing about FTP is you don't have to have a special account to use it. When the site asks you for a user id, type "anonymous." (no quotes!) When a host asks you for a password, type your email address.
In my case this would be: "lhsGSS@maillink.berkeley.edu". You're in!

Once you're in, there are three basic commands: "cd" to change to a specific directory, "cd up" for changing to a more general directory, and "get" to obtain a file. Frequently you'll arrive in a directory called pub. On ctp.org you would see lots of directories, one of them will be GSS. Type "cd GSS", and you will see our directories like Ozone, Greenhouse, and Newsletters.

Other Anonymous FTP Stuff

There is lots of information available via anonymous FTP. Here are two announcements I pulled while surfing the net: "Guide to Environmental Resources on the Internet." It is available via anonymous ftp host:
una.hh.lib.umich.edupath:/inetdirsstacksfile:environment:murphybriggs

In this case the host is apparently a computer at the University of Michigan. "Path" refers to the directory path. You may have to type "cd inetdirsstacks" once you connect. The file is of course the thing you want to get.

Another announcement I found is about HOTLINE. It is billed as an occasional newsletter from the US Climate Action Network dedicated to updates and information on climate change science and policy! It is available via anonymous FTP from:
igc.apc.org (192.82.108.1) (numbers can also be used to designate a host). The sub directory is pub/ECIX.

I do not know the quality of this information. Please let me know if you find things particularly useful to those interested in Global Systems Science so I can pass on your recommendation, Contact me at the above address.

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MINI IDEAS

Greenhouse Gas-ette, May 1993
Climate Protection Institute
5833 Balmoral Drive
Oakland, CA 94619

SYSTEMS IS OUR MIDDLE NAME

Given all the efforts of educators, why do students seem to forget so quickly? Why is there so little carry-over from one learning experience to another, or from one semester to another? One of the problems may be the mass of detailed information we offer to students. Although the information may be necessary for a complete picture, for some students the quantity may obscure the understanding. Understanding is particularly difficult when the subject material is dynamic. When variable inputs produce changing outcomes it is easy for some students to become bewildered.

Global Systems Science emphasizes the systems view of phenomena. Its topics are never static. When examined carefully, most of the things we teach in science are aspects of dynamic systems. The complex relationships among the parts of a cell or the way the Sun's energy flows through the atmosphere are examples. Students need encouragement to step back and view the whole picture so they understand what they are studying is a system and not just a collection of parts.

The systems view

A systems view can be essential to understanding as well as an aid to memory. A diagram, a flow chart or a concept map may be remembered when definitions have been forgotten. Such representation can also show students how the whole is greater than the sum of the parts and how to identify multiple causes and effects. Most importantly, a systems view can help students detect unrecognized relationships and experience the "aha!" that signifies insightful learning.

What is a System?

The largest system we know is the Universe itself. The smallest is the collection of elementary particles that make up the mass of the Universe and it is that mass which produces gravity, then the elementary particles interact with all of the Universe. This illustrates on the grandest of scales that "everything is connected to everything else."

System is such a frequently used word that its definition comes easily to mind. *A collection of parts that interact with each other to function as a whole is a system.* The digestive system, the solar system, the political system, the educational system are familiar examples. In the definition is the source of the saying that "the whole is greater than the parts." The behavior of a system is dependent on the entire structure and is not the sum of the characteristics of the parts. It is the relationship among the parts that makes a system function. Occasionally the formation of a system may produce something which is brand new in the world.

Novelty in the world

The synergism of interacting parts can bring new properties into existence. A familiar example is the combination of the gases oxygen and hydrogen. The combined molecule is much more than two gaseous atoms added together. When water is formed new and different properties come into being. The water molecule system behaves in ways that the individual atoms do not. The examples of novel properties entering the world as a result of the formation of new systems are as numerous as the number of different chemical compounds.

On another level the combination of molecules that form living organisms present a whole new collection of systems with novel properties of their own. It is the *organization* of molecules into a dynamic structure that produces the attribute called *life*. The organization of neurons into a brain structure brings consciousness into the Universe.

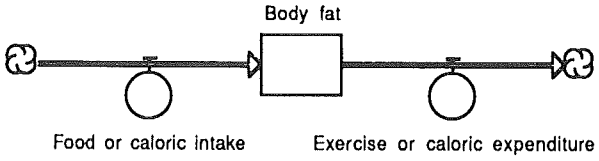
A fundamental organizing principle

One of the fundamental organizing principles of the world may be that systems on one level combine to form new systems on more complex levels. (For an enlightening presentation of the principles of emergence and self-organizing systems see: Waldrop, M. Mitchell, *Complexity: The Emerging Science at the Edge of Order and Chaos*, Simon and Schuster, 1992).

Building Systems Thinking

Encouraging students to think in terms of systems is easy because they are doing it all the time. All of us are constantly constructing mental models of portions of the world around us. Since they most often involve dynamic relationships they can be modeled as systems.

To take a very simple example, if a student is concerned about body weight a diagram relating eating and exercising, like the one the follows, can clarify the relationships.



The symbols are explained on the next page. Looking at the diagram of the system it becomes obvious that if the flow of food into the body is greater than the caloric expenditure the quantity of body will increase. Conversely, the body fat will decrease if expenditure exceeds intake.

What if...? Suppose I...?

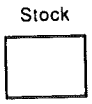
These two common phrases precede the "running" of a mental model of a system. We use the method many times a day to predict the future of a system of interest. Forethought, that special ability which human beings are supposed to be so good at, is essentially modeling a system and mentally running it.

Getting Comfortable With Systems Diagrams

Just as words form a language of discourse, symbols provide a way of depicting systems.

Stocks

In every system there are things or quantities that accumulate.

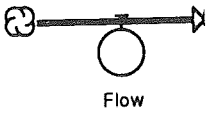


Whether it is the momentum of a moving object, the number of individuals in a population, or money in a bank account, systems have items that increase or diminish in time. They are called *stocks* or *reservoirs.*

Clouds

Irregular circles, "clouds," symbolize general sources and sinks of our stock flows. They serve as boundaries of the system being diagrammed.

Flows



Stocks cannot change unless they are filled or drained. The pipeline and circle valve symbol indicate what is flowing through the system and in which direction. Flows may go from a source, to a stock or a sink, or from one stock to another.

Connectors

A circle with an arrow links parts of a system diagram together. Connectors convey information. Think of them as wires not pipes. They control the valves of the flows and bring information from the stocks.

State

The "state" of a system can be understood by watching how the accumulations change when the flows are active. By altering the flows a system diagram can be used to predict future changes.

SYSTEMS MAPPING - STEP BY STEP

Following these suggestions may make system mapping easier.

Write out a statement of what the system produces or what it does and keep it in mind as the system is mapped.

Make a list of the parts that make up the system. These are the *nouns* of system mapping.

Make a list of what makes the system go. These are actions or processes. To find them think of those things that influence the system as it goes about its work. These represent the *verbs* of system mapping.

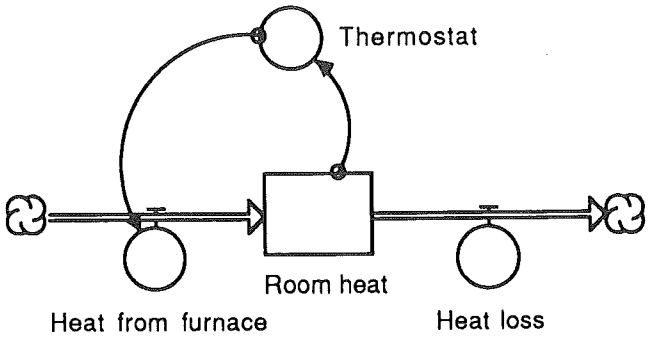
Map the system

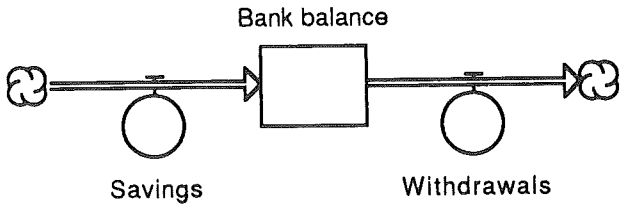
Check to see that all the actions are connected properly.

Analyze the map.

Mentally "run" the model. Change an action or a stock and follow the resultant changes. Does the system map make sense? If it doesn't, has anything been left out? Are the relationships correct?

Some simple examples for your students





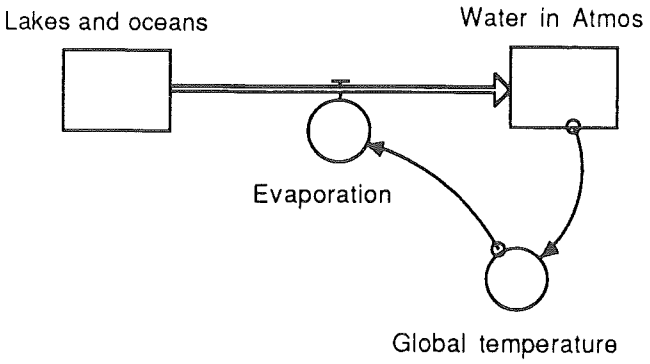
In a diagram of a room heating system (left), a thermostat would be shown as a connector because it conveys information from the room to the furnace. The thermostat provides **negative feedback** since it acts to reduce change in the system, maintaining the room heat at a constant level.

Student Activity 1 - Mapping a system with both positive and negative feedbacks

Information for the student

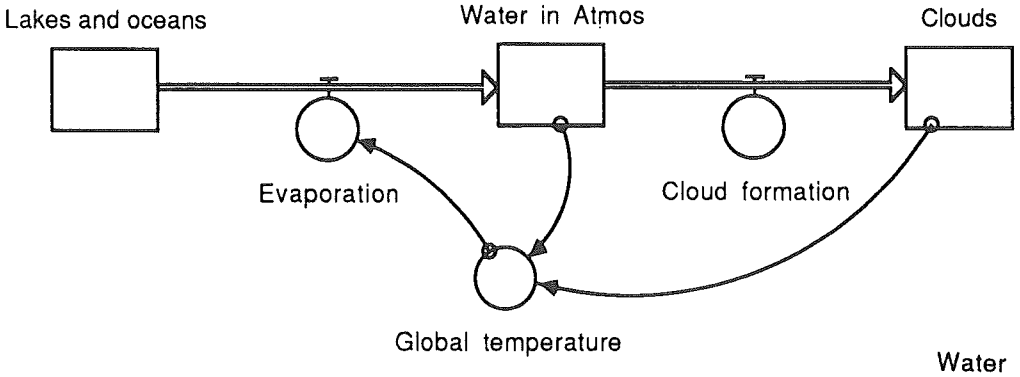
Have your students build a diagram of a portion of the climate system. The stocks are 1) water in lakes and the oceans, and 2) water in the atmosphere. The flow from one to the other proceeds by evaporation.

Since water vapor is a greenhouse gas, increased water in the atmosphere increases the global temperature which in turn increases evaporation, sending even more water into the atmosphere. We must add a global temperature connector to the diagram. The arrows show that water in the atmosphere affects global temperature and global temperature affects evaporation.



Since global temperature adds to the change in the system, it is termed a **positive feedback.**

Now if we want to expand the system to include the effect of clouds a new stock and flow are added to the diagram. The flow of water vapor into clouds is through the process of condensation into droplets. Clouds on average tend to cool the surface therefore they will reduce the average global temperature. The arrow connecting clouds to global temperature indicates this relationship but since this reduces the change to the system it provides a **negative feedback.** Scientists do not know, as yet, which of these processes will dominate. An interesting challenge for your students is to have them add the stocks "rain" and "water in forests" to the system. Leaves add moisture to the air via transpiration. They receive their inflow of water from rain. Droplet formation is the process that produces rain.



Student Activity 2 - The tank toilet system

A - Mapping the system - step by step

To gain practice in systems thinking students should begin by mapping simple systems and then move to increasingly complex ones. Working in small groups is always recommended. The students should begin this mapping by carefully inspecting what happens inside the tank when a toilet is flushed.

Question 1 - What does this system do?

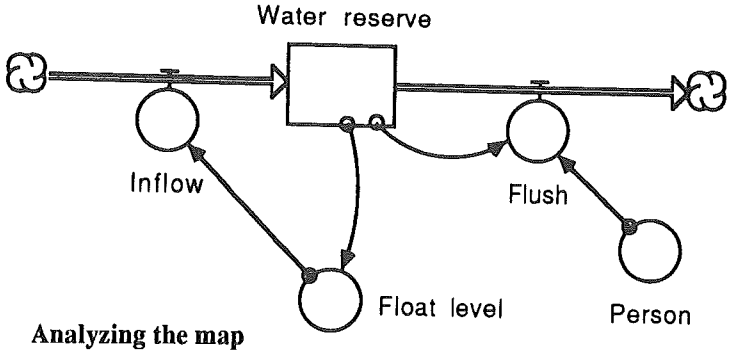
The system stores a specific volume of water, releases it on command and then restores the same volume of water to the reserve.

Question 2 - What are the parts of the system?

The parts of the system are: Water reserve tank, inflow pipes, outflow pipes, valves that control inflow and outflow, float control arrangement, the person activating the flush valve.

Question 3 - What makes the system work?

Things that make the system work: water pressure in the inflow pipe, opening and closing of the inflow and outflow valves, and the changing level of water.



Analyzing the map

Initially the water reserve is full. The person activates the flush valve. The water rushes out, draining the reserve. This lowers the float level and opens the inflow valve. The flush valve drops shut when the water level drops. The water reserve increases. As the water level rises the float level arm reduces the inflow until the original level in the reserve is reached. The cycle is complete.

Discussion of feedback

The tank toilet is another example of a negative feedback system. The information about the water level is fed back into the system to control the water level. This is a good opportunity for a discussion of feedback as a transfer of information.

Aerodynamics
Air Track
Air Transportation
Alternate Fuels
Automobile Manufacturing
Automobile Transportation
Bio-Related Technology
Biosphere
Bio-Tech Earth
Bio-Tech Sewage
Bio-Tech Water
Bridge Building
Bridge Construction
CNC Mill and Lathe
Communications
Computer Animation
Computer Applications
Computer Problem Solving
Desktop Publishing
Electrical Control
Electrical Power
Electricity
Electronics
Engineering Structures
Environmental Management
Environmental Technology
Fiber Optics
Flight Technology
Flight Transportation
Health Care Technology

Home Building
Hydraulics
Hydro Electric Power
Laser & Fiber Optics
Manufacturing Technology
Mechanical Power
Meteorology & Weather
Microwave Technology
Petroleum Manufacturing
Plastics Technology
Pneumatics
Pneumatics & Simple Machines
Power Generation
Precision Measuring
Process Control
Radio Communications
Research & Design
Road Transportation
Robotics
Satellite Communications
Solar Energy
Solar Photovoltaic
Solar Stirling Engine
Solar Thermal
Space & Rocketry
Telecommunications
Transportation
TV & Video Production
Waste Water Management
Wind Power

Al Fleming
Champaign Centennial High School
913 Crescent Dr.
Champaign, IL 61821

HOW CLOSE IS THE MOON?

A difficult concept to teach students of any age is the great distances in space. Most people are amazed when they learn how truly vast the universe is. This realization can come about quickly by using a simple technique involving our nearest celestial neighbor, the Moon. Most people have a misconception of the true distance to the Moon from the Earth. Estimates are usually much less than the actual distance. This misconception has been propagated in illustrations in most astronomy or space science textbooks. We can demonstrate the true scaled distance with a simple demonstration that the students can do themselves.

Bring a box with a number of spherical objects to represent the Earth and Moon. Include objects such as a marble, ball bearing, golf ball, ping pong ball, tennis ball, basketball, baseball, racquetball, BB, nerf ball, mini-basketball, various sized rubber balls; etc. A variety of choices in size enhances the demonstration. Have enough objects to allow the class to work in groups of two. Have each group select one object to represent the Earth and one to represent the Moon. Their selection should be based on the relative size of the Earth and Moon.

Then, based on their selected scale size of the Earth and Moon, have each pair of students hold the spheres apart to represent the Earth-Moon distance. Be sure to emphasize that the distance must be based on the relative size of the objects they selected.

There can be a number of correct answers depending on the objects selected. In fact, there should be enough objects so that all groups could potentially get the right answer. For example, if a group selected a tennis ball to represent the Earth, a marble would represent the approximate size of the Moon. At this scale the two objects would be held 2.0 meters apart. If a mini basketball is used for the Earth, then a racquetball would be the correct size for the moon. At this scale the two objects would be held 5.5m. apart. The following information will prove useful in guiding this activity.

Diameter of the Earth = 12,756 km or 7,921 mi
Diameter of the Moon = 3,476 km or 2,159 mi
Earth-Moon Distance = 384,400 km or 238,712 mi

Generally speaking, the Earth-Moon distance is 30 times the diameter of the Earth and the diameter of the Moon should be one quarter that of the Earth. Therefore once the object is selected to represent the Earth, it's diameter can be measured. The size of the Moon as well as the Earth-Moon distance can also then be estimated. Rulers can be used to measure diameters and distances.

Most will overestimate the Earth-Moon size ratio and underestimate the Earth-Moon distance. The reason this is true is because textbook depictions are often inaccurate. To show any detail of the Moon in an illustration with the Earth the Moon has to be enlarged. And to get the Earth and Moon on the same page of text the distance between the two objects has to be reduced significantly.

OPPORTUNITIES

University of Illinois Physics Department
Outreach Programs
Dr. Inga Karliner, Prof Mats Selen, Mr. Bob Williams
Physics Department
University of Illinois at Urbana-Champaign
1110 W. Green Street
Urbana, IL 61801

THE PHYSICS VAN

The Department of Physics has been working on a multifaceted outreach program. The Physics Van is designed for kindergarten through middle school. The Saturday Physics Honors Series offers contact with research physicists to selected high school seniors. We also sponsor physics workshops for science teachers with workshops appropriate for teaching grades K through 12. The goal of the program is to stimulate students' and teachers' interest in science and physics by improving their familiarity with classical and modern physics. In this article we review the Physics Van program in more detail. Contact information for the Physics Workshop and Saturday Honors programs was included in the Winter '94 issue of the Spectrum. .

The University of Illinois Physics Van

The Physics Van project, directed by Professor Mats Selen, has given twenty seven shows between March and November of 1994. Most of these shows were done at area schools, although some were performed at the Loomis Laboratory of Physics for visiting groups such as Urbana Park District Summer Day Camps, or the Countryside School Science Camp. A Van show was also given at the Don Moyer Boys and Girls Club. In a typical performance, three or four undergraduate volunteers perform for a group of between twenty and two hundred students and teachers. They show a number of fun and interesting experiments demonstrating, for example, states of matter, electricity, or gas pressure. Some of the demonstrations can be repeated by children on their own at home. Students and teachers from the audience participate in the experiments whenever possible. The children impersonate solids, liquids and gases in the demonstration of atomic motion in the three states of matter. They experience the sudden push backwards when they hold a fire hose in an experiment illustrating the use of momentum conservation by rockets. They see their teacher's hair stand up when the teacher's body is charged by the Van de Graaf. They compete with an air vortex generator trying to blow out a candle. Even when they cannot participate directly, their attention is captured by the experiments. For example, the liquid nitrogen cannon provides a loud and startling illustration the power of expanding gases, and a hard but very brittle banana cooled in liquid nitrogen is used to pound a nail into a piece of wood. The goal of the program is to create enthusiasm and stimulate curiosity among elementary and middle level students and their teachers alike, showing them that science is interesting, fun, and within their grasp. Teachers receive descriptive material ahead of time. Special topics can be requested by teachers to enrich and illustrate their lessons. The Van personnel collects questions that arise after the visit and Physics Department faculty and staff work out and distribute the answers to these questions. Feedback has been extremely positive, both formal evaluations and informal comments. One of our favorites was a six year old girl who asked her teacher how to spell physicist after the Van visit. She wanted to write in her journal that she wanted to be physicist when she grew up. Another favorite was a letter from a school principal who wrote he would have made time to come seethe show himself had he known how good it was going to be. The Van effort will continue in 1995. Information about scheduling a Physics Van visit should be directed to Prof. Mats Selen in the Department. The Van program is free of charge. Contact:

Prof Mats Selen
433 Loomis Laboratory of Physics
tel (217) 333 4173
email mats@uihepa.hep.uiuc.edu

MOLECULAR BIOLOGY ENRICHMENT FOR YOUTH 1988-95

MBEY is designed to intellectually challenge students and assist them in developing critical-thinking skills. MBEY introduces participants to hands-on science, giving them the opportunity to develop their lab skills and providing them with the equipment, supplies, and guidance to pursue their own interests and initiate an independent research project. Lectures provide the necessary background to understand the lab activities and in the final week there is a discovery environment as each participant carries out experiments on an independent project.

The four week residential program is held on the campus of Iowa State University (ISU) in Ames, Iowa. Ames has all the conveniences and cultural attractions of a large city, but in a beautifully green and safe small town environment. Participants will live in an air-conditioned campus residence hall with supervision provided by MBEY resident assistants.

Dr. Bernard J. White, Professor and Chairman of the Department of Biochemistry and Biophysics, directs the program, now in its sixth year. In addition, the teaching staff includes other ISU professors and instructors, secondary school teachers, and undergraduates in science. Participants will interact with other practicing scientists in visits to biotechnology research centers both on and off campus. Throughout the four weeks, participants will investigate career options in the sciences. Stimulating academics are the main emphasis, but various social, cultural, and recreational activities are planned.

ELIGIBILITY

All students entering eighth or ninth grade with high ability or high potential in science are eligible. We especially encourage women, minority, and handicapped students to apply. *Applicants should realize that this program assumes an interest in science and that it will be an intense experience—but we guarantee participants won't be bored!*

DATES

The program runs from Saturday, June 19, 1995 through Saturday evening, July 17, 1995. Parents/guardians are strongly encouraged to participate in opening day. An open house and banquet for participant's family and friends will be held on the closing Saturday.

COSTS AND FINANCIAL AID

Grants from Eli Lilly and Company, National Science Foundation, and Iowa State University cover tuition costs. Participants pay only room and board—a total of $650. Financial aid is available by application. No applicant will be denied access to the program because of financial need.

For an application packet, please write our office:
Molecular Biology Enrichment for Youth
4210 Molecular Biology Building
Iowa State University
Ames, IA 50011
or call 515-294-7713; FAX: 515-294-0453
Deadline for completed applications: April 21, 1995.

MATERIALS WORLD MODULES

The Material World Modules are integrated, inquiry based, project centered, supplementary instructional packages for your science, technology or mathematics course. The first three of nine modules are ready for classroom testing. Six additional modules are under development. The first three modules are:

Composites Module guides students through the construction, testing and evaluation of composite materials leading to the design of a model fishing pole in preparation for a composites design project.

Smart Materials Module allows students to investigate piezo film transducers, memory wire, and electrorheological materials as preparation for designing a "smart response" device.

Polymer Module has students making, testing and evaluating the properties of polystyrene and polyvinyl acetate polymers in preparation for a project designing a humidity testing device.

Modules under development include materials which are:

- Biosensors, Infrastructure, Ceramics, and Biogradable
- Characteristics of MW
- Teach students about materials science
- Provide hands-on-minds-on labs with high tech materials
- Increase students' scientific literacy
- Close the gap between current research and school science
- Emphasize the development of questioning skills
- Provide practice with interactive design cycles
- Includes projects requiring creative, cooperative solutions
- Meet the NRC and 2061 inquiry and technology standards
- Supplement existing science and mathematics curricula

The MWM project is seeking teachers to test modules with classes. If you wish to become involved or learn more about the Materials World Modules, please contact us;

Materials World Modules
Annenberg Hall
Northwestern University
Evanston, IL 60208-2610
708-467-2489
fax 708-491-8999

FIELD TRIPS/WORKSHOPS

ILLINOIS DEPARTMENT OF CONSERVATION WORKSHOPS

The Illinois Department of Conservation, along with over 200 volunteer-trained facilitators throughout the state, offers workshops on the national environmental education programs Project WILD, Project WILD Aquatic and Project Learning Tree. Persons attending a 4 1/2 hour workshop on any one Project take home the related activity guide, many interesting activity ideas and other resources pertaining to conservation and environmental education in Illinois.

Project WILD is an interdisciplinary, natural resources education program for grades K-12. It is of value to teachers as well as leaders at camps, parks and nature centers. The focus is on wildlife and wildlife habitats. **Project WILD Aquatic** focuses on water habitats and their unique wildlife. The activities cover ponds, lakes, streams, oceans and more. Students K-12 develop a deep understanding of the issues we face in protecting this limited, vital resource. **Project Learning Tree** deals with forestry issues. Students PreK-8 interact with the natural and social environments. PLT includes dozens of well-designed, easy to use activities. The PLT guide has undergone an extensive, three-year review. If you've previously attended a workshop, you might want to attend another one to receive the new activity guide containing 96 new and exciting activities.

The Illinois Department of Conservation is organizing a workshop to train additional volunteer facilitators for Project WILD and Project WILD Aquatic. To quality for the training you must have attended Project WILD and Project WILD Aquatic workshops. The fifteen workshop will be held in mid-June in central Illinois. An advanced workshop will be held on July 6 for persons having already received Project WILD Aquatic training. The workshop will be held on the Wabash River near Beall Woods State Natural Area and will provide opportunities to learn about a variety of aquatic topics, such as fisheries, macroinvertebrate and water quality sampling.

All of the activities in the Projects activity guides have been correlated to the Illinois State Goals for Learning. A reference book is distributed at each workshop.

To learn more about the Projects or to schedule a workshop for your school or district, contact IDOC—Conservation Education, 524 S. Second Street, Springfield, Illinois 62701; 217/524-4126.

GEO-RESOURCES and the ENVIRONMENT
A Field Activity for Teachers
June 25 - 29, 1995

This 5-day field trip for teachers at all levels will investigate how resources along Lake Michigan's eastern shoreline are utilized and reclaimed. Concepts and topics featured at visitation sites will be integrated with major science goals and objectives. Along with the extensive field guide, participants will receive classroom-ready activities keyed to locations visited during the trips Tentative sites include:

- Beach & Dune Use including Environmental Concerns.
- Kent County Incinerator & Regional Recycling Center.
- Kent County Waste Water Treatment Facility.
- Grand Rapids Water Supply Intake & Treatment Facility.
- Consumers Power Coal-Fired Electrical Generator.
- Muskegon County Waste Water Treatment Facility.
- Ludington Pump Storage Plant.
- Sand Dune Mining and Foundry Sand Operation.
- Salt Solution Mining & Reclamation Facility.
- Sleeping Bear Dunes National Lakeshore.
- Oil Field Operation.
- Medusa Limestone Quarry.
- Big Rock Point Nuclear Power Plant.
- Penn Dixie Quarry Reclamation Project @ Petoskey.

(Opportunities to collect specimens and a fly-over will be provided)

Great Lakes Geoscience provides the leadership expertise, and fun. You provide transportation, lodging, and meals. Family/spouses welcomed.

Two sem. hrs. credit option from Michigan State University.

For further information:
Great Lakes Geoscience
7705 N. Canfield Road
Belding, Michigan 48809
(616) 794-3339 or (517) 321-2473

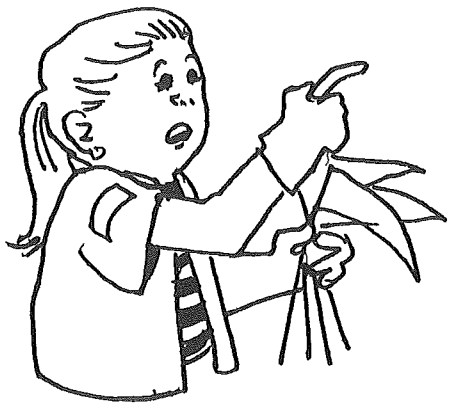


IMAGE PROCESSING WORKSHOPS FOR SCIENCE AND MATH TEACHERS

The Center for Image Processing in Education is offering workshops during Summer 1995 to introduce teachers to the powerful technology of digital image processing. Workshops will be held in nine convenient locations around the United States.

Basic Workshops

Albuquerque, NM	June 19—23
Seattle, WA	June 26—30
Phoenix, AZ	July 8—12
Philadelphia, PA	July 17-21
Dallas, TX	July 24—28
Rochester, MN	July 24—28
St. Louis, MO	July 31—Aug. 4
Orlando, FL	July 31—Aug. 4
Springfield, MA	August 14—18

Advanced Workshop

Phoenix, Arizona	July 8—12

The five-day Basic Workshops provide a hands-on introduction to the theory, techniques, and applications of image processing. Teachers learn to enable students to create, display, enhance, and analyze digital images using state-of-the-art tools and data sets.

The Advanced Workshop, introduced last summer, has been expanded to a full five days. It focuses on advanced techniques, image creation, activity development and student research. This workshop is designed for teachers who have already taken one of our Basic Workshops, and wish to enhance their image processing knowledge and skills.

Each participant receives a notebook and CD-ROM filled with 75 ready-to-use activities, software, documentation, and a collection of scientific images. Designed and tested by teachers, these open-ended and customizable activities cover a wide range of topics and disciplines.

Participants should have color Macintosh computers in their schools, either in the classroom or a lab setting, and are responsible for bringing their own computers to the workshop.

The Workshop fee of $ 1,000 includes instruction, materials, lodging for six nights, and follow-up support via electronic mail and toll-free telephone. Participants are responsible for their own travel expenses and meals.

Graduate credit and Continuing Education Units from the University of Arizona is available for workshop participants who wish to complete additional work and pay required tuition fees.

For more information on summer workshops and other inservice programs, contact Melanie Magisos at: Center for Image Processing in Education 5343 E. Pima St., Suite 201 Tucson, AZ 85712 Phone: 800/322-9884 or 602/322-0118

Ronnee Yashon,
Educational Coordinator
Wright Center for Science Education
Tufts University
4 Colby St.
Medford, MA 02144

Summer Workshops offered by The Dudley Wright Center for Science Education

The Wright Center for Science Education is offering four workshops during the summer of 1995. They are as follows:

June 19-23, 1995: Advanced Biotechnology for HS Biology Teachers

Using the latest equipment, participants will do DNA extraction, southern blot techniques, and extract their own DNA using amplification by PCR.

June 25-28, 1995: Frontiers in Science III for HS/Middle School Science Teachers

A multidisciplinary program offered at Governor Dummer Academy in Byfield, MA. Teachers explore interdisciplinary methods of using science.

June 29-30, 1995: Space Science Workshop VIII for HS/Middle School Science Teachers

This program will emphasize earth science, geology and planetary science. Experts and teachers will work on integrating these topics into classrooms.

July 31-Aug. 11, 95: Current Perspectives on Human Genetics for HS Biology Teachers.

Sam Rhine, Genetics educator will present the newest work in Human Genetics in week one. In week two, teachers will work on units to place these materials in the classroom.

All workshops at The Wright Center are free and include accommodation for those in residence. **For applications contact Ronnee Yashon, Educational Coordinator at the address above or call (617) 628-5000 x5394.**

The Bronx Zoo Wildlife Conservation Park
Project W.I.Z.E.: ***Survival Strategies***
Summer Seminar for Teachers
July 31-August 5,1995.

This NSF supported program is available for teachers of grades 7-10, **nationwide.** Project W.I.Z.E. enables to utilize local zoos and other community resources in combination with an outstanding dassroom life science program. Teachers accepted into the seminar will receive free room &c board, a $200 partial travel reimbursement, a $300 participation stipend and a Sunaval Strategies dassroom kit. Graduate level credit is available at an additional cost For further information or an application, write to: Rose Baker, Bronx Zoo Wildlife Conservation Center, Education Department, Bronx, NY 10460, or call 1-800-YES-5131.

The National Science Teachers Association
presents
KENYAN SAFARI
July 23-August 7, 1995

This is your opportunity to take participate in that East African experience you've always dreamed about. Join your fellow science teachers and natural history buffs for twelve days of exploring the forests and plains of Kenya on this NSTA-sponsored tour.

This unforgettable trip includes visits to Masai Mara National Park during the Great Serengeti Migration, exploring the Great Rift Valley, the Kariandusi Prehistoric Site, the flamingos of Lake Nakuru, the mountain forests of Aberdares National Park, a local school and village as well as the people and cultures of cosmopolitan Nairobi.

This workshop is led by dr. Barbara Klemm, Asst. Professor of Science Education, University of Hawaii and Chris Migliaccio, Assistant Professor of Natural Science at Miami-Dade Community College/Wolfson Campus. Both Barbara and Chris are experienced environmental educators who bring great enthusiasm and creativity to their classrooms and field workshops. Credit is available, pending sufficient interest. Cost: $3,450 includes double occupancy, New York departure, all lodging, all but 4 meals, flight insurance, Flying Doctors membership in Kenya, London day room and special lectures.

For more information, contact Chris Migliaccio at 18710 Belmont Drive, Miami, FL 33157 (305-238-5770).

Ira Geer
Education Program
American Meteorological Society
1701 K Street NW Suite 300
Washington, DC 20006-1509
Phone: (202) 466-5728
Fax: (202) 466-5729

We will be conducting two two-week programs for precollege teachers, one on weather at the National Weather Service Training Center in Kansas City and one on the physical foundations of oceanography at the United States Naval Academy. We are seeking elementary, middle and high school teachers who will conduct peer training sessions in their home areas after workshop attendance. We are especially interested in locating applicants who are members of minorities and/or are teachers in schools with significant numbers of minority students.

We are also seeking undergraduate two-and four-year college faculty members who teach introductory-level courses with significant weather content for a second program at the National Weather Service Training Center. We are especially interested in attracting those faculty members who teach sizable numbers of preservice teachers. Contact Dr. Geer at the address given above for more information about programs. **Deadlines are April 14.**

SENSI

(Satellite Evolution and the Nature of Science Institute)

Sponsored by

The National Science Foundation

July 17-28, 1995

Field Museum

Roosevelt Road at Lake Shore Drive

Chicago, IL 66605

EVOLUTION AND THE NATURE OF SCIENCE

* How does a clam mount a fish on its tail?
* Why do all living organisms have the same 20 amino acids in their proteins?
* How does studying the growth of plants or fruit fly genetics increase the understanding of human biology?
* Why is it true that "Nothing in biology makes sense, except in the light of evolution?" -- T. Dobzhansky
* Your students will be more involved in learning science.
* You will have new materials and new methods for teaching biology.
* The unifying theories of science make organizing your curriculum for the school year ever-so-much easier.
* Institute instructors are award winning high school teachers who have tested these materials, and know THEY WORK.

PROGRAM

* 2-week institute at the Field Museum
* 20 Chicago area High School Biology Teachers
* Topics will include: The Nature of Science, Evolution as a Unifying Theme in Biology, History of Life on Earth, Anthropology
* Stipend of $600 will be provided.
* Two hours of graduate credit available from San Jose State University

INSTITUTE FACULTY

Lead Teachers:

Steve Randak - Jefferson H.S.

Tom Watts - North Judson H.S.

Consulting Faculty:

Dr. J. Beard - San Jose State University

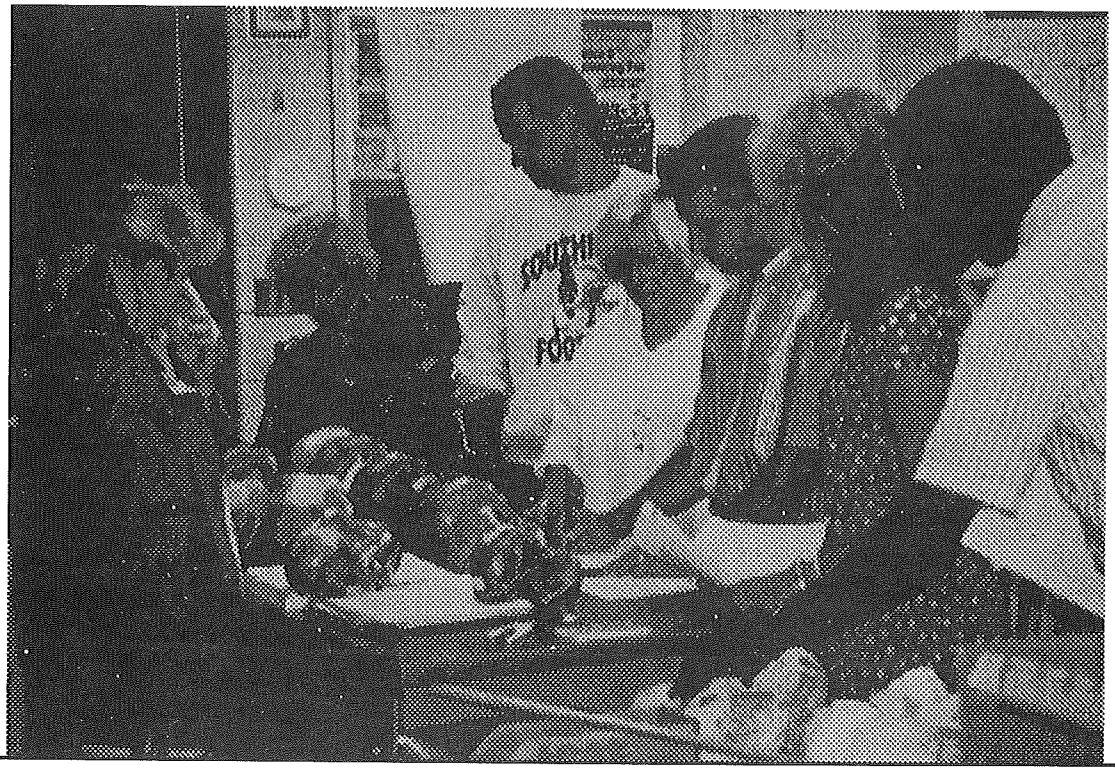
Dr. C. Nelson - Indiana University

Dr. M. Nickels - Illinois State University

DEADLINE FOR APPLICATION: 15 APRIL, 1995

Please send application requests and inquiries to:

Steve Randak
1003 Tory Lane
Lafayette, IN 47905
317-477-7127
FAX: 317-449-3413
E-mail: AESRandak@aol.com



Sharron Santure and Tandy Lacy
Illinois State Museum
Spring and Edwards Streets
Springfield, IL 62706
217-782-0061

ILLINOIS STATE MUSEUM RECEIVES SCIENTIFIC LITERACY GRANT

The Illinois State Museum has received funding for the first year of a three-year scientific literacy program for staff development with teachers of public middle-schools. The program is funded through a grant from the Illinois State Board of Education, Division of School Improvement. An Interdisciplinary Study of Illinois Wetlands focuses on the ecology of wetlands through learning that integrates the disciplines of history, archaeology, geology, zoology, and botany. Teachers of language arts, science, social studies, and mathematics will receive training in a curriculum that includes lesson plans, field trip exercises, and a teaching video to use with grades 5-8.

Workshops in six wetland areas throughout Illinois, as well as implementation and evaluation of classroom curriculum, will be carried out during the first two years. In the third year the program will establish a computer network among participating schools for information exchange. During the summer of 1995, three 2-day workshops will be held in the area of the central Illinois River valley of Mason and Fulton Counties (June 13-14, June 15-16, June 19-20); and in the glacial wetlands of the Volo Bog area of Lake and McHenry Counties (July 11-12, 13-14, July 17-18). Summer workshops for 1996 (dates to be scheduled) will be held in the Green River Conservation Area of Lee and Whiteside Counties, Vermilion River area near Danville, Mississippi River floodplain of Madison and St. Clair Counties, and the Cache River wetlands of Alexander and Pulaski Counties.

Scientists and educators from several state agencies and private conservation organizations are working in partnership to implement the program. They include the Illinois State Museum, Illinois Natural History Survey, Illinois State Geological Survey, Illinois Historic Preservation Agency, Illinois Department of Conservation, The Nature Conservancy, Shawnee Community College, Southern Illinois University School of Medicine, Vermilion County Conservation District, U. S. Natural Resource Conservation Service, and U. S. Fish and Wildlife Service. The grant amount is $69,000 for the first year of the program, with a total 3-year budget of $397,000. Individuals who are interested in further information may contact the Program Director Sharron Santure in the Education Section of the Illinois State Museum, 217-782-0061.

GLENBROOK SUMMER SCIENCE WORKSHOP STS BIOLOGY JUNE 19th -- 23th, 1995

The Glenbrook Summer Science Workshop will offer middle school and high school biology teachers and science administrators an exploration of biology teaching from the perspective of science-technologysociety. This workshop features;

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

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

AAS WORKSHOPS

The American Astronomical Society, with support from the National Science Foundation is sponsoring a four week summer institute to prepare teachers to become AAS Teacher Resource Agents. As agents, teachers are expected to become leaders in astonomy education within their local geographic area. Teachers with a strong interest in astronomy and leadership characteristics are urged to apply. Local site is Loyola University in Chicago (June 19-July 14, 1995). Write today for more information. **Deadline is March 31, 1995.**

Contact:
American Astronomical Society Education Office
University of Texas
Austin TX 78712-1083
(512) 471-6503
aas@astro.as.utexas.edu

SPRING/SUMMER TRIMESTER 1995

DATE	TIME	COURSE
June 2 & 9 Location TBA	1-9 p.m. (F)	**PHYS 51E Eclipses** (credit hour) An annual eclipse of the sun occured on May 10, 1994. The path for best viewing of the eclipse passed from just north of St. Louis to just south of Chicago. This event provided a natural opportunity to accumulate data for understanding one of nature's most spectacular events: an eclipse of the sun. This new course provides practical experience in astronomy and introduces the student to lunar and solar eclipses, the conditions necessary for each type of eclipse, and the proper procedures for observing safely eclipses of the sun.
June 3 & 10 Location TBA	9 a.m.-5 p.m. (S)	**PHYS 518 Inner Solar System: The Terrestrial Planets** (1 credit hour) The planets Mercury, Venus, Earth, Mars, and their natural satellites.
June 16 & 23 GSU	1-9 p.m. (F)	**PHYS 520 Outer Solar System: The Jovian Planets** (1 credit hour) The planets Jupiter, Saturn, Uranus, Neptune, and their natural satellites. Includes new information related to Comet Shoemaker- Levy.
June 17 & 24 GSU	9 a.m.-5 p.m. (S)	**PHYS 516 Halley's Comet** (1 credit hour) A study of early ideas about comets, origin and behavior of comets, and Halley's Comet. Includes new information related to Comet Shoemaker-Levy.

Contact Beverly Kyser at (708)534-4099 for information on other classes and workshops or write Governors State University, Conferences/Workshops and Weekend College, University Park, IL 60466-3191

Cancellation Policy—Registrations cancelled five working days before the program will receive full refund of fees. After that time a service charge may be assessed. No refunds are permitted after the first session.

Who Should Attend—Graduate and undergraduate students in arts and sciences, science teachers (and prospective teachers) on the elementary and secondary levels, astronomy buffs, and the intellectually curious public.

Format—Each course is taught as an intensive workshop. The films, slides, and scientific models used by Dr. Hensley Once the Instruction and introduce students to resource — or their further study and teaching. The instructor will provide students with a comprehensive handout at the first class meeting that will serve as the text for the course. There is a one-hour test at the close of each session.

Credit—Most courses are available for one hour of graduate or undergraduate credit as well as for noncredit. While each course is offered separately, the series adds up to a solid up-to-date preparation in modern astronomy.

Tuition and Fees—Fees per course are: Undergraduate $114.25, Graduate $118.50, Noncredit $50.

Astrology Workshop Just for fun and as an added diversion, Professor Hensley lets his hair down with a workshop on astrology. Astrology is a study of heavenly cycles and cosmic events as they are reflected in our earthly environment. The movements and cycles of the planets form a huge clock that ticks off the time and events of the past, present, and future. Can a study of astrology allow a person to predict the future? Does astrology allow us to see ourselves and life in a greater perspective? Come ponder these fascinating questions 7:30-9:30 p.m. Thursday, June 22, 1995. Participants should know their date, time, and place of birth. They will then learn how to cast a horoscope and try to interpret it. Fee: $15.

REVIEWS

David M. Stone
University High School
1212 W. Springfield Ave.
Urbana, IL 61801
dstone@ncsa.uiuc.edu

Human Genetics: Concepts and Applications

Ricki Lewis, Wm. C. Brown Publishers, Dubuque, IA, 1994, 394 pages. ISBN #0-697-13315-X.

Last summer I had the opportunity to again attend the weeklong Human Genome Project: Genetics Education Workshop for Secondary Science Teachers Workshop sponsored by the University of Kansas Medical Center. During the workshop I came across this text, clearly one of the best written, up to date genetics books suitable as either a high school level text or a life science/biology teacher reference book. This book is clearly one of the best I've encountered in my search for current information regarding genetic maladies and current technologies. Each topic is introduced using a case study approach, thus humanizing and making clear the application's significance at the onset of topic coverage.

Traditional topic (e.g. meiosis/mitosis, the cell cycle) coverage is uniformly excellent. The development chapter is one of the most clearly written chapters I've seen in any textbook, particularly the sections dealing with genetic control of aging and the developmental effects of alcohol, cocaine and cigarettes. Inheritance coverage includes traditional Mendelian topics (with a particularly large number of human examples) as well as nontraditional inheritance topics such as uniparental disomy. Coverage of linkage, X chromosome inactivation and genomic imprinting (a situation in which the expression of the disorder differs depending upon which parent transmits the disease-causing gene or chromosome) are uniformly excellent. Detailed discussion of the multifactorial inheritance of skin color, cleft lips, hypertension, cardiovascular disease, obesity, intelligence and schizophrenia are particularly interesting.

DNA structure and replication, gene function, gene mutation and cytogenetics sections are well presented and clearly updated. Topics I found particularly valuable in these sections include those dealing with PCR, DNA repair, homeoboxes, triplet repeat disorders (e.g. Fragile X and Alzheimer's disease) and collagen disorders (aortic aneuryism, osteoarthritis and osteoporosis). The cytogentics sections dealing with chromosome morphology, amniocentesis, chorionic villi sampling and various syndromes (Down, Turner, Klinefelter and Jacob) are particularly current, moving away from much of the stereotypical, often incorrect, information still found in many current text editions.

Population genetics finally receives more than the traditional cursory coverage of Hardy-Weinberg equilibrium, expanding to coverage of DNA fingerprinting, controversy regarding ethnic databases, geographic and linguistic cues regarding consanguinity, founder effect in Afrikaners, the impact of bottlenecks, and the applications of population genetics in the tracing of African heritage.

A large section is devoted to human origins and evolution. This becomes the vehicle for introduction of molecular evolution, including comparison of chromosome banding patterns, protein sequences (parsimony analysis and mitochondrial DNA clocks) and expands to the use of molecular systematics in captive breeding of endangered species.

The final three chapters deal particularly with applied aspects of human genetics and technology. Recombinant DNA technology, recombinant drugs and transgenic organisms (bacteria, plants and animals) are introduced through a number of examples and case studies. Gene therapy is approached historically through a number of case studies, thus demystifying a number of aspects of this rapidly growing area of endeavor. The chapter dealing with DNA probes and their application is particulary straightforward. The final chapter is devoted to reproductive technologies, emphasizing types of infertility, infertility testing, artificial insemination and surrogacy.

Beyond the text coverage, I was impressed with a number of organizational efforts that make the book a particularly useful reference. The glossary is divided into three components: a general glossary, a chemical term glossary and a glossary of disorders discussed in the text. Each chapter ends with a bioethical issue section, sample case studies for discussion and an excellent suggested reading list which includes a 1 to 2 sentence summary of the content of each reading. The author makes outstanding use of photographs, diagrams and tables throughout the book. The only things I find to be negative regarding this book are its high cost ($45) for a large trade paperback and its less than durable cover, making it less desirable as a student text.

K R. Cranson
Great Lakes Geoscience
(517) 321-2473

Volcanoes of the World

Simkin, Tom and Lee Siebert, Smithsonian Institute, 1994, 349+ pages, $25.00(?), Geoscience Press, P.O. Box 42948, Tucson, AZ 95733-2948, 602/326-9595.

Picture this situation: you have been using the media to build interest in geologic events and illustrate the importance of earth science in our modern world. One of your smartaleck students comes to class with a clipping from some remote publication about an eruption of the Bezymianny volcano. "Where is it?" she asks. No problem, just haul out *Volcanoes of the World* and show her how to find the volcano in question.

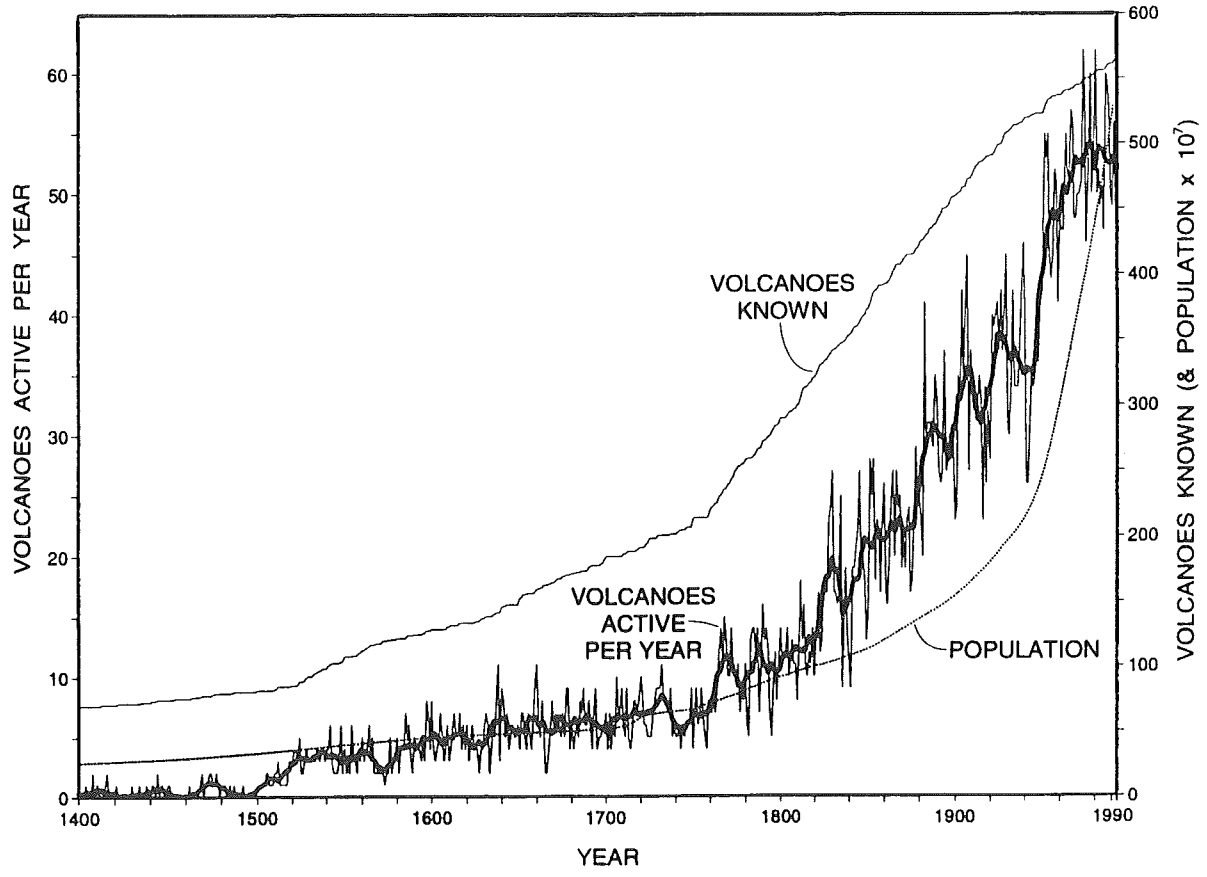
Volcanoes of the World is an amazing collection of information about one of the most exciting aspects of our dynamic earth. It offers this information in four data tables: Directory of Volcanoes, Fatalities & Evacuations, Chronology of Eruptions, and Gazetteer. These allow you to track down a volcano and/or its history with very little information to start with In the scenario above; all I had was a name. You can also begin with just a location or date of eruption. In addition, for serious students, an extensive reference list is provided.

An introduction provides a complete description of the four data tables that compose most of this reference. In addition, it contains an excellent review of volcanoes, their behavior, and related terms used to describe these aspects. In fact, the introduction represents a fair mini-course in the nature and history of volcanoes and their eruptions to the degree that historical records allow. This chapter also describes the volcano location map (inside the covers), volcano numbering system (each is assigned an ID number), dating techniques, historic trends, and many other interesting insights on volcanoes. Numerous tables and graphs enhance understanding of the more technical aspects of volcanology.

It's fun just to browse and ask questions that come to mind; "What was the largest eruption ever?", "What country has the most volcanoes?" or "Are there any volcanoes in Florida?" Looking for a fantastic source for trivia questions? Here it is!

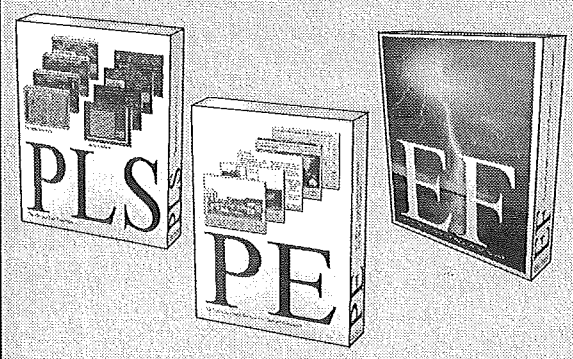
Let's talk value now. *Volcanoes of the World* lists over fifteen hundred volcanoes. At under $30, including tax and other costs, this reference provides tons of information on volcanoes at less than two cents apiece. Show me another book that gives such a bargain.

By the way, Bezymianny is located on Russia's Kamchatka Peninsula at the west end of the Aleutian Island chain. It has erupted every year since 1989, often with violent explosions. One of Bezymianny's largest eruption started on October 22, 1955 and continued until March 1, 1957. During that period a central crater eruption produced 10° cubic meters of tephra in nuees ardentes/pyroclastic flows and mud flows. The Volcanic Explosive Index is 5, considered very large on this scale of 1 to 8. A crater dome was also built. I discovered all this detailed information in just a few minutes with *Volcanoes of the World.* You and your students can do it too!



This graph compares volcanic eruption activity with known active volcanoes and human population over the past 600 years. The dramatic increase in erupting volcanoes shown during the past 200 years is probably just a result of better reporting and communications, not an increase in activity.

Make Science Visual!



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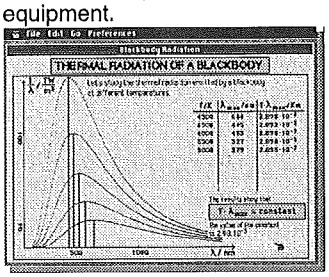
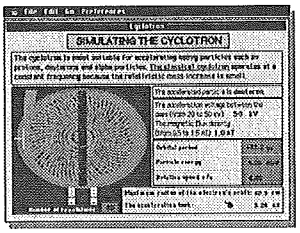


Simulation parameters are controlled by the user, and several illustrative example settings are available with quick mouse clicks. The parameters are clearly displayed and all graphs are well labeled. No pre-programming is needed by the instructor. Demonstrates several physics phenomena with emphasis in modern physics.



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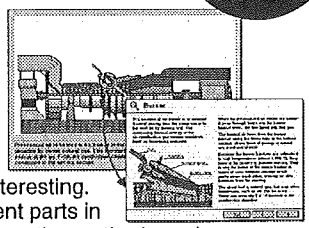
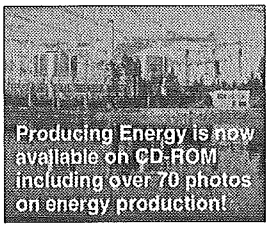
Producing Energy (PE) is a combination of animation, simulation and multimedia designed to make energy education easy and interesting. PE explains the different parts in power generation, shows the methods and machines, and calculates the cost of energy to the taxpayer and the environment. PE also presents this information in numbers, graphs and charts.





Due to the hierarchial structure, users can get a brief overview or zoom in for closer study of each power generation step.

(PE) Available on 3.5" diskettes or on CD-ROM (CD-ROM includes both Windows and Macintosh versions on a single disc)

EnergyFlow

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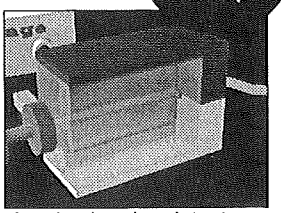
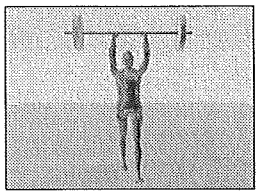
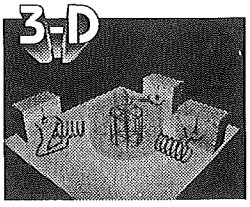
For MS Windows and Mac (CD only)

EnergyFlow (EF) supplies concrete facts to support abstract concepts in science. EF presents the principles, units used and the transformations of different forms of energy through practical examples with three dimensional animation, latest simulation techniques, graphics and video. Despite the practical approach taken the attention to detail inherent in science is carefully maintained.

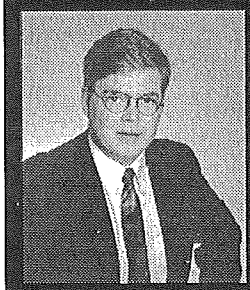






EF is a valuable tool in teaching biology, physics, chemistry and geography.

(EF) Available on CD-ROM with both Windows and Macintosh versions on a single disc.



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Illinois Department of Conservation Produces Conservation Education Materials

RESOURCE CONSERVATION EDUCATION KIT

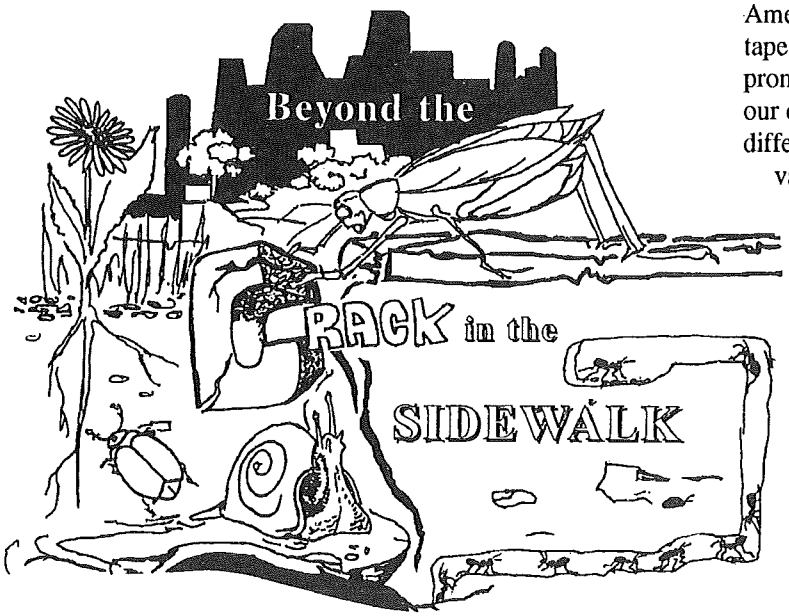
In September 1994 the fourth education kit produced by the Illinois Department of Conservation was released. *Resource Conservation* deals with the renewable natural resources—what they are, how they are managed and how that management may permit consumptive use.

This education kit contains a closed-captioned videotape, ten lesson plans, a two-sided full-color poster and variety of learning activities. Lesson plans and learning activities have been correlated to the Illinois State Goals for Learning.

Each public and private school registered with the Illinois State Board of Education and having grades 7-10 received a copy. County Soil and Water District staff hand-delivered education kits in most counties, with UPS delivery to the six most populated counties.

BEYOND THE CRACK IN THE SIDEWALK

Produced through a grant from the U.S. Forest Service, the Illinois Department of Conservation will release in early 1995 an activity book on urban ecosystems. *Beyond the Crack in the Sidewalk* leads the learner through a variety of activities to learn more about the plants and animals present in an urban ecosystem. Multiple copies of the activity book will be mailed to each public and private school having grades 3-6 and registered with the Illinois State Board of Education.



American Chemical Society
Martha Turckes
Department of Academic Programs
1155 Sixteenth Street N. W.
Washington D.C 20036

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***ChemSource*, a must-have resource for all high school chemistry teachers** has two parts: *SourceView*, a five-hour videotape containing examples of excellent chemistry teaching and *SourceBook*, a set of 36 modules (over 2,000 pages) on chemistry topics. Developed by chemistry teachers, *SourceBook* modules contain topics such as acids and bases, forensic chemistry, polymers, solutions, and stoichiometry. For each topic there are lab activities, demonstrations, and humor.

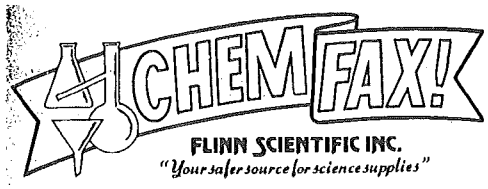
SourceView sells for $55; *SourceBook* (hard copy) sells for $70.00; *SourceBook* (CD-ROM) sells for $50. To order call (202)452-2113 or for additional information write to: American Chemical Society, Education Division, Room 806, 1155 Sixteenth Street, NW, Washington, DC 20036.

People Who Took Chemistry, That's Who is an exciting chemistry career video available from the American Chemical Society. The 15-minute videotape, intended for middle and high school audiences, promotes the value and importance of chemistry in our daily lives. Male and female professionals from different ethnic backgrounds describe their work in various disciplines in which chemistry plays a central role. The video features the chemistry involved in recycling plastics, analyzing environmental pollution, and producing compact discs, polyester fibers, and other high-technology products. A 52-page user's guide accompanies the video.

The video with user's guide costs $24.95 plus postage and handling. To place your order call (202)452-2113 or for additional information write to the address above.

THE STATUS OF SCIENCE TEACHING

A report titled "Science Education in Illinois' Scientific Literacy Target Schools, K-6, 1994 has just been published. The survey examined science curriculum, instructional processes, assessment, leadership, staff effectiveness, school environment, parental involvement, and school-community relations. We also compared the data from Target Schools to the responses we obtained from schools in general (statewide) in a similar survey conducted the previous year. Single copies of this report are available from Dr. Kevin Finson or Dr. John Beaver, Department of Elementary Education and Reading, Western Illinois University, Macomb, IL 61455. Contact them for ordering quantities of this report.



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P.O. Box 219
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Note—Chem Fax! requests can only be sent to teachers at school addresses. Have fun with Flinn Chem Fax!

POPULATION ACTION INTERNATIONAL

Population Action International (formerly Population Crisis Committee) is "an independent, nonprofit research and advocacy organization committed to stabilizing world population through universal reproductive freedom. Supported entirely through private grants and contributions, Population Action works to promote worldwide access to safe, affordable, voluntary planning services and expanded opportunities for women. Its goal is a world that supports the long-term well-being of human life in an abundant and diverse natural environment. The organization's Population and Environment Program tracks scientific research and policy debates and makes findings and conclusions more accessible to the public, the news media, and policymakers." For further information, contact Populations and Environment Program, Population Action International, 1120 19th St., NW, Suite 550, Washington, D.C. 20036; (202) 659-1833.

Single copies of the 56-page booklet C*hallenging the Planet: Connections Between Population and the Environment* (1993) can be purchased from Population Action International for $3 each, or $2 for 2 or more. Also, they offer full-color wall charts and Briefing Papers ($5 each), Studies ($8 each), Booklets ($3 each), and Population Policy Information Sheets: Questions and Answers ($1 each). A 14-minute VHS video on population/environment narrated by Walter Cronkite, titled "Decade of Decision," is available for $15. For more information about these resources, contact Population Action International, 1120 19th St., NW, Suite 550, Washington, D.C. 20036.

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GROUNDWATER PROGRAMS IN THE GREAT LAKES: A NETWORKING RESOURCE

A Directory for Groundwater Professionals from the Freshwater Foundation

THE MISSION Through a grant from the W. K. Kellogg Foundation, a group of groundwater professionals was assembled by the Freshwater Foundation to create a leadership network in the Great lakes Basin. This network forms cooperative partnerships and shares creative solutions. To enhance this effort, the network has created a directory of groundwater efforts in the Great Lakes—*Groundwater Programs in the Great Lakes: A Networking Resource.*

THE DIRECTORY *Groundwater Programs in the Great Lakes* provides summaries of current groundwater programs in the Great Lakes Basin, including contacts in environmental groups, local, state, and federal agencies and citizen groups.

THE NETWORK *Groundwater Programs in the Great Lakes* includes local and state entries from Illinois, Indiana, Michigan, Minnesota, New York, Wisconsin, Ohio, Pennsylvania, Quebec, and Ontario.

THE RESOURCE *Groundwater Programs in the Great Lakes* includes a section of Groundwater Stories—profiles of innovative groundwater research projects, education programs, and management efforts that bring creative solutions to common problems.

THE OFFER While supplies last, we're offering this indispensable resource for **only $14.00**—Order now! Contact: Freshwater Foundation, 725 County Rd 6, Wayzata, MN 55391, (612) 449-0092 FAX (612) 449-0592

AMPHIBIANS AS BIO-INDICATORS: An Amphibian Slide Set, Curriculum and Population Survey

PROBLEM: *Since 1989, scientists worldwide have been alarmed by a dramatic decline in amphibian populations. Because amphibians have a biphasic life cycle and permeable skin, and are exposed to pollutants and other environmental stressors on a daily basis, they can serve as early warning indicators, or "bio-indicators" of potential drastic changes in ecosystems.*

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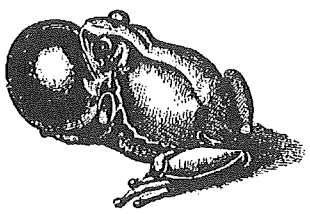
The slide set includes a professional 35mm color slide of each of 173 amphibians. All slides are numbered and identified using current common names. They provide an exciting visual enhancement for the study of amphibians. Customized slide sets are available for 24 states. An accompanying teacher's curriculum guide will provide ideas and background information for the unit.*

The slide set was compiled from the works of several well-known professional wildlife photographers: **Joseph T. Collins**, University of Kansas Museum of Natural History, and co-author of The Peterson Field Guide to Reptiles and Amphibians; **Suzanne L. Collins**, professional wildlife photographer from Lawrence, KS; and **Larry L. Miller**, professional wildlife photographer and Science Department Chairman, Topeka Collegiate School, Topeka, KS.



The 450-page Peterson Field Guide to Reptiles and Amphibians provides detailed descriptions of those amphibians featured in the slide set, as well as 400 others. It features the unique Peterson Identification system, distribution systems, and 656 color illustrations. (For younger students, the simplified, 128-page Peterson First Guide to Reptiles and Amphibians is available.)

The "Calls of Frogs and Toads" cassette, side 1, identifies calls made by 42 species. A 28-page reference guide arranges the species by taxonomic family. Side 2 is a narrated introduction to other types of calls: aggressive, rain, hybrid, warning, distress, advertisement calls, etc.

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FOR ORDERING INFORMATION: Call ECOL-O-KIDS at 1-800-423-7202 **or Write:** 3146 Shadow Lane, Topeka, KS 66604

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Phone: (517) 887-0499

FREE CATALOG LISTS EDUCATIONAL RESOURCES

A free catalog featuring educational resources about insects, spiders, earthworms, and snails is available from the Young Entomologists' Society. Included are books, teacher's guides, kits, rubber bugs, puppets, videos, audio tapes, games, posters, t-shirts, and more. Also includes teaching ideas and information on all services offered by Y.E.S., a not-for-profit educational organization. Write or call Young Entomologists' Society, 1915 Peggy Place, Lansing, MI 48910-2553; (517) 887-0499.

THE INSECT STUDY SOURCE BOOK (5th Ed.). A complete guide to more than 1200 businesses, organizations, and individuals around the world who can provide insect study productions and services: just about anything you need from A to Z! Includes world's most complete list of insect zoos, butterfly houses, and entomological organizations. A must for all insect enthusiasts. Soft-cover, 128pp. Postpaid Prices: $11.00 (USA), $13.00 (Canada/Mexico), $14.00 (Others)

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THE INSECT IDENTIFICATION GUIDE. This guide makes learning insect identification easy! Includes basic classification and identification methods, basic insect biology, key recognition features, insects and immatures), cross-referenced lists to insect common and scientific names, and resource materials. Softcover, 72pp. Postpaid Prices: $9.00 (USA), $11.00 (Canada/Mexico), $12.00 (Others)

THE CASE FOR LIVE PUBLIC BUTTERFLY HABITATS IN THE UNITED STATES. Features information on live butterfly "habitats," how live butterfly environments can serve the public, experiences of existing exhibits, specific components of live butterfly environment, and developing live butterfly environments. 33 pp. Postpaid Prices: $7.00 (USA), $9.00 (Canada/Mexico), $10.00 (Others)

CARING FOR INSECT LIVESTOCK: AN INSECT REARING MANUAL. This manual provides complete information and "tips" for rearing 60 different insects and arthropods. Features the advice of 43 rearing experts that have been compiled and edited into a single treatise. Anyone who raises live insects and other arthropods, for whatever reason, will find this handbook invaluable. Softcover, 96pp. Postpaid Price: $10.00 (USA), $12.00 (Canada/Mexico), $13.00 (Others)

ORGANIZING BUG DAYS AND INSECT FAIRS. Discusses many topics of importance to the organizer of a "bug day" or "insect fair" at parks, nature centers, and museums, or an insect theme day at schools and daycare centers, from initial planning to follow-up after the event. Features hundreds of tips, resource ideas, and activity suggestions, and dozens of ready-to-use reproducible handoutss and an extensive bibliography. Softcover. 66pp. Postpaid Price: $9.00 (USA), $11.00 (Canada/Mexico), $12.00 (Others)

BEGINNER'S GUIDE TO OBSERVING AND COLLECTING INSECTS. Here is the detailed information and practical tips needed by beginning and novice entomologists wanting to study the fascinating world of insects. Written in easy to understand language and filled with lots of illustrations, this guide covers topics such as what is an insect, where, when and how to look for insects, making an insect collection, interacting with other insect enthusiasts, and careers and scholarships. There is also an extensive bibliography and information on entomology resources. Softcover, 96pp. Postpaid Prices: $10.00 (USA), $12.00 (Canada/Mexico), $13.00 (Others)

RECOMMENDED SCIENCE AND SOCIETY EDUCATIONAL RESOURCES

Task Force of the Pre-College Committee, Association for Computing Machinery, *ACM Model High School Computer Science Curriculum*, ACM Inc., P.O. Box 12114, Church Street Station, New York, NY 10257, (800) 342-6626, 1993. 25 pp. $12.00 ($9.00 for ACM members) This report presents a curriculum framework for a one-year high school computer science course. The appendices, which comprise the bulk of the report, present five computer course syllabi established within this framework.

J. G. Calvert, J. B. Heywood, R. F. Sawyer, and J. H. Seinfeld, "Achieving Acceptable Air Quality: Some Reflections on Controlling Vehicle Emissions," *Science*, 261, 37-45 (2 July 1993). This survey reveals that vehicle emissions are better controlled in laboratory tests than on the real road. Most of the difference is attributed to 10% of vehicles called "recent model super emitters," whose emission control system have failed. To deal with this problem, the authors recommend monitoring individual vehicular emissions by means of mobile units, which would also photograph the license plates of vehicles found to be in violation.

Loren R. Graham, "Palchinsky's Travels: A Russian Engineer's Adventures Among Gigantic Projects and Small Minds," *Tech. Rev.*, 96(8), 22-31 (Nov/Dec 1993). Born in Russia in 1874 and killed 55 years later by a Soviet firing squad, Peter Palchinsky was an engineer whose advocacy of meeting the social and economic needs of workers found acceptance from neither of the governments under which he lived and worked. Today his life's work continues to hold forth lessons on the interaction of science, technology, and society for all of us.

Caroline L. Herzenberg and Ruth H. Howes, "Women of the Manhattan Project," *Tech. Rev.*, 96(8), 322-40 (Nov/Dec 1993). These authors are "pursuing a major research effort to

study the contributions that women made to the Manhattan Project." In this article they cite no less than two dozen women whose scientific work was instrumental in building the first American nuclear weapons—and how many of them felt no longer welcome in the scientific work force after WW II.

Bob Holmes, "A New Study Finds There's Life Left in the Green Revolution," *Science*, 261, 1517 (17 September 1993). In contrast to Lester Brown's pessimism abut earth's future agriculture, Donald Pluncknett (of the Consultative Group on International Agricultural Research) finds the yields of wheat, rice, and corn continuing to increase—although he expects a limit somewhere. The larger problem, Peter Hazell feels, is eliminating the poverty that keeps the world's billion starving people from buying the food that is available.

***Eaglewatch*, Kids for Conservation, Box 885, Athens, GA 30603. $10/yr. (individuals); $20/yr. (institutions).** This publication, which premiered in Winter 1993, is edited by Vera Niñez and published four times a year for "kids" of all ages, exhorting them to take better care of planet Earth by consuming less. The Kids for Konservation "consumer disobedience" is based on a hierarchy of refuse (to buy what you don't need), reduce (the amount of waste in what you buy), reuse, and recycle (as much as you can). Featured in the premier issue is an account, "America's Forests: Love 'Em and Leave 'Em Alone."

The Center for Marine Conservation, 1725 DeSales St., NW, Suite 500, Washington, DC 20036, (202) 429-5609. This Center is dedicated to protecting marine wildlife and its habitats and to conserving coastal and ocean resources. Materials offered include free or low cost books, reports, newsletters, slide shows, posters, videos, and fact sheets including sheets on sea otters, manatees, whales, dolphins, sea turtles, and coral reefs. Also, the Center runs two Marine Debris Information Offices which distribute packets to teachers. write Rebecca S. Mackay, Public Information Officer for the Center.

"Water Matters: Every Day. Everywhere, Every Way," Geography Education Program, under the auspices of the National Geographic Society, 1145 17th St., NW, Washington, DC 20036, (202) 775-6577. free. This packet, which focuses on how water plays a role in so many aspects of our life, was prepared for National Geography Awareness Week (14-20 November 1993). It focuses on North America but includes other continents as well.

Directory of Student Science Training Programs for Pre-College Students, Science Service, Inc., 1719 N St., NW, Washington, DC 20036. $3.00. This compilation, funded in part by the National Science Foundation, lists 490 programs and internships for high school students in science and mathematics. It covers not only state and national offerings but also those in foreign countries, including, oddly enough, institution, a description of the program, the qualifications required (many are open only to special groups), dates, cost, and where to obtain further information. Both summer programs and those during the academic year are described.

Project RAMPS (Relationships And Math-friendly Physical Science), P.O. Box 701, Devon, PA 19222, (800) 444-5729. Sourcebook Set (Teacher's Guide, Report Sheet, Worksheets, and Test Sheets plus textbooks), $65. Student Textbook (in class sets), $18. This program, designed for a one-year physical science course for students in grades 8-9, consists of 73 hands-on activities in 16 chapters grouped into an introductory unit and subsequent units on chemistry and organization of knowledge, math and its application to science, physical relationships, and chemistry combined with physics. Based on the premise that "physical science is largely the study of relationships," RAMPS considers both direct and inverse relationships between variables, using the factor-unit method. Having undergone three full-year field tests, this program is approved by the national Diffusion Network. Training workshops for teachers to implement RAMPS are available.

Northeast Sustainable Energy Association, 23 Ames Street, Greenfield, MA 01301, (413) 744-6051. Membership, $35/yr. and up. In addition to sponsoring Tour de Sol solar and electric car races (see "Calendar," this issue), this Association also provides lists of speakers, bibliographies, and lesson plans on energy, pollution, and transportation, with emphasis on solar and electric cars, and sponsors contests that students can enter in conjunction with Tour do Sol races (poster contests, Junior Solar Sprints). Membership is not required for teachers and students to participate in the Association's educational activities and opportunities.

***EPA Journal*, Superintendent of Documents, P.O. Box 371954, Pittsburgh, PA 15250-7954. $7.50/yr. (back issues $3.50)** Now published quarterly, with each issue focusing on a single topic, this publication now comes with lesson plans for teachers at the junior-senior high school level. Topics already available with lesson plans and nonpoint source pollution (Nov/Dec 1991), sustainable development (April-June 1992), recycling (July/August 1992), pollution prevention (Jul-Sep 1993), and indoor air pollution (Apr-Jun 94).

American Indian Science and Engineering Society, *Winds of Change: American Indian Education and Opportunity*, AmISES Publishing, Inc., 1630 30th St., Suite 301, Boulder, CO 80301, (303) 444-9099. $24/yr. Those interested in the American Indians' struggles to regain their place in society will be interested in this publication. The Autumn 1993 issue contains an article entitled "Sharing a Piece of the Whole," a trio of articles on science and education and an article on new methods of forest restoration that address the entire ecosystem rather than a single species of plant or animal.

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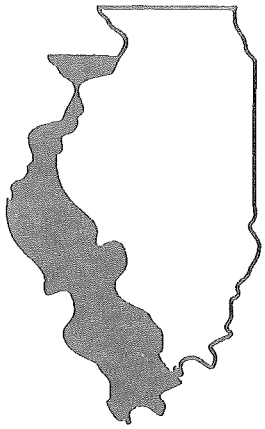

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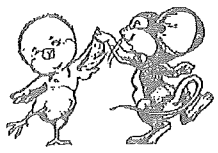

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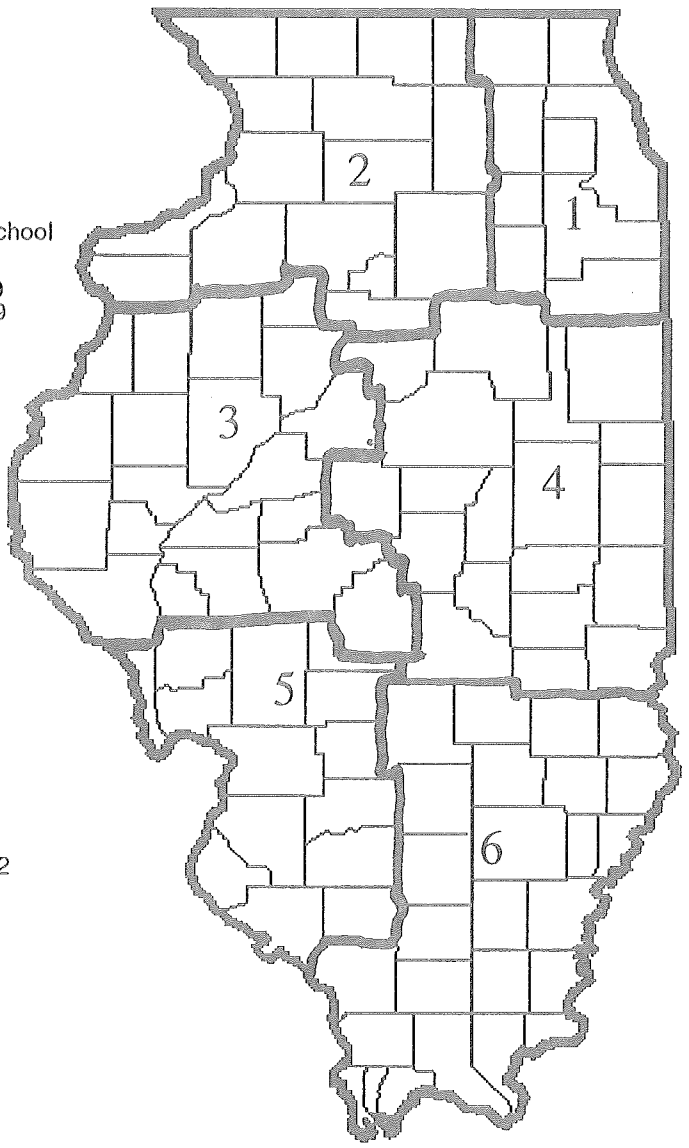

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